A STUDY ON STUDENTS' ENVIRONMENTAL KNOWLEDGE AND
ATTITUDES: THE EFFECT OF GRADE LEVEL AND GENDER

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ABSTRACT

A STUDY ON STUDENTS' ENVIRONMENTAL KNOWLEDGE AND
ATTITUDES: THE EFFECT OF GRADE LEVEL AND GENDER

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The aim of this study is four fold: (1) to determine 6th, 8th and 10th grade students' environmental knowledge and attitudes, (2) to investigate the effect of the grade level and gender on students' environmental knowledge and attitudes, (3) to examine environmental knowledge and attitudes of 10th grade students, exposed to "Human and Environment" course and those not exposed to this course, (4) to explore the relationship between participants' environmental knowledge and attitudes.

In this study the data was obtained by the administration of Turkish version of Children's Environmental Attitudes and Knowledge Scale (T-CHEAKS) as a measuring instrument to 2536 students from 18 randomly selected elementary schools and 10 secondary schools throughout Çankaya and Yenimahalle districts of Ankara in spring 2003-2004 semester.

The data were analyzed by using two-way analyses of variance (ANOVA), independent-samples t test and bivariate correlations. A statistically significant effect of grade level was found on environmental knowledge and attitudes. While no statistically significant effect of "Human and Environment" course was found on environmental knowledge of 10th grade level students, "Human and Environment" course had a significant effect on attitudes toward the environment in favor of students exposed to this course. The gender difference on environmental knowledge was statistically significant for 6th grade students in favor of males. On the other hand, for each grade levels, females had more favorable environmental attitudes than males. Bivariate correlations revealed low, but positive correlation between students' environmental knowledge and attitudes.

Keywords: Environmental Education, Attitudes toward the Environment, Environmental Knowledge, Cross-age, Gender

ÖZ

ÖĞRENCİLERİN ÇEVRE BİLGİLERİ VE TUTUMLARI ÜZERİNE BİR ÇALIŞMA: SINIF DÜZEYİNİN VE CİNSİYETİN ETKİSİ

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Bu çalışmanın amacı; (1) devlet okullarında öğrenim gören 6., 8. ve 10. sınıf öğrencilerinin çevreye yönelik tutumlarını ve bilgilerini araştırmak, (2) sınıf düzeyinin ve cinsiyetin, öğrencilerin çevreye yönelik tutumları ve bilgileri üzerinde etkisini belirlemek, (3) "Çevre ve İnsan" dersinin, 10. sınıf öğrencilerinin çevreye yönelik tutumları ve bilgileri üzerinde etkisini belirlemek, (4) çevreye yönelik tutum ile çevre bilgisi arasındaki ilişkiyi araştırmaktır.

Bu çalışmada "Çocukların Çevreye Yönelik Tutumları ve Bilgileri Anketi"nin Türkçe versiyonu 2003-2004 bahar döneminde Çankaya ve Yenimahalle ilçelerindeki 18 ilköğretim okulundan ve 10 liseden seçilen toplam 2536 öğrenciye uygulanmasıyla veri toplanmıştır.

Elde edilen veriler, iki yönlü varyans analizi (ANOVA), bağımsız-örneklem t test istatistiksel teknikleri ve basit ilişki analizi kullanılarak değerlendirilmiştir. Sınıf düzeyinin, çevre bilgisi ve çevreye yönelik tutumları üzerinde istatistiksel olarak anlamlı bir etkisi bulunmuştur. "Çevre ve İnsan" dersinin, çevreye yönelik tutumları üzerinde bu dersi almış olan öğrencilerin lehine istatistiksel olarak anlamlı etkisi bulunurken, "Çevre ve İnsan" dersinin, 10. sınıf öğrencilerinin çevre bilgisi üzerinde istatistiksel olarak anlamlı bir etkisi yoktur. Çevre bilgisi üzerinde cinsiyet farklılığının 6. sınıfta öğrenim gören erkek öğrencilerin lehine anlamlı olduğu tespit edilmiştir. Diğer yanda, her sınıf düzeyinde, kız öğrencilerin çevreye yönelik tutumlarının erkek öğrencilere göre daha olumlu olduğu saptanmıştır. Analizler, çevre bilgisinin çevreye yönelik tutum ile düşük fakat positif bir ilişkisi olduğunu göstermiştir.

Anahtar Kelimeler: Çevre Eğitimi, Çevreye Yönelik Tutum, Çevre Bilgisi, Yaşlar-arası, Cinsiyet

To My Parents

Muazzez and Gürcan ALP

ACKNOWLEDGEMENT

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SYMBOLS

CHEAKS   : Chidren's Environmental Attitudes and Knowledge Scale

T-CHEAKS: Turkish versin of Children's Environmental Attitudes and Knowledge

KNOW   : Environmental Knowledge

ATTI   : Environmental Attitudes

INTENT   : Behavioral Intentions

BEHAVE   : Environmental Friendly Behaviors

AFFECT   : Environmental Affects

GRADE   : Grade Level

DV   : Dependent Variable

ANOVA   : Analysis of Variance

SPSS   : Statistical Package for the Social Sciences Program

Df   : Degree of Freedom

N   : Sample Size

CHAPTER I

INTRODUCTION

As the new century begins, natural resources are under increasing pressure, threatening public health and development. Water shortages, soil exhaustion, loss of forests, air and water pollution, and degradation of coastlines afflict many areas. As the world's population grows, improving living standards without destroying the environment is a global challenge. Two thousand years ago one quarter of a billion people lived on the Earth; by 1830 the population of the Earth reached one billion, and in just 100 years after that the population doubled. Approximately in the late 1960's the population doubled again, only 34 years later. Currently the population carries more than six billion people. Overexploitation of the earth's resources is an inevitable consequence of rapid population growth.

Most developing countries with rapid population growth face the urgent need to improve living standards. As we exploit nature to meet present needs, we are destroying resources needed for the future. Parallel with the population explosion, severity of environmental deterioration has rapidly reached a crisis point. In the past decade in every environmental sector, conditions have either failed to improve, or they are worsening (Hinrichsen & Robey, 2000).

Public health: Unclean water, along with poor sanitation, kills over 12 million people each year, most in developing countries. Air pollution kills nearly 3 million more. Heavy metals and other contaminants also cause widespread health problems.

Food supply: In 64 of 105 developing countries studied by the United Nations Food and Agriculture Organization, the population has been growing faster than food supplies.

Freshwater: The supply of freshwater is finite, but demand is soaring as population grows. By 2025, when world population is projected to be 8 billion, 48 countries containing 3 billion people will face shortages.

Coastlines and oceans: Half of all coastal ecosystems are pressured by high population densities and urban development. A tide of pollution is rising in the world's seas. Ocean fisheries are being overexploited, and fish catches are down.

Forests: Nearly half of the world's original forest cover has been lost, and each year another 16 million hectares are cut, bulldozed, or burned. Forests contribute to the world economy and are vital to maintaining healthy ecosystems. Yet, current demand for forest products may exceed the limit of sustainable consumption.

Biodiversity: The earth's biological diversity is crucial to the continued vitality of agriculture, medicine and to life on earth itself. Human activities are pushing many thousands of plant and animal species into extinction. Two of every three species is estimated to be in decline.

Global climate change: The earth's surface is warming due to greenhouse gas emissions, largely from burning fossil fuels. If the global temperature rises as projected, sea levels would rise by several meters, causing widespread flooding. Global warming also could cause droughts and disrupt agriculture.

The growth of ecological problems with the human being-nature interaction has started to influence more seriously their effects with the development of technology and wealth of countries entering into the industrial

process. As a result of the mutual interaction between human being and nature, human being had to pay the cost of its desire for dominating nature by bearing the developing environmental problems. However, the fact that the environmental problems reached a dimension endangering the life of human being and other living things, forced countries to find a solution to this problem in national and international field. Only legal arrangements could not be effective in solving environmental problems. Since the problem comes out from human being alone, in that case, the most effective solution to the environmental problems would be to enlighten and render conscious the society on the subject of environment.

1.1 The Main Problems and Sub-Problems

1.1.1 The Main Problems

The aims of the present study are (1) to determine 6th, 8th and 10th grade public school students' environmental knowledge and attitudes, (2) to investigate the effects of the grade level and gender on students' environmental knowledge and attitudes, (3) to examine environmental knowledge and attitudes of 10th grade public school students, exposed to "Human and Environment" course and those not exposed to this course, (4) to explore the relationship between participants' environmental knowledge and attitudes toward the environment.

1.1.2 The Sub-problems

The sub-problems related to main problem (1) are:

1. What are the environmental knowledge and attitudes of 6th grade public elementary school students?
2. What are the environmental knowledge and attitudes of 8th grade public elementary school students?

3. What are the environmental knowledge and attitudes of 10th grade public secondary school students not exposed to "Human and Environment" course?

4. What are the environmental knowledge and attitudes of 10th grade public secondary school students exposed to "Human and Environment" course?

The sub-problems related to main problem (2) are:

5. Is there a significant difference between 6th, 8th and 10th grade public school students not exposed to "Human and Environment" course on environmental knowledge?

6. Is there a significant difference between 6th, 8th and 10th grade public school students not exposed to "Human and Environment" course on environmental attitudes?

7. What is the effect of gender on environmental knowledge of 6th, 8th, and 10th grade public school students not exposed to "Human and Environment" course?

8. What is the effect of gender on environmental attitudes of 6th, 8th, and 10th grade public school students not exposed to "Human and Environment" course?

9. What is the effect of gender on 6th grade public school students' environmental knowledge?

10. What is the effect of gender on 6th grade public school students' environmental attitudes?

11. What is the effect of gender on 8th grade public school students' environmental knowledge?

12. What is the effect of gender on 8th grade public school students' environmental attitudes?

13. What is the effect of gender on environmental knowledge of 10th grade public school students not exposed to "Human and Environment" course?

14. What is the effect of gender on environmental attitudes of 10th grade public school students not exposed to "Human and Environment" course?

15. What is the effect of gender on environmental knowledge of 10th grade public school students exposed to "Human and Environment" course?

16. What is the effect of gender on environmental attitudes of 10th grade public school students exposed to "Human and Environment" course?

The sub-problems related to main problem (3) are:

17. Is there a significant difference between 10th grade public school students, exposed to "Human and Environment" course and those not exposed to this course, on environmental knowledge?

18. Is there a significant difference between 10th grade public school students, exposed to "Human and Environment" course and those not exposed to this course, on environmental attitudes?

The sub-problems related to main problem (4) are:

19. Is there a significant relationship between students' environmental knowledge and behavioral intentions?

20. Is there a significant relationship between students' environmental knowledge and environmental friendly behaviors?

21. Is there a significant relationship between students' environmental knowledge and environmental affects?

22. Is there a significant relationship between students' environmental friendly behaviors and behavioral intentions?

23. Is there a significant relationship between students' environmental friendly behaviors and environmental affects?

24. Is there a significant relationship between students' environmental affects and behavioral intentions?

1.2   Null Hypotheses

        The problems stated above are tested with the following hypotheses.

Null Hypothesis 1

    There is no significant main effect of grade level on the population means of the scores on environmental knowledge.

Null Hypothesis 2

    There is no significant main effect of grade level on the population means of the scores on environmental attitudes.

Null Hypothesis 3

    There is no significant main effect of gender on the population mean scores of 6th, 8th, and 10th grade students not exposed to "Human and Environment" course on environmental knowledge.

Null Hypothesis 4

    There is no significant main effect of gender on the population mean scores of 6th, 8th, and 10th grade students not exposed to "Human and Environment" course on environmental attitudes.

Null Hypothesis 5

    There is no significant main effect of gender on the population means of 6th grade public school students' environmental knowledge scores.

Null Hypothesis 6

    There is no significant main effect of gender on the population means of 6th grade public school students' environmental attitude scores.

Null Hypothesis 7

    There is no significant main effect of gender on the population means of 8th grade public school students' environmental knowledge scores.

Null Hypothesis 8

    There is no significant main effect of gender on the population means of 8th grade public school students' environmental attitude scores.

Null Hypothesis 9

There is no significant main effect of gender on the population mean scores of 10th grade students not exposed to "Human and Environment" course on environmental knowledge.

Null Hypothesis 10

There is no significant main effect of gender on the population mean scores of 10th grade students not exposed to "Human and Environment" course on environmental attitudes.

Null Hypothesis11

There is no significant main effect of gender on the population mean scores of 10th grade students exposed to "Human and Environment" course on environmental knowledge.

Null Hypothesis 12

There is no significant main effect of gender on the population mean scores of 10th grade students exposed to "Human and Environment" course on environmental attitudes.

Null Hypothesis 13

There is no main effect of "Human and Environment" course on population means of 10th grade public school students' scores on environmental knowledge.

Null Hypothesis 14

There is no main effect of "Human and Environment" course on population means of 10th grade public school students' scores on environmental attitudes.

Null Hypothesis 15

There is no significant relationship between students' environmental knowledge and behavioral intentions.

Null Hypothesis 16

There is no significant relationship between students' environmental knowledge and environmental friendly behaviors.

<u>Null Hypothesis 17</u>

There is no significant relationship between students' environmental knowledge and environmental affect.

<u>Null Hypothesis 18</u>

There is no significant relationship between students' environmental friendly behaviors and behavioral intentions.

<u>Null Hypothesis 19</u>

There is no significant relationship between students' environmental friendly behaviors and environmental affects.

<u>Null Hypothesis 20</u>

There is no significant relationship between students' environmental affects and behavioral intentions.

1.3   Definition of Important Terms

        This section includes some important definitions related to study.

<u>Environmental Knowledge Topics:</u> Environmental knowledge of students on six general environmental topics included in the Turkish science curriculum or dealt with in the media. These topics are water, pollution, energy, recycling, animals and general issues. The knowledge of students on these topics was measured with the knowledge subscale of Turkish version of Children's Environmental Attitudes and Knowledge Scale (T-CHEAKS) developed by Leeming & Dwyer (1995). Water, energy, recycling and animals topics were measured by 5 items. On the other hand, general issues were measured by 7 and pollution topic was measured by 2 items.

<u>Environmental Attitude Subdomains:</u> Three subdomains based on the students' attitudes toward the environment were participants' commitment to environmental friendly behaviors, environmental affect and behavioral intentions toward the environment. These subdomains were measured with the attitude subscale of T-CHEAKS, each subdomain were measured by 12 items.

<u>Behavioral Intentions:</u> This subdomain measures what a person states he/she is willing to do in reference to the environment-pollution issues.

Commitment to Environmental Friendly Behaviors: This subdomain measures what a person actually does in relation to environment-pollution issues.

Environmental Affect: This subdomain measures the degree of an individual's emotionality related to ecological issues.

1.4   Significance of the Study

Environmental education programs are designed to prepare environmentally literate future citizens who would take an active role in confronting environmental problems through making vital decisions and fostering behaviors toward environmentally responsible actions (Abd-El-Khalick, BouJaoude, & Makki, 2003).

As the complexity of interlocking environmental problems, the process of developing an education program on environmental issues is also complex. For sure, an ultimate goal of this process remains to develop environmentally responsible behavior. The assumptions underlined in a rich variety of education models are that (a) if people are aware of the need for and ways of protecting the environment they will act to preserve it, (b) schools should assume responsibility for educating about environmental protection (c) environmental education can be effective as a part of a school curriculum (Padeliadu & Paraskevopoulos, 1998). The theory of reasoned action contends that one's behavior toward any object or event is in part dependent upon the constellation of attitudes and values which bear upon that situation. It has been proposed that ecological behavioral intentions are correlated with environmental knowledge (Dillon & Gayford, 1997). Environmental knowledge and attitudes are factors identified to influence environmental decisions and behaviors. Since being able to cope with environmental problems lie in the alteration of human behavior, educators must assess the factors influencing environmentally desirable behavior; environmental knowledge and attitudes and understand the relationship between these aspects.

As Turkish public makes an effort to achieve sustainable, economic and social development, it also experiences several environmental handicaps,

such as water pollution, solid waste management, soil degradation, haphazard urbanization and a rapid flow of population to the large cities. If young adults are going to effectively confront such issues and make informed decisions, then they must be equipped with a fundamental knowledge of basic environmental concepts and processes. Uninformed environmental decisions and actions could be very costly at the ecological, economic and social levels.

To overcome the environmental deterioration, a formal education program was introduced in 1992 for the first time into Turkish elementary and high school education curriculum to help students deal with the issues as they interact with their culture and biophysical environment. An environmental education component was integrated into selected topics with subject areas such as life sciences. Moreover, an elective course covering the environmental issues was introduced for developing the awareness and skills of high school students to solve environmental problems. This curriculum, however, was developed without any research regarding Turkish students' environmental knowledge and attitudes. Also, it has been more than ten years since environmental education program was introduced first. The measuring instruments used in this study are expected to provide valid and reliable results to assess this environmental education program by revealing the environmental knowledge and attitudes of Turkish students. Thus, an assessment of these aspects can inform science educators about classroom instruction through establishing a baseline. Moreover, such a baseline could later be used to consider the effectiveness of the Turkish environmental curriculum carefully for the purposes of refinement and improvement. Investigating the relationship between environmental knowledge and other related aspects can help curriculum developers to plan the appropriate activities for each grade level students and which methods should be included in environmental education programs.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter aims to present a brief review of related literature on the definition and goals of the environmental education and the research studies concerning environmental knowledge, environmental attitudes, environmentally desirable behavior and gender differences in the context of the environmental education.

2.1   Environmental Education

In recent decades the increased concern about the environment has been paralleled by a growth in the development of environmental education, and in particular by the clarification of its aims and purposes. Actually, for more than 30 years researchers in environmental education, regional planning, psychology, sociology, and related fields have been engaged in a quest to understand and map the environmental education, its objectives, and a model that lead people to engage in "pro-environmental behavior". The common idea that appeared in the various definitions and models were synthesized meticulous and detailed research study conducted by Harvey (1976). Harvey's research led to the development on the model of environmental education. The model focused on an important goal that called for the development of a homeostatic relationship between man and the environment. Harvey's model appeared to be validated by Tbilisi Declaration (UNESCO, 1977).

The world's first intergovernmental conference on environmental education was organized by the United Nations Education, Scientific, and Cultural Organization in cooperation with the United Nations Environment Program and was convened in Tbilisi, Georgia from October 14-26, 1977.

The declaration noted the unanimous accord in the important role of environmental education in the preservation and improvement of the world's

environment. The conference suggested that environmental education is the result of the reorientation and dovetailing of different disciplines and educational experiences which facilitate an integrated perception of the problems of the environment, enabling more rational actions capable of meeting social needs to be taken.

