

AN ASSESSMENT OF ENVIRONMENTAL LITERACY OF TURKISH SCIENCE
AND TECHNOLOGY TEACHERS

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**AN ASSESSMENT OF ENVIRONMENTAL LITERACY OF TURKISH
SCIENCE AND TECHNOLOGY TEACHERS**

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ABSTRACT

AN ASSESSMENT OF ENVIRONMENTAL LITERACY OF TURKISH SCIENCE AND TECHNOLOGY TEACHERS

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The interest on environmental education increases with the increasing environmental problems of today's worlds. This thesis has been conducted as a country wide study to investigate levels, components and predictors of environmental literacy of primary school science and technology teachers, since teachers are the fundamental actors of environmental education. The study is comprised of environmental literacy level determination as well as the investigation of the relationships between the components of environmental literacy and the factors (environmental interest, importance of environmental problems, self assessment on environmental knowledge, outdoor activity choices, age, income, gender, experience, importance perception of environmental education, education level, residential difference, environmental knowledge source, and having an environmental related course) affecting environmental literacy. The sample of the study was selected from 34 provinces of 12 subregions of Turkey. A total of 1182 science and technology teachers answered the Environment Literacy Questionnaire including four components (knowledge, attitude, use, and concern) of environmental literacy. Besides descriptive analysis, zero order correlation, MANOVA, and Canonical correlation analyses were conducted to obtain the results. Descriptive analysis revealed that 77 % of the science and technology teachers have adequate level of environmental knowledge, have positive attitudes, high degrees of responsibility and concern toward environment. Further analyses indicated that all environmental literacy components correlated with each others with different correlation strengths.

Moreover environmental interest, importance of environmental problems, self assessment on environmental knowledge, outdoor activity choices, age, income, gender, experience, importance perception of environmental education are found to have significant effects on environmental literacy of the participants but no significant effect was observed for education level, residential difference, environmental knowledge source, and having an environmental related course on environmental literacy.

Keywords: environmental education, environmental literacy, science and technology teachers.

ÖZ

TÜRKİYE’DEKİ FEN VE TEKNOLOJİ ÖĞRETMENLERİNİN ÇEVRE OKURYAZARLIĞININ DEĞERLENDİRİLMESİ

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Günümüz dünyasının artan çevre problemleriyle birlikte, çevre eğitime olan ilgi artmaktadır. Öğretmenler çevre eğitiminin temel aktörleri olduğundan, bu tez ilköğretim fen ve teknoloji öğretmenlerinin çevre okuryazarlığı düzeyleri, çevre okuryazarlığı bileşenleri ve belirleyen faktörleri araştırmak için ülke çapında bir çalışma olarak gerçekleştirilmiştir. Bu çalışma çevre okuryazarlığı düzeylerinin belirlenmesinin yanı sıra çevre okuryazarlığı bileşenleri arasındaki ilişkilerin ve bu okuryazarlığı etkileyen faktörlerin (çevreye duyulan ilgi, çevre problemlerine verilen önem, çevresel bilgi düzeyi algısı, açık hava faaliyet seçimleri, yaş, gelir, cinsiyet, deneyim, çevre eğitime verilen önem düzeyi, eğitim düzeyi, yerleşim yeri farklılıkları, çevresel bilgi kaynakları ve çevreyle ilgili ders alma durumu) belirlenmesini kapsar. Çalışmanın örneklemini Türkiye’nin 12 bölgesindeki 34 ilden seçilmiştir. Toplam 1182 fen ve teknoloji öğretmeni çevre okuryazarlığının dört bileşenini (bilgi, tutum, kullanma ve endişe) kapsayan Çevre Okuryazarlığı Anketi’ni cevaplamıştır. Sonuçları elde etmek için tanımlayıcı analizlerin yanı sıra zero order korelasyon, MANOVA ve Kanonik korelasyon analizleri de gerçekleştirilmiştir. Tanımlayıcı analizler fen ve teknoloji öğretmenlerinin %77’sinin çevre bilgisi düzeylerinin yeterli olduğunu, çevreye yönelik tutumlarının pozitif olduğunu, çevreyle ilgili sorumluluk ve endişe düzeylerinin ise yüksek olduğunu ortaya koymuştur. Diğer analizler de çevre okuryazarlığı bileşenlerinin tümü arasında farklı

düzeylede korelasyon olduğunu göstermiştir. Ayrıca çevreye duyulan ilgi, çevre problemlerine verilen önem, çevresel bilgi düzeyi algısı, açık hava faaliyet seçimleri, yaş, gelir, cinsiyet, deneyim, çevre eğitime verilen önem düzeyinin katılımcıların çevre okuryazarlığı düzeyleri üzerinde etkili oldukları, fakat eğitim düzeyi, yerleşim yeri farklılıkları, çevresel bilgi kaynakları ve çevreyle ilgili ders alma durumlarının katılımcıların çevre okuryazarlığı düzeyleri üzerinde etkisi olmadığı gözlenmiştir.