The well known Tbilisi Declaration endorsed the following goals, objectives and guiding principles for environmental education:

The goals of the environmental education are:

- to foster clear awareness of, and concern about, economic social, political and ecological interdependence in urban and rural areas;

- to provide every person with opportunities to acquire the knowledge, values, attitudes, commitment and skills needed to protect and improve the environment;

- to create new patterns of behavior of individuals, groups and society as a whole towards the environment.

The categories of environmental education objectives are:

- Awareness; to help social groups and individual acquire awareness and sensitivity to the total environment and its allied problems

- Sensitivity; to help social groups and individual gain a variety of experiences in, and acquire a basic understanding of environment and associated problems

- Attitudes; to help social groups and individual 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 individual acquire skills for identifying and solving environmental problems

- Participation; to provide social groups and individuals with an opportunity to be actively involved at all levels in working toward resolution of environmental problems

Guiding principles; environmental education should

- consider the environment in its totality; natural and built, technological and social;

- be a continuous lifelong process, beginning at the preschool level and continuing through all formal and nonformal stages;

- be interdisciplinary in its approach, drawing on the specific content of each discipline in making possible a holistic and balanced perspective;

- examine major environmental issues from local, national, regional, and international points of view so that students receive insights into environmental conditions in other geographical areas;

- focus on current and potential environmental situations while taking into account the historical perspective;

- promote the value and necessity of local, national, and international cooperation in the prevention and solution of environmental problems;

- explicitly consider environmental aspects in plans for development and growth;

- enable learners to have a role in planning their learning experiences and provide an opportunity for making decisions and accepting their consequences;

- relate environmental sensitivity, knowledge, problem-solving skills, and values clarification to every age, but with special emphasis on environmental sensitivity to the learner's own community in early years;

-help learners discover the symptoms and real causes of environmental problems;

- emphasize the complexity of environmental problems and thus the need to develop the critical thinking and problem-solving skills;

- utilize diverse learning environments and a broad array of educational approaches to teaching, learning about and from the

environment with due stress on practical activities and first-hand experience.

The goals of the environmental education described above suggest that the acquisition of responsible environmental behavior by a mediating factor of environmental literacy is a desired outcome of environmental education. Environmental education as proposed in a recent UNESCO document (1987) describes a model of environmental action in which individuals and the community gain awareness of their environment and acquire the knowledge, values, skills, experiences and also the determination which will enable them to act individually and collectively to solve present and future environmental problems. There is a considerable debate on the extent to which the acquisition of knowledge and understanding of environmental issues necessarily leads to more positive attitudes towards or behavior in, the natural environment. Moyer (1975) has pointed out that cognitive understanding does not automatically lead to strong attitudes about an issue. The assumption that environmental behavior can be influenced via the improvement of environmental knowledge and attitudes is not well founded (Posch, 1993). Therefore, schools may look beyond the accumulation of knowledge and promote the use of practical activities as a major tool for teaching and developing positive values and attitudes toward the environment. In order to emphasize the exploration of values and attitudes and the development of social and political skills as much as the accumulation of facts, the curriculum in schools needs to develop different dimensions: environmental, political, social and economical. These are essential elements in the process of transforming schools into places where children can interact and provide opportunities for motivating experience and skills needed by students to address complex issues (Smyth, 1999). In a research conducted by Barraza & Walford (2002) how environmental education is transmitted at primary level in two countries, Mexico and England, with significant educational and political differences was studied. At the beginning of the 1982-1988 a major educational

reform was announced in Mexico. For the first time environmental education was mentioned as a topic to be included into the curriculum. In practice, however this did not happen, mainly because there was not a specific strategy to affect it. Nevertheless, in 1983 the Mexican government created Ministry of Urban Development and Ecology which included the promotion of environmental education. This was a crucial step, publicly emphasizing the importance of developing environmental education policy at all levels in the country (Barraza, 2001). By 1987 the National Environmental Education Program was oriented to school teachers, basically of primary level. One of its major goals was to offer conceptual guidelines and suggest different methodologies related to environmental education for their training. In 1990 the process of incorporating the environmental dimension into primary education was begun. This incorporation into the curriculum covered in two main areas: knowledge, and the formation of values and attitudes. In 1993 as a part of the governmental project improving the quality of primary education, a renewable program for textbooks was initiated. Even though environmental education is not included as an independent topic in the National Curriculum, environmental issues are strongly represented in the natural and social science text books (Barraza, 2000). In 1999 the National Academy of Environmental Educators was founded in order to promote and facilitate the development of the theory and practice of environmental education in the country.

On the other hand, in England environmental education has long been established as an idea on the curriculum map of schools (Palmer & Neal, 1994). Traditionally, in the 20th century, environmental education in English schools has been included in programs of study identified as nature study, rural studies, and field studies and as components in geography and biology courses at most levels (Hale, 1990). In the early 1950s the idea of conservation education was first introduced into formal education, seeking to promote an understanding and appreciation of the environment by encouraging teachers to include in their work. The 1960s were crucial years for the evolution of environmental education in England. According to Martin & Wheeler (1975) it

was only in the mid- and late 1960s that the concept of formal environmental education made its first real impact on the thinking of teachers. In the early 1970s, the Department of Environment was set up and it became the chief agency through which government made a contribution to the progress of environmental education (Sterling, 1991). From the early 1980s a new direction in environmental education began. This was an approach to understanding nature and ecological principles, based on direct experience of nature, which engaged children's feelings and sensory faculties (Sebba, 1991). In the 1990s the documents highlighting the importance of having environmental education both in schools and in lifelong learning, and the importance of encouraging public participation in environmental matters were published. The publication of curriculum guidance for teachers in environmental topics was revised. Reviews of the National Curriculum which continue to emphasize environmental topics in both the subject and geography subject curricula. Looking at the development of an environmental education in the Mexican and English educational systems, for both countries environmental education has become an area of major concern and interest in recent years. Governments, administrators, schools and teachers have become aware of the importance of promoting positive attitudes towards and developing knowledge about environmental matters. In both countries, some manuals for teachers and textbooks about environmental education have been published. However, the use of textbooks varies between these two countries; in Mexico the textbooks are frequently used on a regular basis as a didactic tool, whereas in England it is more likely to be used selectively as a resource for a particular topic. Barraza & Walford (2002) has proposed that it is differences in classroom style and pedagogy, which form a crucial factor in environmental education. The difference in knowledge of students in these countries might be related to the differences in classroom style. Both in Mexico and England the National Curriculum has a rich environmental content. Guideless are available for teachers but to what extend the classroom practice become transformed is unclear. The researchers suggested that teaching emphasis should be on inquiry

and investigative methods, including direct experience. Fieldwork provides opportunities for drawing on the environment as a stimulus to learning, at the same time developing awareness and curiosity about the environment.

In Turkey, it has not been so long that environmental education was established as an understanding in formal school curriculum. Environmental education has been started to discuss as well as environmental issues in recent years. In 1999, Turkish Environmental Institution *(Türkiye Çevre Vakfı)* agreed to develop a project on revealing the probable defects in exposition of environmental education. Environmental education in both elementary and secondary schools was involved in this project.

Protection of the environment, understanding the events happening in nature, responsibility of preserving in environmentally desirable living standards, avoiding the behaviors threatening the human life are among the aims of the elementary school curriculum for early grade level students. However, recognizing the environmental values, detection and understanding the main sources of environmental problems, and taking actions to confront with environmental unfriendly issues are not sufficiently emphasized in elementary school curriculum for later grade levels.

The objectives concerning the environmental issues identified in elementary school are not clearly stated for secondary schools. The basic science courses do not involve environmental concepts and issues whereas an elective course related with the environment is introduced in secondary school education. The topics that the elective course deals with are very extensive and difficult compared with subjects in the elementary school curriculum. Exposition of all topics concerning the ecology in a school semester is not sufficient to the formation of true concepts.

The absence of principles on protection of the environment and nature in elementary and secondary school programs does not allow attaining the specific goals in confronting with the environmental problems via environmental education (Daştan, 1999; Polat, 1999).

2.2　Studies Related to Variables of Individual Environmental Concern

　　　In the literature there are research studies related to the relationship between environmental knowledge, attitudes toward the environment and environmental friendly behavior and the effect of gender on these variables in the context of the environmental education. Following is a brief review of research conducted in this area.

　　　2.2.1 Studies Dealing with Environmental Knowledge, Attitude, and Behavior

　　　One of the major tasks facing environmental psychologists for a long time is to determine the public's response to the environmental crisis which face us; how much do they know, what are their attitudes, what commitments are they making, what commitments are they willing to make. In order to design more effective programs and policies, the environmental psychologist must not only assess environmental attitudes but also study the interplay of these attitudes and the individuals' values, general attitudes, and personality traits.

　　　There is relatively little research about how environmental attitudes are formed. Most research has focused on the more tangible question of impact of specific educational programs. It seems likely that most environmental attitudes are formed as a result of life experiences rather than any specific program that was designed to change attitudes.

　　　A cross-cultural study by Arbuthnot & Lingg (1975) aimed to compare across French and American, with similar levels of economic development the relationships among environmental knowledge, attitude and behavior. The extent to which these variables are related to personality characteristics within the two cultures was also assessed. The survey consisted of three parts: (1) demographic and environmental behavior items, (2) environmental attitude, general attitude, and personality items, and (3) environmental knowledge scale. A total of 112 American subjects were

matched with 56 French subjects on a two-for-one basis based on a correspondence of social class, sex, age and education. Although sampling was not representative of the total American and French populations, the sample could reflect a wide range of ages, years of education and occupation. According to environmental attitudes, the French appeared to be more concerned with personal economic gain or loss when confronted with ecological issues and to be less concerned with future environmental consequences of present behaviors. The French favored technology to solve environmental problems but less inclined to rely on legal controls over polluters. They saw themselves as able to control the way of environmental developments. With respect to the relationship between environmental attitude and behavior, all attitudinal scales were predictive of recycling behavior for the Americans. However, for the French the correlations did not differ significantly from zero. The same pattern was observed in the relationship between environmental knowledge and recycling behavior. For the Americans, the level of knowledge is a predictive for the recycling behavior. In contrast, significant correlations were not observed for the French. The relationships between standard attitudinal and personality variables and environmental variables are same for both samples. Well-informed subjects in both French and United States tend to be characterized by beliefs in the modifications of the political and social systems, feelings of high personal control, non-conventionalism, and lack of superstition. Generally, while minimal differences were observed in recycling, the relationships of this behavior with other variables indicated differing conceptions between cultures. The Americans' environmental attitudes were more pro-ecological, were more internally consisted and were more likely to environmental behavior and knowledge and other attitudinal and personality variables.

In Holland, Lebanon and Turkey, the research findings on environmental knowledge, environmental attitudes and environmentally responsible behavior studied were in line with each other providing the amelioration of environmental education programs in these countries.

In the Dutch National Assessment Program for a nationwide sample of more than 9000 students from 206 secondary schools were investigated on environmental knowledge, attitudes and behaviors by Kuhlemeier, Bergh & Lagerweij (1999). Two-staged cluster sampling was performed in the geography assessment. 206 schools were selected with a probability proportional to the number of ninth-grade students. Then students were selected within schools. Environmental instruments were assigned to the students randomly. In this study environmental knowledge was restricted to environmental problems on the focus of the media and the educational material of the government. This instrument consisted of 30 items dealing with soil, water and air pollution, recycling, energy usage, farming and market gardening, government regulations. The environmental attitude subscale included statements that examine the degree of environmental inclination, environmental concern, environmental indifference and denial of environmental problems. The subscale of willingness to make sacrifices concerned readiness to make an extra effort for the environment, to take an extra pain, to make extra sacrifices. Environmentally responsible behavior scale approached the student as an energy user, a consumer or a garbage producer. The students' knowledge about environmental problems was fragmentary and often incorrect. Environmentally responsible behavior of many students was not desirable and the students were not willing to take extra pains or to make financial sacrifices for the environment. However, many of the ninth-grade students had a very positive attitude toward environment. The relationship between environmental knowledge, attitude and environmentally responsible behavior was not significant. There was a substantial relation between environmental attitude, willingness to make personal sacrifices, and environmentally responsible behavior. Environmentally responsible behavior was more strongly connected with willingness to make sacrifices than with attitude toward the environment. The lack of knowledge did not seem to prevent students from caring about the environment. The students were sensitive about the seriousness of the environmental problems. Another

conclusion to have been drawn about the study was their willingness to make sacrifices was not favorable. A substantial relation between knowledge of environmental issues, on the one hand, and attitudes and behavior, could not be demonstrated in the study. Perhaps environmentally responsible behavior could not be measured by means of a questionnaire since the researcher should be sure about the correspondence between what people say and what they really do. On the other hand environmental attitude, willingness to make sacrifices and environmentally responsible behavior are correlated. The students with a positive attitude and a high degree of willingness did not put their behavioral intentions into practice more often. One of the explanations was that the students did not have sufficient knowledge of the consequences of their actions on environment. The second explanation indicated by the researcher was the dependency relation found between school-age students and their parents. The third explanation was inferred from the pattern of correlations between attitude, willingness to make sacrifices, and behavior. Environmental attitude was more highly correlated with willingness to make sacrifices ($r = .54$) than with actual environmentally responsible behavior in day-to-day life ($r = .36$). The students did not seem to manage translating environmental attitude into practice. In principle, an individual might truly want to take the environment into account, but that person might prefer not to be one of the firsts to do so, particularly if others do not, if he or she has to make a great effort, or if that effort entails extra expenses.

Another study was conducted by Abd-el-Khalick, Boujaoude & Makki (2003) to investigate the environmental knowledge, attitudes and behaviors. This study aimed to assess Lebanese secondary school students' environmental knowledge and attitudes, and explore the relationship between participants' knowledge and attitudes, biographical and academic variables, and commitment to environmental friendly behavior. The participants, 660 grade 10 and grade 11 students, were administered a questionnaire, CHEAKS (Leeming & Dwyer, 1995) to assess their environmental knowledge, attitudes, beliefs, affect, and intensions, and commitment to environmental friendly

behaviors. Consistent with the research findings of Kuhlemeier, Bergh & Lagerweij (1999), the results showed that participants had favorable attitudes toward the environment but lacked in their environmental knowledge. Although the participants had followed the new Lebanese environmental curriculum the results supported the tentative conclusion that the curriculum was not being implemented effectively. In this study low correlations between participants' environmental knowledge and attitudes implicated that the effect of knowledge on attitude and behavior was not direct but mediated by several factors. Participants' scores on the behavior subscale were significantly correlated with their environmental affect (r = .45) and intentions (r = .46) suggesting that environmental intentions and affect might serve as good predictors of commitment to environmental friendly behaviors. The present finding of the study on gender difference was significant in favor of females but the researchers could not explain this result.

Another study was performed by Tosunoğlu (1993) to investigate which variables among environmental knowledge, sex and parents' educational level are significant determinants of environmental attitudes and environmentally desirable behavior. A total of 639 university students in Ankara were randomly sampled. Environmental attitude scale, a self-reported environmentally desirable behavior scale and an environmental knowledge scale were developed by the researcher. To find the relationship between the exogenous (environmental knowledge, sex and parents' educational level) and endogenous (environmental attitude, environmentally desirable behavior) variables of the study Path analysis was employed using LISREL 7 program. The results indicated that there was a significant direct relationship from sex (in favor of females) and environmental attitudes to environmentally desirable behavior and also from environmental knowledge to environmental attitudes. These results showed that in training environmentally responsible citizens, their attitudes plays an important role, but they do not have adequate knowledge on environmental to make informed decisions.

Some experimental studies were carried on the assessment of influences of activity-based environmental programs. One of these studies was constructed on the effects of outdoor school yard experiences on elementary students' environmental knowledge, attitudes, behaviors, and comfort levels by Martin (1999). Data were collected on 105 students in 4th- and 5th-grade public school classes in Florida. The participants formed two intact classes, one treatment and one control group at each grade level. The treatment group students participated in 14 weeks of weekly outdoor school yard activities exploring environmental science knowledge and attitude topics in a systems context. Researcher-designed instruments were given to measure the effectiveness of the program. ANCOVA was used to analyze the data. The results of the analyses revealed that 5th-grade students who participated in the outdoor school yard activities showed significant differences in environmental knowledge when compared with the 5th-grade control group students. On the other hand, the results of the study did not show significant differences on students' environmental attitudes, behaviors, and comfort levels. Significant gender differences were found in 5th grade females on attitudes and behaviors when compared with 5th grade males. These results indicated the potential for effective use of the school yard to help students learn about environmental knowledge, attitudes, behaviors and issues since the school yard offers teachers and students a readily available and convenient outdoor learning setting.

An environmental education program was developed in Taiwan in order to examine the effects of such programs on students' environmental behavior and related factors (Chieko, Chyan-Chyuan, Huang, Kawata, & Tung, 2002). The program design included school activities, curriculum design, and family participation. School activities included following elements: class discussion, speaker, answering questions for prizes, environmental slogan competition and exhibition, composition competition, poster creation contest and recycling activities. The family-participation component included the following: family forum consisting of an informal discussion session on recycling and distribution of pamphlets to families. Three junior high schools

were chosen as experimental groups and followed different curriculum designs, school activities and family participation program. These educational programs were not implemented on control groups. The results indicated that increasing student knowledge is reasonably simple, but that the affective realm, which encompasses beliefs, attitudes, and values, is generally difficult to change. In addition, some researchers have reasoned that if, before the commencement of an experiment, the students already have a high degree of environmental consciousness, then the effectiveness of the educational methods will not always be evident. However, the research found that two of the approaches taken were significantly effective in the area of self-efficacy, which is related to the affective realm. An approach that created an atmosphere of environmental preservation through schoolwide educational activities and improvement of the school environment significantly increased the recycling behaviors of students but otherwise produced no marked cognitive or affective changes. The overall rate at which environmental behaviors were practiced showed an immediate increase. It is suggested that environmental education programs should be implemented within a learning base of related curricula and should complement the classroom education with school activities in order to obtain greater results.

An interesting study was carried on by Jensen (2002) exploring work with environmental problems in Danish schools and focuses on the general pedagogical dimensions of work done in schools in order to relate these directly to concepts of environmental behavior and environmental action. He emphasized that if the main goal of environmental education is the development of the students' ability to act and effect change, it follows that associated knowledge and insight should essence be action oriented. An environmental education model was proposed with this respect. Some important remarks were concluded. Solutions to environmental problems must be sought at societal level of living conditions as well as a life style level. If individuals contribute to the solutions, they have to identify causes and develop their abilities to influence and change these conditions. Schools have a

responsibility to equip the students with knowledge and commitment to take meaningful decisions and action to address the challenges posed by both societal and lifestyle conditions. Environmental education could be effective by developing the students' abilities to act at the personal and societal levels.

In some countries environmental education programs were designed to remove the environmental deterioration especially in local areas. Municipal waste management has become a major environmental concern in Poland. The current legislation system and waste management practices require numerous improvements and modifications in order to meet European Unity standards. It is contended that such changes need to be accompanied by a community environmental education program designed to improve citizens' knowledge, attitudes and waste behavior (Grodzinska, 2001). The environmental knowledge and awareness of a local population plays a crucial role in waste management, especially if complex solutions are applied. Selective separate collection and the introduction of new treatment methods require full public acceptance and active participation. The implementation of programs encouraging selective separate collection in Poland have not contributed much to the reduction of the amounts of recyclable waste deposited in landfills, and the construction of waste treatment facilities have encountered very strong objections from local residents. Such outcomes were explained by among other things, a lack of a consistent and regular community education program focused upon waste and methods for its treatment (Read, 1999).

Grodzinska & Ballantyne (2003) examined the impact that students' participation in the waste education program has had upon their own, teachers' and parents' knowledge, attitudes, behavior and decision making in the area of municipal solid waste management. The findings of this study helped facilitate the improvements to the program in order to enhance the role that students can play as catalysts of environmental change in their families and communities. The impact of the program on the knowledge, attitudes and behavioral intentions of students, parents and teachers was evaluated using questionnaires. Students were surveyed twice, one week before commencing the school waste

program and one week after its completion. Parents and teachers were asked to fill in a questionnaire at the completion of the program. Pre- and post-program questionnaires for students were developed around the content of the waste education program. The waste program was undertaken by a total of 284 Krakow primary school students (Years 4-6; 11-13 years of age) from 11 different classes over a period of four months. The pre-program questionnaire was completed by 284 students and the post-program questionnaire by 220 students who participated in all the program activities. Of the total of 284 parents who were asked to complete the questionnaire, 138 returned the surveys to the researchers. The school waste management education program impacted positively upon students' knowledge about waste issues. The program also provided opportunities for parents to become more environmentally conscious through discussions with their children. According to parents' reports, the majority of students had discussed the program with their parents, and just over one-third of the students had made suggestions to their parents regarding ways in which they could improve their waste management practices at home. Tikka, Kuitunen & Tynys (2000) suggested that environmental knowledge does not necessarily lead to improved practice. In this study, although students discussed with their parents specific actions that could be taken to improve waste management in their household, there was no evidence that such practices had actually been adopted. It is also possible that some changes in household waste management practice may have occurred as time went on from the actual school education program. This was supported by the fact that a number of students mentioned the intention to change their household practices in the near future. Another implication of this study is that citizens can be influenced to consider these issues, and that school environmental education program can be effective in this regard, resulting in improvements in students' and parents' attitudes and behavior. By involving parents in discussing environmental issues with their children, they can be encouraged to take a more active role in their children's environmental

education, thus contributing to the development of long-term environmental awareness and concern.

2.2.2   Studies Dealing With Environmental Knowledge and Attitudes

As the review of literature indicates, one of the most important influences on environmentally desirable behavior is attitude toward the environment. Young people's attitudes are particularly important because young people ultimately will be affected by and will need to provide solutions to environmental problems arising from present-day actions. Some researchers have studied on the environmental attitudes and knowledge of students exposed to environmental courses. There is no general trend on increase of environmental awareness or knowledge showing that some environmental programs were significantly effective on environmental knowledge, some were significantly effective on attitudes of students toward the environment.

Bradley, Campbell, Waliczek & Zajicek (1999) assessed the environmental knowledge and attitudes of high school students by the administration of a questionnaire before and after exposure to a 10-day environmental science course. From 18 schools, 475 students whose grade levels ranged from 9th through 12th participated in this study. The course consisted of four sections: air, water, land, and living organisms. The instructional portion comprised one-third of the class time; the remaining time was used for hands-on activities. The instructors taught the unit for 10 days in a normal 50-min class period. The environmental knowledge of the students was assessed with a knowledge inventory. The questions were multiple-choice and designed to cover the full scope of the course. The attitude inventory consisted of 15 questions rated on a Likert-type scale. This inventory was used to measure students' attitudes toward the protection of the environment and was developed with a combination of existing measured scales. Paired sample t tests were used to test for significance between pre- and posttests. To test the relationship between attitude and knowledge, Pearson's product-moment correlation was used. The results showed statistically significant increase in

student knowledge scores after exposure to the environmental science course. This increase in knowledge scores indicated that the 10-day course was effective in educating students about environmental issues. In contrast to the study of Martin (1999) the increase in the students' environmental attitude scores was statistically significant. It was reported that students who received the instruction in environmental education possessed more positive attitudes toward the environment than those who did not receive the instruction. The researcher found statistically significant correlations between student attitudes and knowledge. Students scoring higher on the knowledge inventory tended to have more favorable environmental attitudes in both before and after exposure to the environmental science course. It was mentioned that this finding was important because it suggested increased knowledge may help improve environmental attitude. Bradley, Campbell, Waliczek & Zajicek (1999) suggested that "Outside influences such as life experiences, socioeconomic status, and culture probably influence environmental attitudes as well. However, it is encouraging for educators to learn that attitude can be influenced, at least in part, by what is taught in the classroom."

To encourage elementary school classes to engage in proenvironmental activities, The Caretaker Classroom Program was initiated by a major newspaper for the research study of Leeming & Porter (1997). The classes participating the program agreed to engage in a minimum of eight environmentally relevant activities during the course of an academic year. This study was designed to assess whether environmental attitudes and knowledge of participants changed relative to nonparticipants. The Children's Environmental Attitude and Knowledge Scale (CHEAKS) was used to obtain pretest and posttest measures of the students' environmental attitudes and knowledge. The CHEAKS was designed to be a measure of "general" environmental attitudes and knowledge and not intentionally related to any of the Caretaker activities. The program had a significant positive effect on attitude toward the environment but did not influence knowledge of environmental issues. Children rated by their teachers as most interested in the

activities showed greater increases in proenvironmental attitudes than those rated least interested. The children in experimental group showed greater performance in knowledge than those in the control group, but the effect was not statistically significant. Also, all children showed similar changes in knowledge from pretest to posttest. The parents of the participants also displayed significantly more proenvironmental behaviors after their children's activities than did parents of the control group. This experiment showed that Caretaker program was effective. Instruments designed to measure a broad range of environmentally relevant attitudes, knowledge and behavior. Larger effects would have been found if measurement instruments had focused on topics directly related to specific activities performed in each Caretaker class. It was not surprising that program did not significantly affect knowledge about environmental problems. Caretaker program teachers did not present any special curriculum materials associated with the activities. Also as with the attitudes, the instrument used to measure knowledge covering a broad range of topics.

Some environmental educators have suggested that neither formal nor informal environmental education efforts are successful at significantly improving the low level of public knowledge about the environment (Arcury & Johnson, 1987). Bright & Tarrant (2002) tried to objectively measure the effects of environmental education on the extent of people's perceptions regarding truth about environmental information by examining their ability to critically evaluate that information. They specifically aimed to determine the effect of environmental-based coursework on university students' perceptions of endangered species act. Five sections of the writing course were chosen as experimental group focusing on environmental issues. The other five sections of that course serving as a control group did not focus on environmental issues. The students were administered a self-report questionnaire designed to measure attitudes toward the endangered species act. The results showed that attitudes were influenced by the environment-based course; however, the experimental group became more moderately negative than did the control group. That is,

although the coursework influenced the extremity of attitudes, the direction of the attitudes was not influenced.

In Greece, Zakynthos' fast growing industry and unplanned development have threatened the lives of sea turtles. Researchers needed to investigate local people's knowledge and attitudes regarding sea turtle conservation. The study by Dimitrios & Pantis (2003) designed a research study to foster proenvironmental behavior in local inhabitants. Schoolchildren in grades 5 and 6 were selected as a starting point for specified purpose. Knowledge mean scores regarding sea turtles were rather low compared with the mean scores for their attitudes. Knowledge scores were not significantly correlated with attitude mean scores. It was reported that low knowledge of sea turtle issue might mean that school, home, and mass media; three main sources of information for school children did not touch upon the issue or simply engage in aspects of the issue other than knowledge of tea turtle biology. Additionally, the formal school curriculum in Greece did not emphasize local environmental issues.

In a study conducted by Padeliadu & Paraskevopoulos (1998) demonstrated limited knowledge of fifth and sixth graders about plants and animals. This finding showed low levels factual knowledge on environmental issues of plants and animals. The relatively high mean scores in the attitude attributed to the fact that children show sympathy for animals and the preservation of ecosystems. They seem to have high levels of ethical and emotional attitudes because of their tendency toward animals or pets. For the nonsignificant correlation between gender and attitudes, one possible explanation was attitudes may diverge in the years following.

Besides the elementary or secondary school children, university students in a variety of educational establishments were investigated on the attitudes toward nature and environmental knowledge. In Finland, such a study was constructed by Tikka, Kuitunen & Tynys (2000). Students were selected from seven major subjects of a university with five faculties (Humanities,

Education, Sport and Health Sciences, Mathematics and Natural Sciences, and Social Sciences). Biology students scored the highest on attitudes toward the environment. It was quite likely that the choice to study biology presupposes a somewhat positive attitude, or at least an interesting in nature. The engineering students were the most negatively oriented groups. The authors suggested that students were not willing to make sacrifices in the favor of environment if they trusted the capability of technology to solve environmental problems. Biology students had also good knowledge scores, since their studies involved nature or the environment. The correlation between the attitude and knowledge was statistically significant. The possession of good knowledge and a positive attitude were dependent on each other but this has not been the case in every study of this literature review. Furthermore, female students have more positive attitudes towards nature and the environment than male students. It was noticed that men tend to emphasize mastering nature and deriving benefits from natural resources, whereas woman take a more emotional attitude toward nature. The concern felt by women for nature and the environment could be seen as a way of taking care of their offspring, because a clean and safe environment is a precondition for welfare and survival. Consistent with many research findings (Gambro & Switzky, 1999; Kara, 1999) students' degree of knowledge was dependent on gender in favor of males.

Business executives increasingly understand that paying attention to environmental issues is central to running their businesses. Consequently, companies want business schools to develop students' abilities to see the big picture with regard to the environment and be able to bring traditional management tools and problem-solving methods to decisions involving the environment. In this aspect, a research similar to the study of Tikka, Kuitunen & Tynys (2000) aimed to assess the environmental knowledge and attitudes of university students, but in this case the subjects were selected from the faculties of business and arts &sciences (Benton & Raymond, 1994). The instrument used in this study consisted of four subscales designed to measure general knowledge, concern, willingness to act, and actual behavior regarding

ecological issues. The university, at which this instrument was administered, like most American universities, did not take special steps to incorporate an environmental orientation into its curricula. Totally, 562 students from the faculties of Arts &Sciences, the School of Business, the School of Education and the School of Social Work participated in this study. This research showed that business faculty would be less knowledgeable and less ecologically oriented than other faculty in the university. On all four subscales, business faculty scored significantly lower than did other faculties. Business faculty students were less concerned about the government's not doing more to help control pollution of the environment; since business faculty tend to not favor more government activity. They, if environmentally concerned, would exhibit more environmentally oriented market behaviors such as buying or not buying products for ecological reasons. Business faculty did not consider the environment to be their responsibility as educators, either as reflected in their general lack of treatment of environmental issues in their courses.

In the past most environmental education studies focused on students as the target population. Only a few studies selected community leaders. The Tbilisi Declaration (UNESCO, 1977), however suggested that environmental education should be provided for all ages, at all levels and in both formal and nonformal education. The education should constitute a comprehensive lifelong education and must look outward to the community. Dierking & Falk (1985) specified that, in order to influence society, an effective environmental education program should include the whole community and not only school children. Given that many changes in the life of community require fundamental changes in knowledge, attitudes, and behavior, community leaders actively influence the actions, opinions, or directions of the residents. Therefore, at the local level, a study constructed by Hsu & Roth (1996) assessed environmental knowledge and attitudes held by community leaders in Taiwan. A 55-item instrument was administered by mailed questionnaire to 250 randomly selected community leaders. Significant differences were found in knowledge scores by age, education level, income level, and ethnicity, and

in attitude scores by age, educational level, occupation, and ethnicity. The results of the study indicated that education level is the best predictor of environmental knowledge and attitudes. The overall level of environmental knowledge was determined to be moderately high, and the attitudes appeared to be positive.

2.2.3   Studies Related to Environmental Knowledge

The trend for environmental protection has expanded in various areas, including the realm of education. Assuming that the awareness of people for the need and ways of protecting the environment is a crucial point in preserving the environment, the importance of environmental education should be underlined in promoting environmental awareness and protection.

The education system responded promptly to the need for environmental education. A study was conducted to develop a baseline database that would allow effective planning of environmental education by Padeliadu & Paraskevopoulos (1998) in Greece. This study was conducted to provide information on the environmental knowledge of 5th and 6th graders in a Greek city. A total of 686 students were surveyed. To develop an environmental knowledge questionnaire fifth- and sixth- grade textbooks and other children's literature were reviewed. The questionnaire included seven questions, two of which were open ended and the rest of them were multiple choices. Knowledge about plants, animals, energy, pollution, and the interaction between humans and nature was examined. The results indicated that children's knowledge about the environment is influenced by their immediate experience as well as by the content of their textbooks. It was remarked that children consider anything green that people use for food to be alive. Children know more about mammals and pets, but do not recognize many kinds of birds or other species. The researchers indicated that the distorted knowledge mostly originates in textbooks and teaching, as well as urban children urban children use their senses when they are involved   with plants   and   animals   in   their   immediate   surroundings. Significance of

children's education within about nature and their comprehension of the differences between the artificial and the natural environments become evident.

A national survey of American high school students' environmental knowledge was performed by Gambro & Switzky in 1996. The subjects were selected from a national probability sample of approximately 10th and 12th grader, a total number of 2900 high school students from 52 middle school and 51 high schools. Environmental knowledge was defined as student's ability to understand and evaluate the impact of society on the ecosystem. This knowledge was demonstrated by recognizing environmental problems as well as comprehending the origins, implications and consequences of those problems. In knowledge scale, the items covered environmental issues such as acid rain, the greenhouse effect, and future sources energy. The analysis revealed low levels of environmental knowledge. A majority of students were able to recognize basic facts to recognize basic facts concerning environmental problems; however, most students could not apply their knowledge to comprehend the consequences or potential solutions related to the problems. Students also demonstrated extremely little growth in environmental knowledge from 10th grade to 12th grade. The results of the study indicated that environmental educators had to do a great deal to raise the level of environmental knowledge of high school students. Although recognition of a problem is the first step toward higher level understanding, it is insufficient for comprehending the repercussions of environmental problems or proposing appropriate solutions for these problems. Teachers have the opportunity to use students' concerns as a source of motivation. In addition, it is suggested that teachers should take advantage of what students know about environmental issues and develop isolated pieces of information into concepts that can be used for critical thinking.

While many research efforts have been directed toward environmental issues, limited effort has gone into investigating what and how much the public knows about the environment. The research literature indicates that knowledge about the environment very often related with the use of mass media

(Arbuthnot, 1977). To enlarge the understanding of the relationship between the use of mass media and environmental knowledge, a research was designed by Kara (1999). The study was conducted using a structured close-ended type questionnaire in Chinese. The questionnaire consisted of two parts focusing on environmental knowledge and use of mass media. From randomly selected 40 schools, grade 9, 10, and 12 students participated in the study. The results indicated that students were knowledgeable on general and local environmental issues. They had higher levels of knowledge on wildlife and air pollution issues. These two topics were more lively and more relevant to their daily life. The students were less knowledgeable about environmental issues like world population and rain forests. However, students' environmental knowledge is shaped and limited by the reporting of environmental news in Hong Kong. They were least knowledgeable in identification of causes and effects of pollution. This was attributed to low priority of environmental issues among the print and electronic media. There were some indications that students' environmental knowledge was shaped and limited by the reporting of environmental news in Hong Kong. Television news viewership had positive correlation with students' environmental knowledge while Chinese newspaper readership had a positive but weak correlation. Gender, grade level and viewing of television news were major correlates of environmental knowledge. Male students scored higher in both general and local environmental knowledge. It was attributed that environmental knowledge is built on some basic understanding of science and technology of which boys are more knowledgeable.

Some research studies have been carried out on students' environmental conceptions and learning especially concerning the greenhouse effect, depletion of the ozone layer and the consequences of energy use. In a major study (Boyes & Stanisstreet, 1993) of 850 students aged 11-16 years, the participants gave their view of statements dealing with the reasons for the increase in the greenhouse effect, the consequences of this increase and what can be done to stop it. The trend for the students' response was that increasing

from 50% to 80% between ages 11 and 16 years, the participants indicated the increase in carbon dioxide in the atmosphere as a reason for the enhancement of the greenhouse effect. Majority of the students replied that an enhancement of the greenhouse effect leads to global warming, to a change in the weather, and melting of the polar ice caps. As a precaution, the students agreed on traveling less by car, recycling paper, and planting more trees. However, some problematic elements were determined. For instance, about 70-80% of the students agreed with the statements: "The greenhouse effect is made worse by holes in the ozone layer and can be made smaller by using unlead petrol."

A similar study was conducted to investigate how Swedish students in grade 9 and grade 12 explain the greenhouse effect and the depletion of the ozone layer, effects of carbon dioxide reduction on society (Andersson & Wallin, 2000). The method chosen to answer these questions was to give students written tasks of the open-ended type. Five models of the greenhouse effect appeared among the answers, all more or less incomplete, but nevertheless with potential for development. It was observed that at least half of the students understand the greenhouse effect as the enhancement of that effect. The students' responses also indicated that they do not fully understand what fundamental societal changes would occur as a result of a drastic reduction in carbon dioxide emission. On the other hand, they were rather well informed about how injurious depletion of the ozone layer is to humans.

High school students between the ages of 11 and 16 have been questioned about their perception of the ozone layer by Boyes, Stanisstreet & Papantoniou (1998). They were asked what and where they think it is, what it does, what will damage it, and what might be result of any further damage. The results of the present study showed that Greek high school students have a good understanding of the position and purpose of the ozone layer in terms of protection from harmful ultraviolet rays, but some also think that it helps keep the world warm or protects it from acid rain. Students seem aware that the ozone layer is in danger, and they believe that many varied forms of pollution are the cause. It seems well known that further depletion might cause an

increase in skin cancers and eye cataracts, although students assumed strong, erroneous links with the greenhouse effect and other forms of local pollution, particularly those associated with illness and disease.

University students' understanding of both the greenhouse effect and the depletion of the ozone layer has been investigated by Dove (1996). Sixty students were given statements of agreeing or not and some open ended questions. The results indicated that 86% of the students were of the opinion that one reason for the depletion of the ozone layer is emission from motor vehicles. It was pointed out that students confuse the depletion of the ozone layer with the greenhouse effect, or regard them as more or less the same thing. They have a tendency to imagine that all environmentally friendly actions help to solve all environmental problems, for example, the use of unleaded gasoline reduces the risk of global warming.