Anahtar kelimeler: çevre eğitimi, çevre okuryazarlığı, fen ve teknoloji öğretmenleri.

To My Dear Family...

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LIST OF ABBREVIATIONS

EE: Environmental education

EL: Environmental literacy

MANOVA: Multivariate analysis of variance

MoNE: Ministry of National Education

SD: Standard deviation

CHAPTER 1

INTRODUCTION

1.1 Background of the Study

In today's world, all species encounter with the vital issues; environmental problems like inadequacy of water resources, air and water pollution, acid rains, soil pollution and erosion, deforestation, ozone layer depletion, and global warming. According to European Union Environmental Integration Strategy (2006) prepared by Ministry of Environment and Forest of Turkey covering the 2007-2023 period, Turkey also gets its share from global environmental problems at a local level. According to the report, Turkey is going to be a poor country in the future, in terms of its water resources. Moreover, especially the issues like air pollution, surface water and coastal pollution, erosion, soil mineral loss, decreasing biological diversity and endemic species, domestic and industrial wastes, drying of wetlands, excess and illegal fishing, unconscious hunting, uncontrolled woodcutting and fire, sea accidents, road construction, use of pesticides, excess grassing are important problems in Turkey. Although solutions have been seeking for such kinds of problems of Turkey for a time, there is still a long way to handle.

The efforts of seeking the solutions for environmental problems have been increasing due to the effects of increasing environmental problems all over the world. Besides that, scientific and technological efforts were seen as the savers for the environmental problems for years but it was recognized that those efforts are not enough measures anymore for environmental protection. This increased demand in the solution of environmental problems eventuated in the birth of a new area on educational studies named as "environmental education". Thus, environmental education (EE) has been foreseen as one of the major challenges to help protecting

environment and to have a sustainable future. As environmental problems have grown and the results have been expanded in content, EE has also changed in many respects in time.

Environmental education has its roots in 1948, International Union for the Conservation of Nature and Natural Resources conference in Paris (IUCN, 1948). The term “environmental education” was used for the first time at this conference (Palmer, 1998). On the other hand, as a formal education movement, environmental education has its origins in the concerns about environmental degradation and decreasing quality of life in 1960’s. Several studies were performed up to 1970’s and the goals and objectives for environmental education changed.

The importance given to EE motivated the decision makers to do something on this issue. In 1977, United Nations Education, Scientific, and Cultural Organization in cooperation with the United Nations Environment Program organized a conference in Tbilisi, Georgia (UNESCO, 1977) on environmental education. The decision makers came together for the first time for environmental education.

Evolution of environmental education in the 1980’s, in certain parts of the world, developed almost only around a few of the least political and controversial issues “about”, “in” and “for” the “green environment”. In 1992, Earth Summit (UNCED) was realized and ended with a comprehensive action program on conservation and sustainable development.

As a result, new points were introduced to reorient education towards sustainability and a particular emphasis on public awareness and the role of training trainers. In 1997, Education for Environment and Sustainability was proposed by Thessaloniki Declaration to carry a common single message of hope for the future, in a conference on “Education on the Environment and Society and Public Awareness for Sustainability” (UNESCO, 1997).

Several approaches toward environmental education gave rise to the several

definitions.

According to the above mentioned Tbilisi Declaration (UNESCO, 1977), the goals of environmental education are;

1. “To foster clear awareness of economic, social, political and ecological inter-dependence in urban and rural areas.
2. To provide every person to acquire the knowledge, values, skills and attitude to protect the environment.
3. To create new patterns of behavior of individuals and society toward the environment.”

Moreover, EE has framed with 5 complementary categories;

“Awareness to help social groups and individuals acquire an awareness and sensitivity to the total environment and its allied problems.

Knowledge to help social groups and individuals gain a variety of experience in, and acquire a basic understanding of, the environment and its associated problems.

Attitudes to help social groups and individuals acquire a set of values and feelings of concern for the environment and the motivation for actively participating in environmental improvement and protection.