Previous studies revealed that students hold many misconceptions relating to such issues as global warming, ozone depletion, and acid rain. A study by Groves & Pugh (1999) expands on earlier work to examine pre-service teachers' views about these issues, especially global warming and the related term, the greenhouse effect, and the effect their views on elementary student performance. This study employed the Environmental Issues Questionnaire developed by Boyes, Chuckran & Stanisstreet (1993). This questionnaire consisted of 36 statements was administered to 330 college students from the faculties of Education, Pure and Applied Sciences, Pharmacy and Health Sciences. Results support the findings of Boyes & Stanisstreet (1993) that elementary education majors hold many misconceptions about these environmental issues, and can affect their teaching of these topics in elementary classes.

CHAPTER III

DESIGN OF THE STUDY

The present chapter is devoted to information about the population and sampling, description of variables, measuring instruments, data collection and statistical techniques utilized in the analysis of data, assumptions and limitations of the study.

3.1   Population and Sample

This research was desired to be a national study and as the target population all sixth, eighth and tenth grade public schools' students in Turkey were identified. However, an accessible population was compulsorily determined, since it is not feasible to study with this target population. All sixth, eighth and tenth grade public schools' students in Çankaya and Yenimahalle districts of Ankara were defined as the accessible population of this study. In elementary education, it is compulsory to educate students on environmental issues in one class hour per month. However, there is no specially designed curriculum for this class hour. An environmental education component was integrated into seventh grade elementary science education curriculum and an elective course, "Human and Environment", was introduced into ninth grade high school curriculum. For this reason 6th, 8th and 10th grade students were selected as the sample of the study to gauge the effectiveness of the environmental education curriculum. The population of 6th grade students sampled in this study was totally 18957 students; 10215 of whom were from Çankaya district and 8742 from Yenimahalle district. Approximately 52% of this population was males and 48% was females. Total number of students constituting the population of 8th graders sampled in this study was 19197. The number of these students from Çankaya district was 10484 and 8713 from Yenimahalle district. The ratio of the gender of the 8th grade students was same

as the 6th graders. The population of 10th grade students exposed to "Human and Environment" course sampled in this study was approximately 2560 (See Appendix D for the content of the course). On the other hand, the population of 10th grade students not exposed to "Human and Environment" course sampled in this study was approximately 10050. No information could be found about the distribution of gender. Convenience sampling and stratified cluster random sampling methods integrated with purposive sampling were followed to obtain a representative sample of the populations. To select the sample of the study, two districts in Ankara were determined by the convenience sampling method. The participant schools were randomly selected from these districts in similar proportions with the population. Totally six high schools from these districts were participated in the study since "Human and Environment" course was followed. The measuring instruments were administered to the classes that were selected from the participant schools by taking into consideration the convenience of teachers.

A total of 2536 students participated in this study. The subjects were 711 sixth grade (48% female; 52% male), 782 eighth grade (49% female; 51% male), 484 tenth grade students not exposed to "Human and Environment" course (54% female; 46% male), 559 tenth grade students exposed to this course (51% female; 49% male). Due to time limitations and financial problems, sample size was restricted.

Table 3.1 presents the number of elementary schools throughout the districts, the number of selected elementary schools throughout these districts and the number of students from each of the districts. From each elementary school, an average of 65-70 students corresponding to 2 classes for each grade levels 6th and 8th were participated in this study.

Table 3.1 Number of Selected Elementary Schools and Students

District	Total Number of Elementary Schools	Number of Selected Elementary Schools	Number of Participant Students
Çankaya	103	10	792
Yenimahalle	85	8	701
Total	188	18	1493

There are totally 25 public high schools in which the students not exposed to "Human and Environment" course in the districts of Çankaya (13 high schools) and Yenimahalle (12 high schools). An average of 120 tenth grade students from four of these high schools corresponding to 3 classes was participated in the study to reach a sample size comparable with elementary grades.

In each districts, Çankaya and Yenimahalle, there are 3 public high schools in which the students exposed to "Human and Environment" course. An average of 90-95 tenth grade students from each of these high schools corresponding to 3 classes were participated in the study.

3.2   Variables

In this study variables considered are labeled as independent and dependent variables.

3.2.1   Independent Variables

Independent variables are variables that are controlled or manipulated in accordance with the purpose of the investigation. In this study there are two independent variables: grade level (GRADE) and gender (GENDER).

Grade Level: This variable is discrete and in ordinal scale of measurement. It labels the educational level of subjects: 6th, 8th and 10th grade students.

Gender: This variable is nominated dichotomous variable with categories of male and female.

3.2.2   Dependent Variables

A dependent variable is a measure of the effect of the independent variable. This study includes 2 dependent variables: environmental attitudes (ATTI) and environmental knowledge (KNOW). The environmental attitudes and subdomains which are behavioral intentions, environmental friendly behaviors and environmental affects were measured by a subscale of Children's Environmental Knowledge and Attitude Scale (CHEAKS) developed by Leeming & Dwyer (1995). Environmental knowledge level of subjects was measured by a 29-item subscale of CHEAKS. KNOW and ATTI are continuous and in interval scale of measurement.

3.3   Selection and Development of Measuring Tools

In this study the knowledge subscale of Children's Environmental Attitudes and Knowledge Scale (CHEAKS) was used to assess the students' knowledge on environmental concepts and issues. 6 items from Environmental Knowledge Scale developed by Tosunoğlu (1993) was added to the preliminary knowledge subscale. The final version of knowledge subscale comprises 29 multiple choice items with four alternatives. The multiple choice test with 30 items that systematically sample the six content-dependent topics: animals (5 items), energy (5 items), recycling (5 items), water (5 items), pollution (3 items) and general issues (7 items) were adapted into Turkish for the pilot administration. This subscale aims to assess elementary and high school students' knowledge of problems related to environment and general environmental topics included in Turkish curriculum or in the mass media. It should be noted that the questionnaire is by no means an achievement test in the sense of assessing students' mastery of specific environmental objectives addressed in the Turkish environmental curriculum for grades 7 and 9.

Three experts in the field of science education examined the initial version of the subscale regarding: (a) the adequacy of the environmental topics elicited in the questionnaire in terms of their parallelism with the Turkish curriculum and representativeness of the most important environmental issues in Turkey, (b) the accuracy of the multiple-choice item stems and appropriateness of the distracters. The items were modified accordingly resulting in a revised version of the questionnaire.

The 30-item preliminary knowledge test was administered to a total of 150 sixth, eighth and tenth grade students for the purpose of try out.

ITEMAN statistical program of MicroCAT (Assessment Systems Corporation, 1986) has been employed to select the items for the final version of the scale and to determine the internal consistency of the environmental knowledge subscale. Items with less than .20 biserial correlation coefficient value have been excluded from the analysis. Also items having alternatives with unexpected results (wrong alternatives selected more than the correct one) have been revised. At the end of the analysis 29 items were selected for the final scale. One item deleted was from the pollution subtopic. The statistic related to item selection is presented in Table 3.2. The Cronbach's alpha reliability of the knowledge subscale was 0.65. The subscale is given in Appendix A.

Table 3.2 The Statistics Related to Selected Items of Environmental
Knowledge Subscale

Item No	p	r	Item No	p	r
1	0.74	0.50	2	0.86	0.54
3	0.89	0.46	4	0.67	0.42
5	0.64	0.55	6	0.16	-0.12*
7	0.55	0.38	8	0.38	0.42
9	0.77	0.58	10	0.89	0.29
11	0.58	0.74	12	0.69	0.50
13	0.73	0.66	14	0.85	0.52
15	0.73	0.36	16	0.72	0.53
17	0.79	0.47	18	0.44	0.42
19	0.43	0.37	20	0.68	0.54
21	0.32	0.39	22	0.80	0.68
23	0.33	0.44	24	0.94	0.53
25	0.30	0.49	26	0.69	0.50
27	0.69	0.50	28	0.37	0.68
29	0.32	0.50	30	0.29	0.41

*Deleted Item

The attitude subscale of CHEAKS was administered to the subjects of the study to assess participants' behavioral intentions toward the environment (1-12 items), commitment to environmental friendly behaviors (13-24 items) and respondents' affect toward the environment (25-36 items). The attitude subscale comprises 36 five-point Likert-type items (strongly agree, agree, undecided, disagree, strongly disagree). These attitudinal items were sampled systematically from six content-dependent subtopics (two items from each subtopic): animals, energy, pollution, recycling, water, and general issues. The items in attitude subscale were carefully adapted and wording of the statements were examined against Edward's criteria. The subscale was evaluated and revised utilizing responses and reactive comments of colleagues in the Faculty

of Education of METU. This helped to eliminate ambiguities, unfamiliar terms and consensus items. The Cronbach's alpha reliability of the attitude subscale was 0.92. The subscale is given in Appendix B.

The reliability coefficient for the knowledge subscale of CHEAKS was not high but that of the attitude subscale and the CHEAKS total scale (alpha=0.90) were much stronger.

3.4   Procedure

In this research study the effect of gender and grade level on students' environmental knowledge and attitudes were examined. Moreover, the relationships between students' environmental knowledge and attitudes were investigated. Thus, the design of this study was both cross-sectional survey, and causal comparative study. Initially, this study began with the literature review in the aspect of the purpose. Educational Resources Information Center (ERIC), International Dissertations Abstracts, Ebscohost, Science Direct, Kluweronline databases, Internet (Google), thesis and other studies done in Turkey (from HEC, studies presented in Fen Bilimleri Eğitimi Kongresi, Hacettepe Eğitim Dergisi) were searched by the help of a keyword list. All the articles and thesis were read. The instruments developed by the other researchers, measuring environmental knowledge and attitudes of students toward environment were obtained from these articles or thesis. These measuring instruments were administered in different countries and developed for different grade level students. The content of elementary school science curriculum especially seventh grade science course dealing with environmental issues and the curriculum of the elective course in ninth grade curriculum were investigated. The most appropriate instrument measuring environmental attitudes and knowledge of students was selected by taking into consideration the environmental education program in Turkey. After selection and development of measuring tool, a seven page instrument comprising CHEAKS, a demographic information part and an introductory part was prepared. The detailed information about the preparation was given in section 3.3.

Afterwards, the participant schools and subjects of the study were determined. All the principals of the selected schools were communicated with and asked for the administration of the instruments. The permission was granted for the study from the Ministry of Education. The correspondence is given in Appendix C.

The measuring tool was piloted for the purpose of try out and modified. For the main study, this instrument was administered to sixth, eighth and tenth grade students during February, March, and April of 2004 by the researcher. A whole lecture hour was used by the permission of the instructors. The participant students were informed about purpose of the study and directed before the administration of the instrument. They were explained that their identity would be kept secret and the results of the study would not affect their grades in school.

The data obtained from the study were entered in statistical package for the social sciences program (SPSS) coding all the categories of the variables in data by the researcher. Female students were coded as 1, and male students were coded as 2. Sixth grade students were coded as 6, eighth grade students were coded as 8 and tenth grade students were coded as 10. For the mother's and father's educational level items, "illiterate" was coded as 1, "primary school" was coded as 2, "elementary school" was coded as 3, "high school" was coded as 4, "university" was coded as 5, "M.S." was coded as 6, "Ph.D." was coded as 7. For the multiple choice items in environmental knowledge subscale, the responses of students for the first alternative were coded as 1, for the second alternative were coded as 2, for the third alternative were coded as 3, for the forth alternative were coded as 4. Then, the correct responses were coded as 1, others were coded as 0. For the responses to the environmental attitude subscale, "strongly agree" was coded as 5, "agree" was coded as 4, "undecided" was coded as 3, "disagree" was coded as 2, "strongly disagree" was coded as 1. The data entry procedure took one month.

3.5   Statistical Techniques Utilized in the Study

Data file consisting of gender, grade level, age, mother's educational level, father's educational level, and responses of participants to the measuring tool were prepared by using SPSS in which columns show variables and rows show the participants by the researcher. The data obtained from the study was analyzed in two parts, descriptive statistics and inferential statistics by using SPSS.

3.5.1 Descriptive Statistics

The mean, standard deviation, skewness, kurtosis of the variables were presented.

3.5.2 Inferential Statistics

Statistical analysis employed to assess the effects of gender and grade level on elementary and secondary school students' environmental knowledge and attitudes was two-way Analysis of Variance (ANOVA). To determine the effect of "Human and Environment" course on 10th grade students' environmental knowledge and attitudes, independent-samples t test analysis was employed with this grade level students' data. To determine the effect of gender on the environmental knowledge of 6th, 8th, and 10th grade students, independent-samples t test analysis was employed with each grade level of students' data. To determine the effect of gender on attitudes toward the environment of 6th, 8th, and 10th grade students, independent-samples t test was employed with each grade level of students' data. To determine the relationship between environmental knowledge and environmental attitude subdomains, bivariate correlations were conducted with total data. The significance level was set to .05, the mostly used value in educational studies.

3.6   Assumptions and Limitations

The assumptions and limitations of this study considered by the researcher are given below.

3.6.1 Assumptions

1. The administrations of CHEAKS were under standard conditions.
2. The participant students of the study responded to the items of the instrument sincerely.

3.6.2 Limitations

1. The attitude has been evaluated by the use of a self-report measure so the data might not represent the complete objectivity.
2. The participant 6th and 8th grade students may not represent the population of interest.
3. A qualitative study might be conducted to make clear statements with respect to the results of the quantitative analysis.

CHAPTER IV

RESULTS

This chapter is divided into three different sections. First section deals with the descriptive statistics. The second section presents inferential statistics in which the null hypotheses are tested. Finally, the last section summarizes the findings of the study.

4.1. Descriptive Statistics

Descriptive statistics concerning the students' scores on both knowledge and attitude subscales of CHEAKS were considered.

4.1.1 Descriptive Statistics of the Children's Environmental Knowledge
    Subscale

Descriptive statistics related to students' scores on the Children's Environmental Knowledge Subscale were calculated for each grade levels (Table 4.1-4.4). The subscale mean scores are given in percentages and scores higher than 70.0% are taken to represent adequate knowledge. Concerning 6th grade students, total knowledge mean score of 47.0% reflects less than adequate environmental knowledge. These students' knowledge on the environmental topics was equally lacking. In particular, 6th graders' mean scores of 33.5%, 40.5%, and 41.2% on pollution, general issues, and recycling, respectively indicate severely limited knowledge of these environmental topics. By comparison, 6th grade students' mean scores were relatively higher on issues related to animals. Nonetheless, the mean score of 60.0% could not be taken to represent adequate knowledge of this topic. Finally, the large standard deviations, which ranged from 18.5 to 34.0 points, indicate that the total and

topical knowledge scores were widely spread. Such spread indicates that 6th graders' environmental knowledge was disparate.

Table 4.1 Basic Descriptive Statistics on Environmental Knowledge
for 6th Grade Students (N=711)

	Mean	Std. Dev.	Skewness	Kurtosis
Animals	60.0	24.9	-0.8	-0.8
Water	44.9	22.9	0.1	0.5
Energy	56.3	20.7	-0.3	-0.2
Recycle	41.2	21.5	0.1	-0.4
Pollution	33.5	34.0	0.5	-0.8
General	40.5	18.5	0.2	-0.1
Total	47.0	13.1	0.0	-0.3

For 8th grade students, total mean score of 54.6% reflects less than adequate environmental knowledge. Their environmental knowledge of the topics was equally lacking. Eight grade students' mean score of 41.0% on issues related to pollution indicates severely limited knowledge of this environmental topic. By comparison, their mean scores were relatively higher on issues related to animals. Nonetheless, the mean score of 69.0% still could not be taken to represent adequate knowledge of this topic. Finally, the large standard deviations, which ranged from 19.8 to 34.0 points, reflect a lack of common knowledge base on environmental concepts and related issues for 8th graders.

Table 4.2 Basic Descriptive Statistics on Environmental Knowledge

for 8th Grade Students (N=782)

	Mean	Std. Dev.	Skewness	Kurtosis
Animal	69.0	23.3	-0.5	-0.2
Water	53.1	23.7	-0.1	-0.3
Energy	60.8	20.0	-0.3	-0.0
Recycle	49.9	23.3	-0.0	-0.4
Pollution	41.0	34.0	0.2	-0.9
General	48.3	19.8	-0.2	-0.3
Total	54.6	13.9	-0.1	-0.2

The students in 10th grade not exposed to "Human and Environment" course had relatively high mean score of 61.9% on total environmental knowledge. In particular, 10th graders' lowest mean score of 52.1% on recycling indicates severely limited knowledge of this environmental topic. By comparison, 10th grade students not exposed to "Human and Environment" course had the highest mean score of 83.2% on issues related to animals. This mean score of 83.2% could be taken to represent adequate knowledge of this topic. Finally, the large standard deviations, which ranged from 17.2 to 33.7 points, indicate that the total and topical knowledge scores were widely spread. Such spread indicates that 10th graders' environmental knowledge was disparate.

Table 4.3 Basic Descriptive Statistics on Environmental Knowledge for 10th

Graders not exposed to "Human and Environment" course (N=484)

	Mean	Std. Dev.	Skewness	Kurtosis
Animal	83.2	18.7	-0.9	-0.2
Water	61.2	20.2	-0.4	-0.5
Energy	61.3	17.3	0.0	-0.6
Recycle	52.1	21.7	0.0	-0.6
Pollution	54.4	33.7	-0.1	-0.8
General	56.9	17.2	-0.3	-0.9
Total	61.9	11.5	-0.4	-0.3

Concerning 10th grade students exposed to "Human and Environment" course, total knowledge mean score of 61.7% reflects inadequate environmental knowledge. The results revealed that they had adequate knowledge only on issues related to animals with a mean score of 78.3%. The mean scores on the other environmental topics, which ranged from 46.9% to 64.0%, reveal that 10th graders who had taken the related elective course had limited environmental knowledge on these topics. Finally, the large standard deviations, which ranged from 16.9 to 34.7 points, reflect a lack of common knowledge based on environmental concepts and related issues for 10th graders who had taken "Human and Environment" course.

Table 4.4 Basic Descriptive Statistics on Environmental Knowledge for 10th Graders exposed to "Human and Environment" course (N=559)

	Mean	Std. Dev.	Skewness	Kurtosis
Animal	78.3	21.1	-0.9	0.4
Water	60.3	22.2	-0.1	-0.7
Energy	64.0	17.4	-0.4	0.5
Recycle	57.9	21.4	-0.2	-0.4
Pollution	46.9	34.7	-0.1	-0.9
General	56.3	16.9	-0.0	-0.0
Total	61.7	11.1	-0.5	0.8

By comparison of the descriptive statistics on topical environmental knowledge, as Figure 4.1 presents, the general trend for all environmental topics was an increase from 6th grade to 10th grade level. Tenth grade students had the highest mean scores while 6th grade students had the lowest mean scores on all of these environmental issues. However, these results do not indicate that 10th graders had adequate knowledge of environmental topics. The highest mean scores on issues concerning the animals indicate that the students were more knowledgeable on this topic. On the other hand, the lowest mean scores on issues related to pollution reflect severely limited knowledge on this topic for each grade level students.

Figure 4.1 Topical Knowledge Mean Scores across Grade Levels
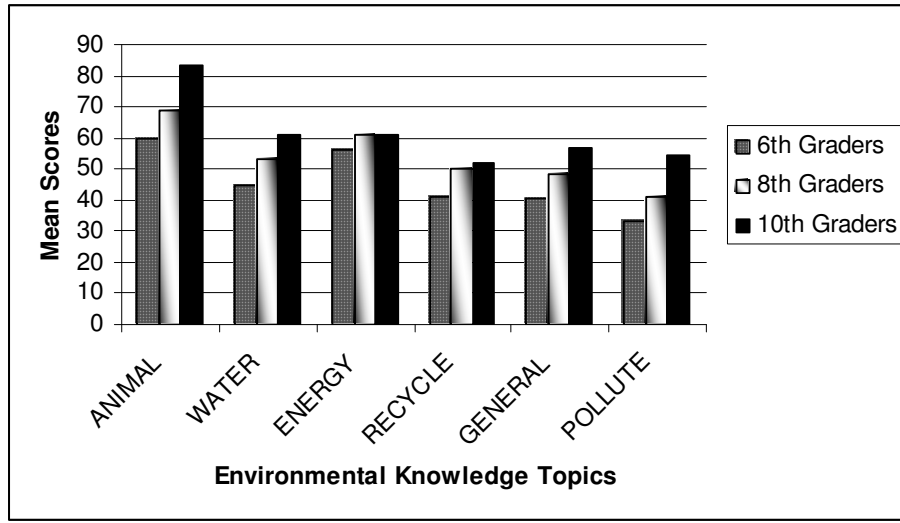
By a comparison of the descriptive statistics on topical environmental knowledge across 10th grade students, as Figure 4.2 presents, 10th grade students not exposed to "Human and Environment" course had the highest mean scores on the topics related to animals, water, pollution and general issues. 10th grade students exposed to "Human and Environment" course had the highest scores on issues related to recycling and energy.

Figure 4.2 Topical Knowledge Mean Scores across 10th Grade Students
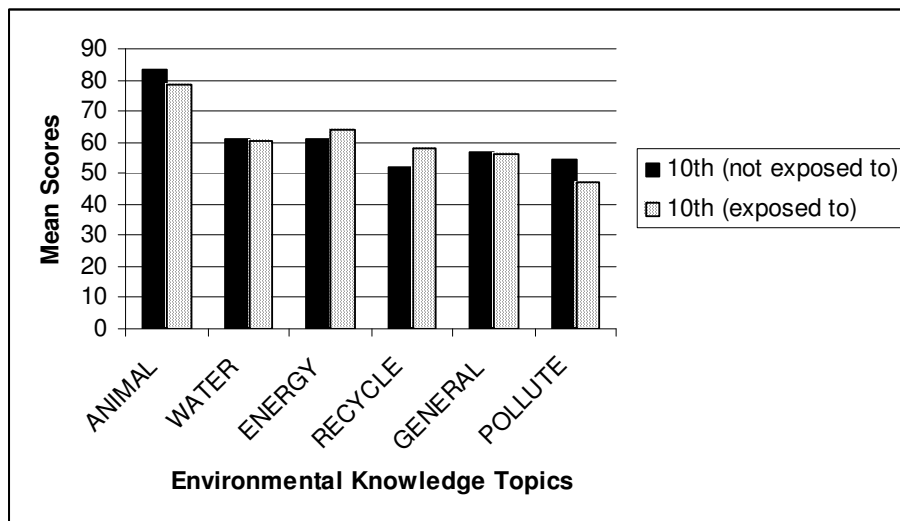
4.1.2 Descriptive Statistics of the Children's Environmental Attitudes Subscale

Descriptive statistics related to students' total environmental attitudes and subdomain scores were calculated for each grade levels (Table 4.5-4.8). Concerning 6th grade students, the relatively high total attitude mean score 77.4% indicates that 6th graders' attitudes toward the environment were favorable. Moreover, these students' mean score of 79.9% on the environmental affect subdomain were higher than the mean scores of 73.2% and 79.0% on the behavioral intentions and commitment to environmental friendly behavior subdomains respectively. Additionally, relative to what was observed in the case of knowledge scores, the standard deviations of total and subdomain attitude scores were relatively small. These deviations, which ranged from 10.9 to 13.3, indicate that 6th grade students' attitudes toward the environment were relatively consistent. As such, 6th graders' environmental attitudes were more uniform than their level of environmental knowledge.

Table 4.5 Basic Descriptive Statistics on Environmental Attitudes

for 6th Grade Students (N= 711)

	Mean	Std. Dev.	Skewness	Kurtosis
Intent	73.2	12.5	-0.5	1.3
Behave	79.0	11.6	-0.8	0.2
Affect	79.9	13.3	-0.7	1.0
Total	77.4	10.9	-0.7	1.0

For 8th grade students, the relatively high total attitude mean score of 75.7% reflects favorable attitudes toward the environment. Moreover, 8th grade students had the highest mean score of 79.5% on the environmental affect, while these students had the lowest mean scores of 71.5% on the behavioral intentions. Additionally, the standard deviations of total and subdomain attitude scores were relatively small. These deviations, which ranged from 12.0 to 14.6, indicate that 8th graders' attitudes toward the environment were more consistent relative to their environmental knowledge.

Table 4.6 Basic Descriptive Statistics on Environmental Attitudes

for 8th Grade Students (N=782)

	Mean	Std. Dev.	Skewness	Kurtosis
Intent	71.5	13.1	-0.6	0.4
Behave	76.2	13.0	-0.7	0.6
Affect	79.5	14.6	-0.8	0.5
Total	75.7	12.0	-0.8	0.8

Concerning 10th grade students not exposed to "Human and Environment" course, total attitude mean score of 73.9% indicates that students had positive attitudes toward the environment. Besides, these participants' mean score of 79.5% on the environmental affect subdomain was higher than the mean scores of 69.5% and 72.6% on the behavioral intentions and commitment to environmental friendly behavior subdomains respectively. Additionally, relatively small the standard deviations of total and subdomain attitude scores which ranged from 13.5 and 16.4 indicate that these students' attitudes toward the environment were consistent and more uniform than their level of environmental knowledge.

Table 4.7 Basic Descriptive Statistics on Environmental Attitudes for

10th Graders not exposed to "Human and Environment" course

(N=484)

	Mean	Std. Dev.	Skewness	Kurtosis
Intent	69.5	15.6	-0.6	-0.2
Behave	72.6	13.5	-0.7	0.4
Affect	79.5	16.4	-1.2	1.6
Total	73.9	13.6	-0.8	0.6

Concerning 10th grade students exposed to "Human and Environment" course, total attitude mean score of 75.6 indicates that students had positive attitudes toward the environment. Moreover, these participants' mean score of 79.7% on the environmental affect subdomain was higher than the mean scores of 72.4% and 74.7% on the behavioral intentions and commitment to environmental friendly behavior subdomains respectively. Additionally, relatively small the standard deviations of total and subdomain attitude scores which ranged from 10.6 and 12.8 indicate that subjects' attitudes toward the environment were consistent and more uniform than their level of environmental knowledge.

Table 4.8 Basic Descriptive Statistics on Environmental Attitudes for
10th Graders exposed to "Human and Environment" course

	Mean	Std. Dev.	Skewness	Kurtosis
Intent	72.4	11.7	-0.7	0.8
Behave	74.7	12.0	-0.9	1.2
Affect	79.7	12.8	-0.7	0.6
Total	75.6	10.6	-0.5	0.3

By a comparison of the descriptive statistics on environmental attitude subdomains across grade levels, as Figure 4.3 presents, each grade level students had very close mean scores. Though a decrease from 6th grade through 10th grade students was observed in total attitude mean scores, the results showed that all students had favorable attitudes toward the environment.

Figure 4.3 Environmental Attitude Subdomain Mean Scores across Grade
Levels
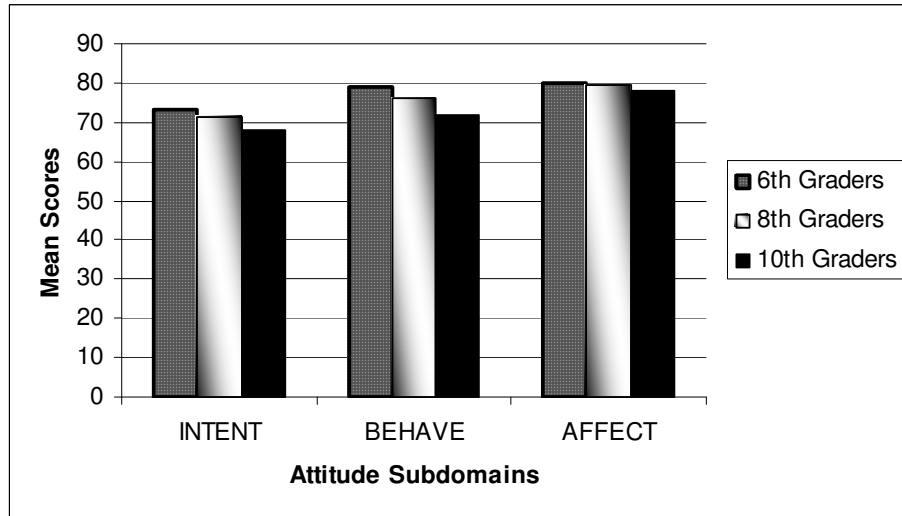
By a comparison of the descriptive statistics on environmental attitude
subdomains across 10th grade students, as Figure 4.4 presents, the same general
trend was observed for environmental attitude subdomains. The students
exposed to "Human and Environment" course had slightly more positive
attitudes than those not exposed to this course.

Figure 4.4 Environmental Attitude Subdomain Mean Scores across 10th Grade
       Students
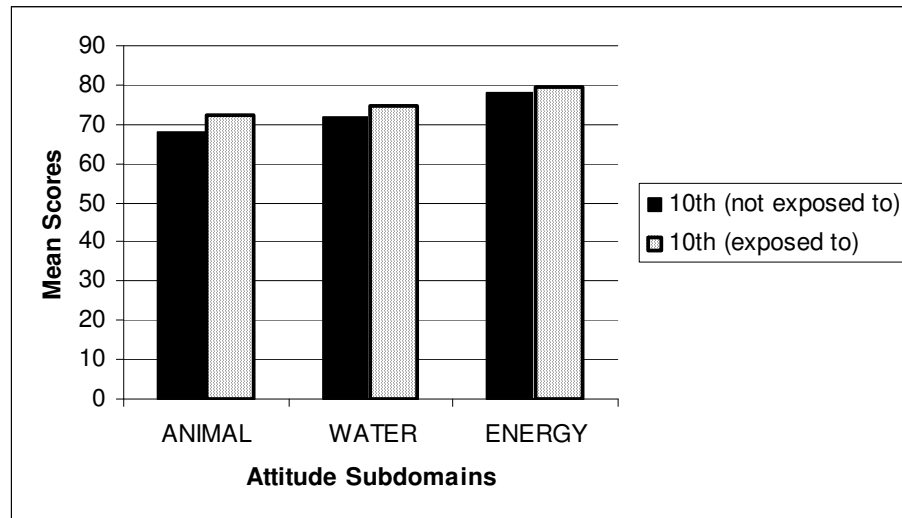
4.1.3 Descriptive Statistics of the Students' Environmental Knowledge and
      Attitudes with respect to Gender

        Descriptive statistics related to all students' total environmental
knowledge (KNOW) and their attitudes toward the environment were
represented in Table 4.9. Both female and male students had very close mean
scores on total environmental knowledge. Female students had a mean of
55.6% from knowledge scores while male students had a mean of 55.3%,
which indicates that male and female students had approximately the same
level of environmental knowledge. On contrary to environmental knowledge
mean scores, total environmental attitude scores favor female students more
than males. Female students had a mean of 78.3% from attitude scores while
male students had a mean score of 73.2%, which means that female students'
attitudes toward the environment are more favorable than male students'
attitudes.

Table 4.9 Basic Descriptive Statistics on the Total Environmental Knowledge
and Attitudes with respect to Gender

	Mean	Std. Dev.	Skewness	Kurtosis
KNOW				
Female (N=1277)	55.6	14.0	-0.3	-0.2
Male (N= 1259)	55.3	14.1	-0.2	-0.4
ATTI				
Female (N= 1277)	78.3	10.5	-0.8	0.9
Male (N= 1259)	73.2	12.4	-0.7	0.8

Descriptive statistics related to students' total environmental knowledge (KNOW) and attitudes (ATTI) were categorized with respect to 6th grade students' gender (Table 4.10). Both female and male students had close mean scores on total environmental knowledge but scores favor male students more than females. Male students had a mean of 48.0% from knowledge scores while female students had a mean of 45.9%, which reflects that male students' environmental knowledge is slightly higher than female students'. On contrary to environmental knowledge mean scores, total environmental attitude scores favor female students more than males. Female students had a mean of 79.4% from attitude scores while male students had a mean score of 75.5%, which reflects that female students' attitudes toward environment are more favorable than male students'.

Table 4.10 Basic Descriptive Statistics on the Total Environmental

Knowledge and Attitudes with respect to 6th Graders' Gender

		Mean	Std. Dev.	Skewness	Kurtosis
KNOW					
Female	(N=339)	45.9	13.2	0.0	-0.4
Male	(N= 372)	48.0	12.9	0.0	-0.3
ATTI					
Female	(N= 339)	79.4	9.9	-0.9	2.0
Male	(N= 372)	75.5	11.4	-0.5	0.6

Descriptive statistics related to students' total environmental knowledge and attitudes categorized according to 8th grade students' gender were presented in Table 4.11. Both female and male students had approximately close mean scores on total environmental knowledge but scores favor female students more than males for 8th graders. Female students had a mean of 55.1% from knowledge scores while female students had a mean of 54.2%, which indicates that female students' environmental knowledge is slightly higher than male students'. As in the case of environmental knowledge mean scores, total environmental attitude scores favor female students more than males. Female students had a mean of 78.2% from attitude scores while male students had a mean score of 73.3%, which reflects that female students' attitudes toward environment are more favorable than male students'.

Table 4.11 Basic Descriptive Statistics on the Total Environmental
Knowledge and Attitudes with respect to 8th Graders' Gender

		Mean	Std. Dev.	Skewness	Kurtosis
KNOW					
Female	(N=385)	55.1	13.2	-0.2	0.1
Male	(N= 397)	54.2	14.6	-0.1	-0.4
ATTI					
Female	(N= 385)	78.2	11.0	-1.0	1.4
Male	(N= 397)	73.3	12.4	-0.6	0.5

Descriptive statistics related to students' total environmental knowledge and attitudes were categorized with respect to the gender of 10th grade students not exposed to "Human and Environment" course and presented in Table 4.12. Both female and male students had approximately close mean scores on total environmental knowledge but scores favor male students more than females. Male students had a mean of 62.4% from knowledge scores while female students had a mean of 61.0% indicating that male students' environmental knowledge is slightly higher than female students'. On contrary to environmental knowledge mean scores, total environmental attitude scores favor female students more than males. Female students had a mean of 77.5% from attitude scores while male students had a mean score of 73.6% which shows that female students' attitudes toward environment are more favorable than male students'.

Table 4.12 Basic Descriptive Statistics on the Total Environmental Knowledge
and Attitudes with respect to Gender of 10th Graders not
exposed to "Human and Environment" course

		Mean	Std. Dev.	Skewness	Kurtosis
KNOW					
Female	(N=270)	62.8	11.3	-0.4	-0.0
Male	(N= 214)	68.6	14.5	-0.8	0.2
ATTI					
Female	(N= 270)	78.1	11.3	-0.5	0.5
Male	(N= 214)	60.9	11.7	-0.3	0.5

Descriptive statistics related to students' total environmental
knowledge and attitudes were categorized with respect to the gender of 10th
grade students exposed to "Human and Environment" course and presented in
Table 4.13. Both female and male students had approximately close mean
scores on total environmental knowledge but scores favor male students more
than females. Male students had a mean of 62.4% from knowledge scores
while female students had a mean of 61.0%, which means that male students'
environmental knowledge is slightly higher than female students'. On contrary
to environmental knowledge mean scores, total environmental attitude scores
favor female students more than males. Female students had a mean of 77.5%
from attitude scores while male students had a mean score of 73.6%, which
means that female students' attitudes toward environment are more favorable
than male students'.

Table 4.13 Basic Descriptive Statistics on the Total Environmental Knowledge
and Attitudes with respect to Gender of 10th Graders exposed to
"Human and Environment" course

	Mean	Std. Dev.	Skewness	Kurtosis
KNOW				
Female (N=283)	61.0	11.2	-0.5	1.0
Male (N= 276)	62.4	11.1	-0.6	0.7
ATTI				
Female (N= 283)	77.5	9.7	-0.6	0.6
Male (N= 276)	73.6	11.0	-0.6	0.4

4.2 Inferential Statistics

This section deals with the clarifications of two-way analysis of variance (ANOVA) assumptions, and analysis of the hypotheses.

4.2.1 Assumptions of Two-way Analysis of Variance

Two-way ANOVA has three assumptions: Normality, equality of variances, and independency of scores on the dependent variable.

For normality assumption, skewness and kurtosis values of scores on total environmental knowledge and attitudes were given in Table 4.14. The skewness and kurtosis of scores on children's environmental knowledge and attitudes subscales were in acceptable range for a normal distribution.

Table 4.14 Descriptive Statistics on Total Environmental Knowledge and
Attitude For Normality Assumption

	KNOW	ATTI
Skewness	-0.16	-0.83
Kurtosis	-0.39	0.96

Levene's Test of Equality was used to determine the equality of variances of the scores on Children's Environmental Knowledge and Attitudes Scale. As Table 4.15 presented, the errors of variance of the dependent variables

were not equal across groups. Since this assumption was violated, one of four methods, Dunnett' C procedure that does not assume that the population variances are equal was conducted for post hoc multiple comparison tests.

Table 4.15 Levene's Test of Equality of Error Variances

	F	df1	df2	Sig.
KNOW	5.359	5	1971	.000
ATTI	10.154	5	1971	.000

As a last assumption, independency of scores was examined. This assumption was met with the observations of classes by the researcher during administration. It was observed that all participants did their tests by themselves. However, the researcher could not observe whole classes participating in the study. Teachers were requested to observe each class in order to validate this assumption.

4.2.2 Two-way Analysis of Variance Model

One of the dependent variable of the study is KNOW. The grade level (GRADE) and gender (GENDER) of the students are the independent variables in the two-way ANOVA model. Table 4.16 indicates the results of the two-way ANOVA.

The other dependent variable of the study is ATTI. The grade level (GRADE) and gender (GENDER) of the students are the independent variables in the two-way ANOVA model. Table 4.17 indicates the results of the ANOVA.

Table 4.16 Tests of Between-Subjects Effects for Knowledge Subscale

Source	DV	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Sq.	Ob. Power
Corrected Model	KNOW	66908.1	5	13381.6	78.5	.000	.17	1.0
Interce.	KNOW	5582406.9	1	5582406.9	32761.2	.000	.94	1.0
GRADE	KNOW	64609.9	2	32304.9	189.6	.000	.16	1.0
GENDER	KNOW	20.83	1	20.83	.122	.727	.000	.06
GRADE*GENDER	KNOW	1421.7	2	710.84	4.172	.056	.004	.74
Error	KNOW	335852.4	1971	170.4				
Total	KNOW	6097217	1977					
Correct. Total	KNOW	402760.5	1976					

65

Table 4.17 Tests of Between-Subjects Effects for Attitude Subscale

Source	DV	Type III Sum of Squares	df	Mean Square	F	Sig.	Eta Sq.	Ob. Power
Corrected Model	ATTI.	21449.2	5	4289.8	31.6	.000	.07	1.0
Interce.	ATTI.	10729339.3	1	10729339.3	79148.6	.000	.08	1.0
GRADE	ATTI.	4780.9	2	2390.4	17.63	.000	.02	1.0
GENDER	ATTI	17330.8	1	17330.8	127.8	.000	.06	1.0
GRADE*GENDER	ATTI	2409.4	2	1204.9	8.887	.052	.01	0.97
Error	ATTI.	267187.5	1971	135.6				
Total	ATTI.	11664375	1977					
Correct. Total	ATTI.	288636.8	1976					

4.2.3 Null Hypothesis 1

There is no significant main effect of grade level on the population means of the scores on environmental knowledge.

Two-way analysis of variance (ANOVA) was conducted to determine the effect of grade level on students' environmental knowledge. The result revealed that there was a statistically significant effect of grade level on students' environmental knowledge (F (2,1971) = 189.6, p = .000). In other words, this null hypothesis was rejected.

Since the overall ANOVA was significant, a follow-up test, Dunnett's C was conducted in order to evaluate pairwise differences among the means. As Table 4.18 presents, there was a significant mean difference between 6th and 8th (in favor of 8th graders), 6th and 10th (in favor of 10th graders), 8th and 10th grade level students (in favor of 10th graders) with respect to environmental knowledge.

Table 4.18 Multiple Comparisons for Knowledge Subscale

(I) Grade	(J) Grade	Mean Difference (I-J)	Std. Error	Sig.
6	8	-7.635	.68	.000
	10	-14.940	.77	.000
8	6	7.635	.68	.000
	10	-7.308	.75	.000
10	6	14.940	.77	.000
	8	7.308	.75	.000

*The mean difference is significant at the 0.05 level

The statistical result of the SPSS calculated eta squared as 0.16 representing that 16% of the variance in environmental knowledge scores was explained by grade level of the students. The effect size measured here matched the large effect size indicating that practical significance of this study

is high. Power was found as 1.0. Therefore, the probability of failing to reject a false null hypothesis (probability of making Type-2 error) was calculated as 0.

4.2.4 Null Hypothesis 2

There is no significant main effect of grade level on the population means of the scores on environmental attitudes.

Two-way analysis of variance (ANOVA) was conducted to determine the effect of grade level on students' attitudes toward the environment. This result revealed that there was a statistically significant effect of grade level on students' attitudes toward the environment ($F (2,1971) = 17.63$, p = .000). In other words, this null hypothesis was rejected.

Since the overall ANOVA was significant, a follow-up test, Dunnett's C was conducted in order to evaluate pairwise differences among the means. As Table 4.19 presents, there was a significant mean difference between 6th and 8th (in favor of 6th graders), 6th and 10th (in favor of 6th graders), 8th and 10th (in favor of 8th graders) grade level students with respect to environmental attitudes.

Table 4.19 Multiple Comparisons for Attitude Subscale

		Mean Difference		
(I) Grade	(J) Grade	(I-J)	Std. Error	Sig.
6	8	1.611	.59	.019
	10	3.455	.74	.000
8	6	-1.611	.59	.019
	10	1.844	.75	.043
10	6	-3.455	.74	.000
	8	-1.844	.75	.043

*The mean difference is significant at the 0.05 level

The statistical result of the SPSS calculated eta squared as 0.02 representing that 2% of the variance in environmental attitude scores was explained by grade level of the students. The effect size measured here matched the small effect size indicating that practical significance of this study is low. Power was found as 1.0. Therefore, the probability of failing to reject a false null hypothesis (probability of making Type-2 error) was calculated as 0.

4.2.7 Null Hypothesis 3

There is no significant main effect of gender on the population mean scores of 6th, 8th and 10th grade level students not exposed to "Human and Environment" course on environmental knowledge.

Two-way analysis of variance (ANOVA) was conducted to determine the effect of gender on students' environmental knowledge. This result revealed that there was not a statistically significant effect of gender on students' environmental knowledge scores (F (1,1971) = .122, p = .727). In other words, this null hypothesis was failed to reject.

4.2.8 Null Hypothesis 4

There is no significant main effect of gender on the population mean scores of 6th, 8th and 10th grade level students not exposed to "Human and Environment" course on environmental attitudes.

Two-way analysis of variance (ANOVA) was conducted to determine the effect of gender on students' attitudes toward the environment. This result revealed that there was a statistically significant effect of gender (in favor of females) on students' environmental knowledge (F (1,1971) = 127.8, p = .000). In other words, this null hypothesis was rejected.

The statistical result of the SPSS calculated eta squared as 0.06 representing that 6% of the variance in environmental attitude scores was explained by gender of the students. The effect size measured here matched the medium effect size indicating that practical significance of this study is moderate. Power was found as 1.0. Therefore, the probability of failing to

reject a false null hypothesis (probability of making Type-2 error) was calculated as 0.

4.2.9 Null Hypothesis 5

There is no significant main effect of gender on the population means of 6th grade regular state school students' environmental knowledge scores.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. A statistically significant effect of gender on 6th grade level students' environmental knowledge scores was found in favor of male students (t (709) =-2.21, p = .027). This null hypothesis was rejected.

4.2.10 Null Hypothesis 6

There is no significant main effect of gender on the population means of 6th grade regular state school students' environmental attitude scores.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. The result revealed that there was a statistically significant effect of gender on 6th grade level students' attitudes toward the environment in favor of females (t (709) = 4.83, p = .000). In other words, this null hypothesis was rejected.

4.2.11 Null Hypothesis 7

There is no significant main effect of gender on the population means of 8th grade regular state school students' environmental knowledge scores.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. The result revealed that there was not a statistically significant effect of gender on 8th grade level students' environmental knowledge (t (776) = .94, p = .347). In other words, this null hypothesis was failed to reject.

4.2.12 Null Hypothesis 8

There is no significant main effect of gender on the population means of 8th grade regular state school students' environmental attitude scores.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. The result revealed that there was a statistically significant effect of gender on 8th grade level students' attitudes toward the environment in favor of females (t (776) = 5.83, p = .000). In other words, this null hypothesis was rejected.

4.2.13 Null Hypothesis 9

There is no significant main effect of gender on the population mean scores of 10th grade students not exposed to "Human and Environment" course on environmental knowledge.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. The result revealed that there was not a statistically significant effect of gender on 10th grade level students' (not exposed to this course) environmental knowledge (t (482) = 1.78, p = .076). In other words, this null hypothesis was failed to reject.

4.2.14 Null Hypothesis 10

There is no significant main effect of gender on the population mean scores of 10th grade students not exposed to "Human and Environment" course on environmental attitudes.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. The result revealed that there was a statistically significant effect of gender on 10th grade level students' (not exposed to this course) attitudes toward the environment in favor of females (t (396) = 7.86, p = .000). In other words, this null hypothesis was rejected.

4.2.15 Null Hypothesis 11

There is no significant main effect of gender on the population mean scores of 10th grade students exposed to "Human and Environment" course on environmental knowledge.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. The results revealed that there was not a statistically significant effect of gender on 10th grade level students' (exposed to this course) environmental knowledge (t (557) = -1.45, p = .147). This null hypothesis was failed to reject.

4.2.16 Null Hypothesis 12

There is no significant main effect of gender on the population mean scores of 10th grade students exposed to "Human and Environment" course on environmental attitude.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. A statistically significant effect of gender on 10th grade students' (exposed to this course) attitudes toward the environment was found in favor of female students (t (557) = 4.47, p = .000). This null hypothesis was rejected.

4.2.5 Null Hypothesis 13

There is no main effect of "Human and Environment" course on population means of 10th grade regular state school students' scores on environmental knowledge.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. This result revealed that there was not a significant effect of "Human and Environment" course on 10th grade level students' environmental knowledge scores (t(1041)=-0.326, p=.744). In other words, this null hypothesis was failed to reject.

4.2.6 Null Hypothesis 14

There is no main effect of "Human and Environment" course on population means of 10th grade regular state school students' scores on environmental attitudes.

An independent-samples t test analysis was conducted to evaluate this null hypothesis. A significant effect of "Human and Environment" course on 10th grade level students' environmental attitude scores (t(905)=2.219, p=.027) was found in favor of the students exposed to this course. In other words, this null hypothesis was rejected.

Eta squared was calculated as 0.005 representing that 0.5% of the variance in environmental attitude scores was explained by exposure to "Human and Environment" course. The effect size measured here matched the small effect size indicating that practical significance of this study is low.

4.2.17 Correlational Analysis

The correlational matrix presented in Table 4.20 shows correlation coefficients between total knowledge scores, scores for attitude subdomains including behavioral intentions, commitment to environmental friendly behavior and environmental affects. The matrix was generated to assess whether students' environmental knowledge, environmental attitude subdomains, and commitment to environmental friendly behavior were significantly related.

Table 4.20 Inter-correlations among total knowledge scores and
       attitude subdomain scores

	KNOW	INTENT	BEHAVE
INTENT	.106*		
BEHAVE	.036	.663*	
AFFECT	.127*	.624*	.702*

*Correlation is significant at .01 level (2-tailed)

4.2.18 Null Hypothesis 15

There is no significant relationship between all students' environmental knowledge and behavioral intentions.

A significant positive correlation between all students' environmental knowledge and behavioral intentions was found (p=.000, r=.103). This null hypothesis was rejected. However, this relationship was weak and only 1.12% of the total variance in behavioral intentions could be explained by the variance in environmental knowledge.

4.2.19 Null Hypothesis 16

There is no significant relationship between all students' environmental knowledge and environmental friendly behaviors.

The results indicated that there was no significant correlation between all students' environmental knowledge and environmentally friendly behaviors (p=.067, r=.036). This null hypothesis was failed to reject.

4.2.20 Null Hypothesis 17

There is no significant relationship between all students' environmental knowledge and environmental affects.

A significant positive correlation between all students' environmental knowledge and environmental affects was found (p=.000, r=.127). This null hypothesis was rejected. However, this relationship was weak and only 1.61% of the total variance in environmental affects could be explained by the variance in environmental knowledge.

4.2.21 Null Hypothesis 18

There is no significant relationship between all students' environmental friendly behaviors and behavioral intentions.

A significant positive correlation between all students' environmental friendly behaviors and behavioral intentions was found (p=.000, r=.663). This null hypothesis was rejected. The relationship was moderately high and 43.96% of the total variance in environmental friendly behaviors could be explained by the variance in behavioral intentions.

4.2.22 Null Hypothesis 19

There is no significant relationship between all students' environmental friendly behaviors and environmental affects.

A significant positive correlation between all students' environmental friendly behaviors and environmental affects was found (p=.000, r=.702). This null hypothesis was rejected. The relationship was high and 49.28% of the total variance in environmental friendly behaviors could be explained by the variance in environmental affects.

4.2.23 Null Hypothesis 20

There is no significant relationship between all students' environmental affects and behavioral intentions.

A significant positive correlation between all students' environmental friendly behaviors and behavioral intentions was found (p=.000, r=.624). This null hypothesis was rejected. The relationship was moderately high and 38.94% of the total variance in behavioral intentions could be explained by the variance in environmental affects.

4.3 Summary of Results

The results of this research can be summarized as follows.

❖ It can be easily understood from the mean scores on environmental knowledge that the students did not have adequate knowledge on environmental issues.

❖ Students' attitudes toward environment were quite favorable.

❖ The grade level had a statistically significant effect on students' environmental knowledge. 6th graders had the lowest mean scores and 10th graders had the highest mean scores on environmental knowledge.

❖ The grade level had a statistically significant effect on students' attitudes toward environment. 6th graders mean scores on environmental attitudes were significantly higher than 8th and 10th graders'.

❖ There was no significant mean difference between the knowledge mean sores of 10th grade students exposed to "Human and Environment" course and those not exposed to this course.

❖ "Human and Environment" course had a statistically significant effect on students' environmental attitude scores in favor of 10th graders exposed to this course.

❖ The gender difference on environmental knowledge was statistically significant for 6th graders in the favor of males.

❖ The gender difference on environmental attitudes was statistically significant across grade levels. Female students had significantly higher mean scores on environmental attitudes than male students.

❖ There was no significant relationship between all students' environmental knowledge and environmental friendly behavior. On the other hand, their environmental knowledge was significantly related to their environmental affects and behavioral intentions.

❖ Students' mean scores on environmental attitude subdomains were highly correlated with each other.

CHAPTER V

CONCLUSIONS, DISCUSSIONS AND IMPLICATIONS

This chapter presents the summary of the research study, conclusions and discussion of the results, internal and external validity of the study, and finally announces the implications of the study and recommendations for further studies.

5.1 Summary of the Research Study

In order to investigate the specified purposes of this study, 711 sixth grade, 782 eighth grade, 484 tenth grade students not exposed "Human and Environment" course and 559 tenth grade students exposed to this course selected from an accessible population were administered the Turkish version of Children's Environmental Attitudes and Knowledge Scale (T-CHEAKS). To obtain the representative sample, stratified clustered random sampling and purposive sampling integrated with convenience sampling was used. Cross sectional survey and causal comparative research were the two research methodologies utilized during the course of this study.

5.2 Conclusions

The results of the study reflect that the students had less than adequate knowledge on environmental issues. For instance, students' knowledge on environmental issues related to pollution and recycling was severely limited. Participants had relatively higher mean scores on environmental issues related to animals, but these mean scores could not be taken to represent adequate knowledge of these topics. Although the students' environmental knowledge was incorrect and fragmentary, the results indicate that students' attitudes toward the environment were favorable.

The effect of grade level on students' environmental knowledge was found to be statistically significant. While 6th grade level students had the lowest mean scores on environmental knowledge, 10th grade level students had the highest mean scores. The grade level had a significant effect on students' attitudes toward the environment, too. On contrary, mean scores of 6th grade level students' attitudes toward the environment were significantly greater than those of 8th and 10th graders. Besides, a statistically significant difference was found between 8th and 10th grader students' attitudes toward the environment in favor of 8th graders.

The results of this study indicated that there was no significant difference between 10th grade students exposed to "Human and Environment" course and those not exposed to this course on environmental knowledge. On the other hand, it was found that the effect of "Human and Environment" course had a significant effect on environmental attitudes in favor of 10th graders exposed to this course.

As most of the previous research studies pointed out, 6th grade male students were more equipped with environmental knowledge than 6th grade female students. However, gender did not have a significant effect on grade 8 and 10 students' environmental knowledge.

The gender difference on environmental attitudes was statistically significant for each grade level students. Female students had more favorable environmental attitudes than male students.

The results also underlined that there was no significant relationship between students' environmental knowledge and environmental friendly behavior. On the other hand, it was observed their environmental knowledge was significantly related to other environmental attitude subdomains; behavioral intentions and environmental affects. There were high positive correlations between students' behavioral intentions, commitment to environmental friendly behavior and environmental affects.

5.3 Discussion of the Results

The effects of grade level, "Human and Environment" course and gender on students' environmental attitudes and knowledge have been the major concern of this discussion. In addition, the relationships between students' knowledge, behavioral intentions, commitment to environmental friendly behavior and environmental affects have been discussed.

When the results of this research were compared with those of previous ones, current research supports some findings from other studies while contradicting with some of them.

Consistent with research undertaken in other countries (Kuhlemeier, Bergh & Lagerweij, 1999; Dimitrios & Pantis, 2003; Abd-El-Khalick, et al., 2003), both elementary and high school students had low levels of knowledge on basic environmental concepts and issues, but held relatively uniform and favorable attitudes toward the environment. The students seemed willing to make sacrifices and take necessary actions to protect the environment, but lacked the knowledge base necessary to take informed decisions.

In elementary schools, participants have followed the environmental curriculum as a part of science courses. The results showed that higher grade level students had significantly higher levels of knowledge on environmental issues. One possible explanation for this finding might be that understanding of basic aspects of environmental issues increases as the amount of relevant information presented increases. At this point it should be also noted that knowledge is more subject to maturation levels. There is a developmental process in the formation of a concept, parallel to cognitive development. When a word has been learned by the child, its development is barely starting; the word at first is a generalization of the most primitive type; as the child's intellect develops, it is replaced by generalizations of a higher type which lead to the formation of true concepts (Vygotsky, 1986). Intellectual development influences children's understanding of environmental concepts (Palmer, 1995). As students grow older and have more experience on the world, it becomes easier to understand the basic concepts on environmental issues. On the other

hand, older students' knowledge on environmental problems was still fragmentary and incorrect. Besides, no statistically significant effect of "Human and Environment" course on 10th grade students' environmental knowledge was found. The present finding supports the tentative conclusion that this environmental curriculum is not being implemented effectively.

However, in some countries, the students exposed to environmental curriculum for extensive periods of time, still had inadequate understandings of environmental topics (Gambro & Switzky, 1996, 1999). Gambro & Switzky (1999) suggested that it is not enough to develop and implement a curriculum in which basic environmental concepts and issues are prominently presented. Furthermore, as Abd-El-Khalick et al., (2003) reported an environmental curriculum may provide both teachers and students with lots of information, but this information may be presented in ways that do not foster students' interest and creativity, resulting in a lack of motivation and little meaningful learning. What is needed is not only to provide teachers and students with an appropriate curriculum. Rather, teacher-training activities, quality instructional materials, careful monitoring, and classroom support during implementation should be considered as well. With these components missing, Turkish educational system will continue to provide inadequate education program and as a result, students will continue to have fragmentary understandings of environmental concepts and issues.

The results of the study indicated that students were more knowledgeable about environmental issues related to animals and energy. These two topics are more lively and more relevant to their daily life. The students' knowledge was severely limited on environmental issues related to pollution. Besides the school, home and media are the main sources of information for the children (Kara, 1999; Palmer, 1993; Richmond, 1978). The findings of the study may mean that these three sources of information do not touch upon the issues dealing with pollution or simply engage in aspects of the issue other than knowledge of pollution. Kara (1999) found significant positive correlations between students' environmental knowledge and use of mass

media. Turkish television news and newspapers considerably mention environmental issues concerning the protection of animals, energy usage and conservation. Therefore, mass media may be effective in disseminating environmental knowledge.

The relatively high mean scores in attitude section of the instrument can be attributed to probably to the fact that children show sympathy for preservation of ecosystems and animals (Dettmann-Easler & Pease, 1999; Raglon, 1986). The students seem to possess high levels of emotional attitudes because of their tendency toward strong emotional bonding to nature (Dimitrios & Pantis, 2003).

The results concerning the relationship between the grade level and environmental attitude were unexpected, particularly the finding that students in 6th grade showed a more positive attitude toward the environment than students' in 8th and 10th grade. Also, 8th grade students had more favorable attitudes than 10th graders. The few researchers who previously studied young children's environmental attitudes in a way that allowed meaningful comparison of different grade levels did not find significant age differences. Fennessey, Livingston, Edwards, Kidder, & Nafziger (1974) found nonsignificant differences in attitude among third, fourth, and eighth grade students, and Armstrong & Impara (1991) found nonsignificant differences between fifth and seventh grade students. No significant correlation between the grade level and attitudes of students in 5th and 6th grades was found in a research study by Dimitrios & Pantis (2003). Consistent with our research findings, Leeming & Porter (1997) found a more positive attitude toward the environment for younger students. However, no clear explanation could be made. Additional research, particularly longitudinal work, is urgently needed in this important area.

The results of this study clearly showed that exposure to "Human and Environment" course resulted in more positive attitudes toward the environment than in students not exposed to this course. This supported the findings of earlier investigators (Leeming & Porter, 1997; Bradley, Champbell,

Waliczek & Zajicek, 1999; Bright & Tarrant, 2002) regarding the effects of participation in a course on environmental education. The positive impact of "Human and Environment" course was desirable for students' attitudes toward the environment. However, it must be considered that it is needed to prepare environmentally literate students who would play an active role in protecting the environment through making informed decisions. At this point, the science educators should be active on preparing future citizens with environmental knowledge as well as environmentally desirable behaviors. Further research should answer the questions addressing whether favorable attitudes of students exposed to "Human and Environment" course are stable and how best to capitalize on the improved attitudes to bring about significant knowledge gains.

According to the results of this study, the effect of gender on all students' environmental knowledge was not significant. This result was consistent with the findings of the investigation on gender difference of 8th and 10th grade level students. On the other hand, gender was found to be significantly related to 6th grade students' levels of knowledge on environmental issues in favor of males. Furthermore, males in grade 10 had higher environmental knowledge scores than females. It may be that environmental knowledge is built on some basic understanding of science and technology of which boys are usually more knowledgeable (Kara, 1999). One possible explanation suggested by Gambro & Switzky (1999) involves gender bias in the schools. These researchers have indicated that male and female students may receive very different treatment in classrooms and particularly in their interactions with teachers. Teachers give more attention to male students, ask more questions and provide more meaningful feedback to male students. 6th grade female students might have received significantly different opportunities and not received the same quality learning experience when compared male students.

Consistent with the other research findings (Tosunoğlu, 1993; Riechard & Peterson, 1998; Worsley & Skrzypiec, 1998) the present study showed that females had significantly more favorable attitudes toward the

environment for all grade levels. This review of literature showed that females consistently express greater anxiety toward dangers than males. Worsley & Skrzypiec (1998) stressed that a high prevalence of depressive disorders and accordingly, hopelessness are characteristic dispositions for developing teenagers and such attributes may influence adolescents' environmental concerns. The authors found that females have higher environmental sensitiveness than males depending on being more likely to experience depressive moods. Another possible explanation suggested by Tosunoğlu (1993) was related with the different socialization of males and females. Most environmentally relevant behaviors take place at home (saving electricity, water, recycling, and so on), but the housework is much more often done by women than by men. This situation has not fundamentally changed in the past years. So women have much more experience in housework than do men and are more confronted with questions of environmental problems. The researchers Tikka, Kuitunen & Tynys (2000) have identified similar tendencies: Males tend to emphasize mastering nature and deriving benefits from natural resources, whereas women take a more emotional attitude toward nature. The concern felt by females for nature and the environment could be seen as a way of taking care of their offspring, because a clean and safe environment is a prediction for welfare and survival. Although the sample of our study was constituted of younger people, these suggestions might have an impact on this sample, too.

As with previous researches (Kuhlemeier, Bergh & Lagerweij, 1999; Abd-El-Khalick, et al., 2003), there was a low correlation between students' environmental knowledge and attitude subdomains toward the environment showing that knowledge is not directly effective on environmental attitudes but several factors should be considered. In fact, it is a plausible assumption that the students with more knowledge of environmental problems care about the environment more, are prepared to make some sacrifices, and take the environment into account more in everyday life. However, the research results indicated that there was a low correlation between students' environmental

knowledge, on the one hand, and behavioral intentions and environmental affect. Indeed, a substantial relation between knowledge of environmental problems and environmental friendly behaviors could not be demonstrated in our study. Various explanations can underlie these findings. In line with the results of study by Tosunoğlu (1993), it is possible that there was no clear relation in our population between knowledge, on the one hand, and attitude and environmentally friendly behavior, or as reported by Kuhlemeier, Bergh & Lagerweij (1999), environmentally responsible behavior can not be measured by means of a questionnaire. The authors suggested that we should not be too optimistic about the correspondence between what people say and what really do. To construct the linkage between the knowledge and environmental friendly behaviors, environmental education plays an important role. Schools have a responsibility to help equip the students with the knowledge and commitment to take personally meaningful and informed decisions. Traditional knowledge about the environment as it is taught in our schools is not in essence action oriented. Environmental education at school in Turkey has traditionally focused on passing knowledge to students, who have not been afforded the possibility of actively appropriating and internalizing that knowledge. To prepare environmentally literate students, who would play an active role in protecting the environment through making informed decisions; activity-based teaching should be held in our schools. Activity-based teaching is described as being action oriented. Such activities may consist of physical, chemical and biological investigations of a polluted lake or demonstrating against traffic conditions. Such activities are valuable and productive to the extent that they facilitate motivation and the acquisition of knowledge (Jensen, 2002).

In our study, evidence was found for another common sense opinion that behavioral intentions, environmental friendly behaviors, and environmental affects are highly correlated. These relations were stronger than in most other studies (Kuhlemeier, Bergh & Lagerweij, 1999; Abd-El-Khalick, Boujaoude, and Makki 2003). As suggested by Abd-El-Khalick, Boujaoude and Makki, (2003) behavioral intentions and environmental affects could serve

as determinants of proper environmental behavior. Higher relationship between behavioral intentions and behaviors could be expected in this study. One of the possible explanations is that they do not have sufficient knowledge of consequences of their actions on the environment. At this point, the important role of environmental education must be stressed. Environmental education should help students by providing them with knowledge and increasing their action competence.

5.4 Internal Validity of the Study

Internal validity means that the observed differences on the dependent variable are directly related to the dependent variable, not due to some other extraneous variable. Possible threats to internal validity and the methods used to cope with them are discussed in this section.

Although schools involved in this study were thought as clusters and randomly selected, random assignment of subjects was not possible. Since the groups were already formed, not the individuals, but the groups were randomly assigned. Hence, many subject characteristics (age, maturity, ethnicity, intelligence, speed, motivation, socioeconomic status, previous knowledge) could be the major threat to the internal validity for this study. The grade level and gender were the independent variables of the study. Besides, attitude of the students was one of the dependent variables of the study. These characteristics of participants were under investigation. Motivation and socioeconomic status of the students could be considered in further investigations. The amount of previous environmental knowledge of students was assumed to be equal across the grade levels.

Location and instrumentation could not be threats to the study since the instruments were administered to all groups in similar physical arrangement of the certain classrooms and mostly by the researcher.

Data collector characteristics and data collector bias threats were assumed to be controlled by training and informing the teachers to ensure standard procedures under which the data were collected.

Finally, confidentiality was not a possible threat for this study since names of the students were not collected and used anywhere.

5.5 External Validity of the Study

The extent to which the results of a study can be generalized determines the external validity of the study. Both the nature of the sample and the environmental conditions, the settings, within which a study takes place, must be considered in thinking about generalizability.

Subjects of the study were randomly selected from the accessible population. 711 sixth grade, 782 eighth grade, 1043 tenth grade level students were involved in the study. The results and conclusions found at the end of this study can be easily applied to accessible population for tenth graders. However, it is very difficult to reach a sample size to make generalizations on the accessible population of sixth and eighth graders. The findings of the study have some limitations at this point.

Since all the administration procedure took place in ordinary classrooms during regular class hours, there were possibly no remarkable differences among the environmental conditions. Therefore, it was believed that external effects were sufficiently controlled by the settings used in the study.

5.6 Implications of the Study

Results of the present study have some implications for teachers, curriculum planners, school administrators, and the researchers who deal with the environmental education programs in Turkey. The following suggestions can be offered:

1. Students' low levels of knowledge indicate that the effectiveness of the environmental education program should be scrutinized again.

2. To provide teachers and students with an appropriate curriculum may not be enough. Rather, teacher-training activities, quality instructional materials, careful monitoring, and classroom support during implementation should be considered as well.

3. The results seem to suggest that the use of mass media and students' environmental knowledge may be related. News coverage on environmental issues should be enhanced in the mass media in order to cultivate an environmentally informed public.

4. Since students' attitudes toward the environment were highly correlated to their environmental friendly behavior, attitudes toward the environment should be one of the main goals of environmental education programs.

5. Students' high levels of emotional attitudes and its direct relation with behavioral intentions and the environmental friendly behaviors should be used as an advantage to prepare environmentally literate citizens.

6. Some environmental education researches could be conducted investigating the efficacy of programs by examining their effects on both attitudes toward the environment and behaviors.

7. To develop environmentally literate and responsible citizenry, effect of personality variables should be seriously examined and recognized as well.

8. Teachers and teacher educators should work together to eliminate the gender difference on environmental knowledge in favor of males. Female students should receive the same opportunities and the same

quality learning experience when compared male students. Girls could not remain behind boys in environmental education.

9. Not only male students but also females should be encouraged to learn in environmental education programs.

10. Environmental education programs should be constructed to increase the favorable attitudes of males as well as females.

5.7 Recommendations for Further Research

Current study has suggested a variety of useful topics for further studies. These are briefly as follows:

1. A similar study can be conducted with a random sample from different schools (e.g. private schools, Anatolian high schools) to reach a generalization for Turkish population.

2. A study can be conducted to identify and compare environmental awareness of university students from different faculties.

3. A more detailed study should be conducted to identify the determinants of environmental attitudes and environmental friendly behaviors for different age groups.

4. Further research is necessary to develop teaching strategies enhancing the learning and cognitive development of students on environmental issues.

5. Similar studies can be conducted to investigate the parent's environmental attitudes and knowledge.

6. There is a strong need to examine the self-efficacy of science teachers on environmental education and the other potential barriers that handicap the effective exposition of the environmental education curriculum.

7. Rather than a questionnaire, observed environmental friendly behaviors of students should be assessed in further studies.

8. There is a clear need for longitudinal studies of the effects of formal environmental education program on environmental attitudes of different student populations.

9. Change in environmental knowledge, attitudes and environmental friendly behaviors of students can be considered in further studies.

REFERENCES

Abd-El-Khalick, F., Boujaoude, S., & Makki, M., 2003. "Lebanese Secondary School Students' Environmental Knowledge and Attitudes", Environmental Education Research, Vol.9, No.1

Andersson, B., & Wallin, A., 2000. "Students' Understanding of the Greenhouse Effect, Societal Consequences of Reducing CO_2 Emission and the Problem of Ozone Layer Depletion", Journal of Research In Science Teaching, Vol.37, No.10, 1096-1111

Arbuthnot, J., 1977, "The Roles of Attitudinal and Personality Variables in the Prediction of Environmental Behavior and Knowledge", Environment and Behavior, 9(2), 217-233

Arbuthnot, J., & Lingg, S., 1975. "A Comparison of French and American Environmental Behaviors, Knowledge and Attitudes", International Journal of Psychology, Vol.10 pp.275-281

Arcury, T., & Johnson, T., 1987. "Public Environmental Knowledge: A Statewide Survey", The Journal of Environmental Education, 18(4), 31-37

Armstrong, J., & Impara, J., 1991. "The Impact of Environmental Education Program on Knowledge and Attitude", The Journal of Environmental Education, 22, 36-40

-------------Assessment Systems Corporation. 1986. ITEMAN. (Computer Program).

Barraza, L., 2000. "Perceptions of Social and Environmental Problems by English and Mexican Children", Canadian Journal of Environmental Education, 6, pp. 31-36

Barraza, L., 2001. "Environmental Education in Mexican Schools: A Review of the Primary Level", Journal of Environmental Education, 32, pp. 31-36

Barraza, L., & Walford, R., 2002. "Environmental Education: A Comparison Between English and Mexican School Children", Environmental Education Research, Vol. 8, No. 2

Benton, J., & Raymond, 1994. "Environmental Knowledge and Attitudes of Faculty: Business versus Arts and Sciences", Journal of Education for Business, Vol. 70, Issue 1

Boyes, E., Chuckran, D., & Stanisstreet, M., 1993. "How do high school students perceive global climate change: What are its manifestations? What are its origins? What corrective action can be taken?", Journal of Science Education and Technology, 2: 541-557

Boyes, E., & Stanisstreet, M., 1993. "The Greenhouse Effect: Children's Perceptions of Causes, Consequences and Cures", International Journal of Science Education, 15(5), 531-552

Boyes, E., Stanisstreet, M., & Papantoniou, V., 1998. "The Ideas of Greek High School Students about the Ozone Layer", John Wiley & Sons, Sci. Ed., 83: 724-737

Bradley, Champbell, J., Waliczek, T., & Zajicek, J., 1999. "Relationship Between Environmental Knowledge and Environmental Attitude of High School Students", Journal of Environmental Education, Vol.30, Issue 3

Bright, A., & Tarrant, M., 2002, "Effect of Environment-Based Coursework on the Nature of Attitudes Toward the Endangered Species Act", Journal of Environmental Education, Vol. 33, No.3, 10-19

Chen-Yin, Chieko, Chyan-Chyuan, Huang, Kawata, & Tung, 2002. "The Effects of Different Environmental Education Programs on the Environmental Behavior of Seventh Grade Students and Related Factors", Journal of Environmental Health, Vol.64 Issue 7

Daştan, H., 1999. "Çevre Koruma Bilinci ve Duyarlılığının Oluşmasında Eğitimin Yeri ve Önemi", Ms. Thesis, Gazi University, Ankara,

Dettman-Easler, D., & Pease, J., 1999, "Evaluating the Effectiveness of Residential Environmental Education Programs in Fostering Positive Attitudes Toward Wildlife", The Journal of Environmental Education, 31 (1), 33-39

Dierking, L., & Falk, J., 1985. "A community Based Model for Environmental Innovation", Paper presented at The Third International Conference on the Nature and Teaching of Environmental Studies in Higher Education. UK: Sunderland Polytechnic.

Dillon, P., & Gayford, C., 1997. "A Psychometric Approach to Investigating the Environmental Beliefs, Intentions and Behaviors of Pre-service Teachers", Environmental Education Research, 3(3), pp. 283-298

Dimitrios, D., & Pantis, J., 2003. "Knowledge and Attitudes Regarding Sea Turtles in Elementary Students on Zakynthos, Greece", Journal of Environmental Education, Vol. 34, No. 3, 30-38

Dove, J., 1996. "Students Teacher Understanding of the Greenhouse Effect, Ozone Layer Depletion and Acid Rain", Environmental Education Research, 2(1), 89-100

Fennessey, G., Livingston, S., Edwards, K., Kidder, S., & Nafziger, A., 1974. "Simulation, Gaming, and Conventional Instruction in the Teaching of Ecology", The Journal of Environmental Education, 5, 21-24

Gambro, J., & Switzky, H., 1996. "A National Survey of High School Students' Environmental Knowledge", Journal of Environmental Education, Vol. 27 Issue 3

Gambro, J., & Switzky, H., 1999. "Variables Associated with American High School Students' Knowledge of Environmental Issues related to Energy and Pollution", Journal of Environmental Education, Vol. 30 Issue 2

Grodzinska, S., 2001. "Management of industrial and municipal solid wastes in Poland", Resources, Conservation and Recycling, 32/2, pp. 85–103.

Grodzinska, S., & Ballantyne, R., 2003. "Evaluating the Impact of a School Waste Education Programme Upon Students', Parents' and Teachers' Environmental Knowledge, Attitudes, Behaviour", International Research in Geographical and Environmental Education, Vol. 12, No.2

Groves, F., & Pugh, A., 1999. "Elementary Pre-service Teacher Perceptions of the Greenhouse Effect", Journal of Science Education and Technology, Vol.8, No.1

Hale, M., 1990, "Recent Developments in Environmental Education in Britain", Australian Journal of Environmental Education, 6, pp. 29-44

Harvey, G.D., 1976. "Environmental Education: A Delineation of Substantive Structure", Dissertation Abstracts International, Vol. 38, pp. 611-612

Hinrichsen, B., & Robey, B., 2000. "Population and the Environment: The Global Challenge", Population Reports, Series M, No. 10., p.31.

Hsu, S., & Roth, R., 1996. "An Assessment of Environmental Knowledge and Attitudes Held By Community Leaders in the Hualien Area of Taiwan", Journal of Environmental Education, Vol. 28, Issue. 1

Jensen, B., 2002, "Knowledge, Action and Pro-environmental Behavior", Environmental Education Research, Vol. 8, No. 3

Kara, C., 1999. "Mass Media and Environmental Knowledge of Secondary School Students in Hong Kong", The Environmentalist 19, 85-97

Kuhlemeier, H., Bergh, H., & Lagerweij, N., 1999. "Environmental Knowledge, Attitudes, and Behavior in Dutch Secondary Education", Journal of Environmental Education, Vol.30 pp.4-11

Leeming, F., & Dwyer, W., 1995. "Children's Environmental Attitude and Knowledge Scale: Construction and Validation", <u>Journal of Environmental Education</u>, Vol. 26, Issue 3

Leeming, F., & Porter, B., 1997. "Effects of Participation in Class Activities on Children's Environmental Attitudes and Knowledge", <u>Journal of Environmental Education</u>, Vol. 28 ,Issue 2

Martin, S., 1999. "The Influence of Outdoor School Yard Experiences on Elementary Students' Environmental Knowledge, Attitudes, Behaviors, and Comfort Levels", <u>Ph. D. Thesis,</u> The University of Florida

Martin, C., & Wheeler, K., 1975. "Insights into Environmental Education", <u>Edinburg, Oliver & Boyd</u>

Moyer, R.H., 1975. "An Investigation of Factors Influencing Environmental Attitudes", <u>School Science and Mathematics,</u> 3, pp.266-269

Padeliadu, S., & Paraskevopoulos, S., 1998. "Environmental Knowledge of Elementary School Students in Greece", <u>Journal of Environmental Education</u>, Vol. 29, Issue 3

Palmer, J.,1993. "Development of Concern for the Environment and Formative Experiences of Educators", The Journal of Environmental Education, 24 (3), 26-30

Palmer, J., 1995. "How Research is Informing Practice in Environmental Education", <u>Journal of Environmental Education</u>, 50, pp. 33–34.

Palmer, J., & Neal, P., 1994. "Environmental Education in the Primary School", <u>Oxford, Blackwell Education</u>

Polat, Ö., 1999. "Türkiye'de Çevre Eğitiminin Durumu", Ms. Thesis, Akdeniz University, Antalya

Posch, P., 1993. "Research issues in environmental education", <u>Studies in Science Education,</u> 21, pp. 21-48

Raglon, R., 1986, "Reading the World: Overt and Covert Learning in Environmental Writing for Children", The Journal of Environmental Education, 24(4), 4-7

Read, A.D., 1999. " 'A weekly doorstep recycling collection, I had no idea we could!' Overcoming the local barriers to participation", Resources, Conservation and Recycling, 26, pp. 217-49.

Richmond, J., (1978). "Some Outcomes of an Environmental Knowledge and Attitudes Survey in England", Research in Science Education, 8, 119-125

Riechard, D., & Peterson, S., 1998. "Perception of Environmental Risk Related to Gender, Community Socioeconomic Setting, Age, and Locus of Control", Journal of Environmental Education, Vol. 30, Issue 1

Sebba, R., 1991. "The Landscapes of Childhood", Environment and Behavior, 23, pp. 395–422.

Smyth, J., 1999. "Is There a Future for Education Consistent with Agenda 21?", Canadian Journal of Environmental Education, 4, pp. 69–82.

Sterling, S. 1991. "A Review of 1990", Annual Review of Environmental Education, 4, pp. 4–5.

Tikka, P., Kuitunen, M., & Tynys, S., 2000. "Effects of Educational Background on Students' Attitudes, Activity Levels, and Knowledge Concerning the Environment", Journal of Environmental Education, Vol. 31, Issue 3

Tosunoğlu, C., 1993. "A Study on the Dimensions and Determinants of Environmental Attitudes", Ph. D. Thesis, METU, Ankara

United Nations Educational, Scientific, and Cultural Organization, 1977. The world's first Intergovernmental Conference on Environmental Education in Tbilisi

United Nations Educational, Scientific, and Cultural Organization, 1987. International Strategy for Action in Environmental Education and Training for the1990s, Paris, France

Vygotsky, L. 1986 "Thought and Language", Cambridge, MA, The MIT Press

Worsley, A., & Skrzypiec, G., 1998. "Environmental Attitudes of Senior Secondary School Students in South Australia", Global Environmental Change, Vol.8, No.3, pp. 209-225

CHILDREN'S ENVIRONMENTAL KNOWLEDGE SUBSCALE

1. (Genel) Canlılar arasındaki karşılıklı etkileşimi ve fiziksel çevre ile organizmalar arasındaki ilişkileri inceleyen bilim dalına ne ad verilir?

   a) Biyoloji   b) Zooloji   c) Ekoloji   d) Genetik

2. (Hayvanlar) Her yıl çok sayıda fil ………………. için avlanmaktadır.

   a) diş   b) et   c) yağ   d) deri

3. (Enerji) Enerji elde etmek için kömür yakılması çevre sorunudur çünkü …........

   a) hava kirliliğine neden olan maddeleri yayar.
   b) asit yağmurlarını azaltır.
   c) stratosferdeki ozon miktarını düşürür.
   d) su yataklarının kirlenmesine neden olur.

4. (Su) Sulara karışan fosfatlı kimyasal maddeler zararlıdır çünkü ……………

   a) balıklarda kansere neden olur.
   b) balıklarda üremeyi durdurur.
   c) suyu bulanıklaştırır.
   d) alglerin sayısını arttırarak balıkların ölmesine neden olur.

5. (Geri dönüşüm) Geri dönüşümlü *(çeşitli işlemlerden geçirilerek yeni tüketim maddelerine dönüştürülmesi)* kağıtlar, diğer kağıtlarla karşılaştırıldığında aşağıdakilerden hangisi söylenebilir?

 a) yapımında daha fazla su kullanılır.

 b) yapımında daha az enerji harcanır.

 c) daha çok zararlı madde içerirler.

 d) maliyeti daha yüksektir.

6. (Geri dönüşüm) Genel çöplüklere dökülen atıklara daha sonra nasıl bir işlem uygulanır?

 a) denize dökülür.

 b) plastik yapımı için geri dönüşüm işlemi uygulanılır.

 c) toprağa gömülür.

 d) gübre olarak kullanılır.

7. (Su) Aşağıdakilerden hangisi asit yağmurlarının başlıca nedenlerindendir?

 a) kükürtdioksit

 b) karbondioksit

 c) ozon

 d) azot

8. (Hayvanlar) Manyas, Sultan Sazlığı , Çamaltı Tuzlası gibi yer isimleri hangi hayvan türünün barındığı koruma alanlarımızdandır?

 a) kuşlar

 b) balıklar

 c) sürüngenler

 d) böcekler

9. (Enerji) Aşağıdakilerden hangisi sürekli enerji kaynaklarına bir örnektir?

    a) nükleer enerji

    b) yağ

    c) kimyasal enerji

    d) güneş enerjisi

10. (Kirlilik) Verimlilik sağlamak için benzine katılan ve insan sağlığına zararlı olan madde aşağıdakilerden hangisidir?

    a) alkol   b) motorin   c) kurşun   d) civa

11. (Geri dönüşüm) Geri dönüşümün başlıca nedeni aşağıdakilerden hangisidir?

    a) daha dayanıklı plastik maddeler üretebilmek

    b) ormanları korumak

    c) atık miktarını azaltmak

    d) hava kirliliğini azaltmak

12. (Hayvanlar) Bugün yaşamını sürdüren birçok hayvanın neslinin tükenmek üzere olmasının **en önemli** nedeni aşağıdakilerden hangisidir?

    a) iklim değişiklikleri

    b) kirlilikten dolayı üreyememeleri

    c) yaşam alanlarının zarar görmesi

    d) asit yağmurlarından dolayı besin sağlayamamaları

13. (Enerji) Kömür ve petrol hangi tür enerji kaynaklarına örnektir?

    a) fosil yakıtlarına

    b) yenilenebilir enerji kaynaklarına

    c) alternatif enerji kaynaklarına

    d) geri dönüşümlü kaynaklara

14. (Genel) Aşağıdakilerden hangisi için çevre kirliliği bir tehdit oluşturmaktadır?

a) gelişmemiş ülkelerdeki insanlar

b) sadece şehirlerde yaşayan insanlar

c) sadece vahşi hayvanlar

d) yeryüzündeki tüm canlılar

15. (Su) Nehirlerin üzerine baraj inşa edilmesi zararlı olabilir çünkü barajlar

……………

a) nehirdeki çamuru arttırır.

b) su kirliliğini arttırır.

c) nehrin taşmasına neden olur.

d) nehrin doğal ekosistemine zarar verir.

16. (Su) Aşağıdakilerden hangisi yeraltı su kaynaklarındandır?

a) okyanuslar

b) göletler

c) su yatakları

d) nehirler

17. (Enerji) Aşağıdakilerden hangisi **<u>yenilenemez</u>** enerji kaynaklarına bir örnektir?

a) petrol

b) odun

c) deniz

d) güneş ışığı

18. (Kirlilik) Aşağıdakilerden hangisi Ankara'da hava kirliliğine neden olan etmenlerden biri **değildir**?

    a) motorlu taşıtlar

    b) coğrafi konum

    c) bitki örtüsü

    d) meteorolojik koşullar

19. (Geri dönüşüm) Geri dönüşümü **sağlanamayan** ve tekrar **kullanılamayan** madde aşağıdakilerden hangisidir?

    a) çocuk bezleri

    b) gazeteler

    c) aluminyum kaplar

    d) plastik şişeler

20. (Su) Su elde etmek için yeraltı su kaynaklarının kullanılmasındaki en önemli problem aşağıdakilerden hangisidir?

    a) tükenmek üzere olmaları

    b) çok miktarda tatlı su içermeleri

    c) mikrop içermeleri

    d) çıkarılmasının zor olması

21. (Hayvanlar) Aşağıdakilerden hangisi yok olmuş bir tür için doğrudur?

    a) koruma altına alınır.

    b) tehlikededir.

    c) baskındır.

    d) nesli tükenmiştir.

22. (Enerji) Türkiye'de genel olarak evlerde kullanılan aletlerden hangisi **en fazla** enerjiyi tüketmektedir?

    a) lamba

    b) TV

    c) su ısıtıcısı

    d) bilgisayar

23. (Genel) Çevre konularıyla **en fazla** ilgilenen grup aşağıdakilerden hangisidir?

    a) Biyologlar Derneği

    b) Toplumsal Sorunları Araştırma Vakfı

    c) TEMA

    d)Sağlık ve Eğitim Vakfı

24. (Geri dönüşüm) Aşağıdakilerden hangisi doğada en zor kaybolur?

    a) teneke   b) pamuk   c) odun d) aluminyum

25. (Hayvanlar) Güney sahillerimizde yapılan turistik tesisler nedeniyle yumurtlama alanları tehlikeye giren hayvan türü aşağıdakilerden hangisidir?

    a) Flamingo kuşları   b) Kelaynaklar

    c) Deniz kaplumbağaları   d) Akdeniz Fokları

26. (Genel) Ozon tabakasının görevi aşağıdaki seçeneklerden hangisinde en doğru şekilde verilmiştir?

    a) Yeryüzünü yüksek sıcaklıktan korur.

    b) Yeryüzünü güneşten gelen ultraviole ışınlarından korur.

    c) Yeryüzünü asit yağmurlarından korur.

    d) Yeryüzünü zehirli gazlardan korur.

27. (Genel) Aşağıdaki ev araçlarından hangisi ozon tabakasına zarar verir?

    a) çamaşır makinesi

    b) bulaşık makinesi

    c) mikrodalga fırın

    d) buzdolabı

28. (Genel) Atmosferde karbondioksit, metan gibi gazların ve su buharı miktarının artması aşağıdaki olayların hangisi yada hangilerine sebeb olur?

  I. Ozon tabakasının delinmesi   II. Sera etkisi   III. Dünya ısısının artması

    a) Yalnız I   b) II ve III   c) I ve II   d) I ve III

29. (Genel) Aşağıdakilerden hangisi çevre için uzun zaman diliminde **en zararlı** etkendir?

    a) nüfus fazlalığı

    b) doğal afetler

    c) vahşi hayvanlar

    d) erozyon

APPENDIX B

CHILDREN'S ENVIRONMENTAL ATTITUDES SUBSCALE

1. Kesinlikle Katılmıyorum 2. Katılmıyorum 3. Kararsızım

4. Katılıyorum 5. Kesinlikle Katılıyorum

	5	4	3	2	1
1. Hayvanların hayatını korumak için bazı hayvansal ürünleri satın almaktan vazgeçebilirim.					
2. Klimayı daha az kullanarak enerji tasarrufu yapabilirim.					
3. Su tasarrufu için banyo yaparken daha az su kullanabilirim.					
4. Çevre korumasına yardımcı olmak için kendi cebimden bir miktar para verebilirim.					
5. Hava kirliliğini azaltmak için mümkün olduğunca toplu taşıma araçlarına binebilirim.					
6. Evdeki atıkları geri dönüşüm için ayırabilirim. (cam, plastik, kağıt vs.).					
7. Vahşi hayvanların korunmasına yardımcı olmak için kendi cebimden bir miktar para verebilirim.					
8. Enerji tasarrufu için sarfiyatı az olan lambalar kullanabilirim.					
9. Su tasarrufu için ellerimi sabunlarken musluğu sürekli açık tutmayabilirim.					

	5	4	3	2	1
10. İnsanları çevre konusunda bilgilendirmek için çeşitli faaliyetlerde bulunabilirim.					
11. İnsanlara, çevre kirliliğini azaltmakta yardımcı olmaları için mektup, e-mail yazabilirim.					
12. İnsanları geri kazanma yöntemlerini kullanmaya ikna etmeye çalışabilirim.					
13. Bir çevre sorununu çözümlemek için hiç çaba sarfetmedim.					
14. Çevre sorunlarının çözümüne nasıl yardımcı olunabileceği konusunda ailemle konuşurum.					
15. Dişlerimi fırçalarken su tasarrufu için musluğu sürekli açık tutmam.					
16. Enerji tasarrufu için evde gereksiz yanan ışıkları söndürürüm.					
17. Ailemden hayvan kürkünden yapılmış ürünleri almamalarını isterim.					
18. Aileme bazı çöpleri geri dönüşüm kutusuna atmalarını söylerim.					
19. Çevre konuları ile ilgilenen resmi örgütlere çevre kirliliğini azaltmak için ne yapabileceğimi sorarım.					
20. Çoğunlukla çevre konulu belgeselleri seyrederim.					
21. Musluğu gereksiz yere açık bırakmam.					
22. Buzdolabının kapağını uzun süre açık bırakmam.					
23. Evimizin balkonuna gelen kuşları beslerim.					

	5	4	3	2	1
24. Geri dönüşümü sağlanabilecek olan atıkları ayırırım.					
25. İnsanların çevre konusunda duyarlı olmadıklarını düşünmek beni üzer.					
26. Kirliliğin çevreye verdiği zarar beni tedirgin eder.					
27. İnsanların şişe ve kağıtları kullandıktan sonra geri dönüşüm kutusuna attığını görünce mutlu olurum.					
28. Bazı firmaların, hayvanlar üzerinde kimyasal maddeleri denediklerini düşündüğümde üzülürüm.					
29. İnsanların enerji tasarrufu yapmaya çalıştıklarını görmek beni mutlu eder.					
30. Susuz kalmaktan korkarım.					
31. Çevre sorunlarıyla ilgilenmem.					
32. Çevre kirliliğinin bizlere verebileceği zarar beni korkutur.					
33. İnsanların geri dönüşümü mümkün olan atıkları geri dönüşüm kutularına atmadıklarını görmek beni üzer.					
34. Hayvanların yaşam alanlarına bina yapıldığını görünce üzülürüm.					
35. Gereğinden fazla su tüketimi beni üzer.					
36. Boşa sarfedilen enerjinin ne kadar fazla olduğunu düşünmek beni üzer.					

APPENDIX C

THE PERMISSION GRANTED FROM THE MINISTRY OF EDUCATION

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : Kültür
SAYI : B.08.4.MEM.4.06.00.11-070/ 4580
KONU : Anket-İzni.

VALİLİK MAKAMINA
ANKARA

İLGİ: Orta Doğu Teknik Üniversitesi Öğrenci İşleri Dairesi Başkanlığı'nın 24.12.2003 tarih ve 020256 sayılı yazısı.

Orta Doğu Teknik Üniversitesi, Fen Bilimleri Enstitüsü Orta Öğretim Fen ve Matematik Alanları Eğitimi Anabilim Dalı Yüksek Lisans Programı öğrencisi Elvan ALP'in "Türk Öğrencilerinin Çevre Bilgisi ve Tutumları" ile ilgili tez çalışmasını ekli listede isimleri belirtilen ilimiz okullarında anket uygulayabilmesi için ilgi yazı ile izin istenmektedir.

Kamu kurum ve kuruluşlarında uygulanan Devlet Memurları Kılık Kıyafet Yönetmeliği ve Okullarda uyulması gereken usül ve esaslara özen gösterilmesi, 2003-2004 öğretim yılında olması kaydıyla, söz konusu istek Müdürlüğümüzce uygun görülmektedir.

Makamlarınızca da uygun görüldüğü takdirde olurlarınıza arz ederim.

Not : Anket Formundaki Ad-Soyad Kısmının
Çıkarılması Kaydıyla.

Sabri İŞÇOR
Milli Eğitim Müdür V.

OLUR
29./12/2003
Hakkı LOĞOĞLU
Vali'a.
Vali Yardımcısı

DANIŞMA
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HATTI

İl Milli Eğitim Müdürlüğü Kültür Bölümü
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FAX: (0 312) 212 78 20

THE CONTENT OF "HUMAN AND ENVIRONMENT" COURSE

I. TEMEL EKOLOJİ BİLGİSİ

   1. Canlılar ve Çevre

      1.1. Canlılar ve Çevre

      1.2. Fiziksel Çevre

      1.3. Madde Döngüleri

      1.4. Biyolojik Çevre

      1.5. Ekosistemlerde Besin ve Enerji İlişkileri

      1.6. Ekolojik Piramitler

      1.7. Ekosistemlerde Rekabet

   2. Biyomlar

      2.1. Bitki ve Hayvan Dağılımı

      2.2. Kara Biyomları

      2.3. Su Biyomları

   3. Ekolojik Değişmeler

      3.1. Popülasyonların Yapısı ve Değişmeleri

      3.2. Popülasyon Büyümesi

      3.3. İnsan Popülasyonu ve Nüfus Artış Problemi

      3.4. Komünitelerde Değişmeler

II. YAŞADIĞIMIZ ÇEVRE

   1. Kaynaklarımız

      1.1. Genel Bigiler

      1.2. Madde Kaynaklarımız

      1.3. Enerji Kaynaklarımız

5. Doğal Afetlerden Sonra Ortaya Çıkan Çevre Sorunları ve Alınması Gereken Önlemler

VI. NÜFUS HAREKETLERİ
    1. Kentleşme
    2. Göç
    3. Turizm

VII. SOSYAL ÇEVRE
    1. Aile
    2. Toplum
    3. Diğer Sosyal Çevre Ögeleri

VIII. BOZULAN ÇEVRENİN YENİDEN DÜZELTİLMESİ