Skills to help social groups and individuals acquire the skills for identifying and solving environmental problems.

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

(UNESCO, 1977; p.26-27)

The bottom-line goal of environmental education has been declared as to create

environmentally literate individuals (Dissinger and Roth, 1992). Although there is no one universal definition of environmental literacy (EL) (Yavetz, Goldman, and Pe'er, 2009) several researchers tried to define this concept. It is defined by Dissinger and Roth (1992) as; “essentially the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems.” Morrone, Mancl, and Carr (2001), on the other hand, defined environmentally literate individuals as “equipped with more than just knowledge about ecology; a completely literate person combines knowledge with values, which leads to action.” According to the related literature, Hsu (1997) defined four main components for this complex concept as; knowledge, affect, skill, and behavior. By combining several definitions, environmental literacy can be summarized as having the knowledge about current environmental issues and basic ecological concept, possessing positive feelings and values about environment relationship between humans and environment, feeling responsibility toward environment, and being sensitive to the environmental problems.

The importance of having environmentally literate individuals for a society is beyond discussion from the present state of human beings. This importance allocates teachers giving environmental education with very fundamental responsibility. Mosothwane (1992) indicated that “teachers’ attitude towards a particular subject has an effect on the performance and retention of learned subject matter, so he suggested that teachers should possess positive attitude toward environmental education to teach it effectively and successfully in schools.” One of the most important contemporary problems of environmental education is defined as the inadequacy of professional development of teachers by Goldman, Yavetz, and Pe'er (2006). Khalid (2003) stated that “if science teachers have misconceptions on current environmental issues, they will possibly perpetuate them in their classrooms.” In parallel to Khalid’s (2003) view, Shin (2000) stated that if teachers are expected to support environmental education, it is necessary to educate them on this issue. Similarly, Mosoley, Huss, and Utley (2010) indicated the importance of teacher education. They stated that “the increasing popularity of environmental science in school curricula has created a need for effective environmental education for teachers.”

Turkey is at the beginning of the way on environmental education to educate environmentally literate citizens. As a result of the reform movements on the change of “higher education programs” especially for the faculties of education, the decision of Higher Education Council (2006) determined that “environmental science course” is a compulsory part of the science and technology teachers training curriculum. By this way, teachers became a fundamental component of environmental education in line with the constructivist reform movement period in primary school curriculum (MoNE, 2005). As a result of this constructivist movement in primary education, the concept of “environment” became a one of the basic components of the education. Although the subject “environment” has an interdisciplinary structure due to its nature; it has a special place at science and technology course because of the special emphasis given at its attainments to the environment. The curriculum change increased the importance of the researches on environmental issues at educational studies. According to the result of the study with preservice teachers to determine their environmental literacy, for example, (EL) levels and the factors affecting conducted by Tuncer, Tekkaya, Sungur, Çakiroğlu, Ertepinar and Kaplowitz (2009), it was indicated that there is a long way on the studies of environmental literacy in Turkey. Research showed that although the concept of environmental education is a popular subject for some of the preservice teachers, most of them had still seen EE as an extra educational activity. According to Tuncer et al. (2009) it is not possible to train environmentally literate generations without having enough environmental knowledge and acceptable environmental attitude.

The review study by Erdoğan, Marchinkowski, and Ok (2009), on the other hand, investigated the research conducted between 1997 and 2007 with K-8 level participants in Turkey. They investigated 53 different studies and presented some of the deficiencies on environmental education studies in Turkey. According to the results, the studies had been performed up to that time does not give a clear picture on the environmental literacy issue in Turkey. Erdoğan et al. (2009) stated that the most of the researches were concentrated on the knowledge level but the studies on affective features, socio-political-economical knowledge, cognitive skills and environmentally responsible behaviors are few in number, and more studies are

needed in these fields. The research also indicated the need for new researches showing the relationship between the demographic variables and the environmental literacy components. An important point Erdogan et al. (2009) marked was that, most of the researches on this issue in Turkey were conducted with small groups, therefore, nationwide studies are required and it is necessary to cooperate researchers with MoNE on this issue.

Research on the EL levels is needed to be reviewed in detail to understand the possible determinants. Such information is valuable to direct the researchers and policy makers to develop higher level of EL both for students and teachers. Many researchers conducted studies on several factors shaping EL. Among them, gender, age and professional background are the ones seem to be the most emphasized ones.

Gender, being one of the major factors, was studied by Yılmaz and Andersen, 2004; Fernandez-Manzanal, Rodriguez-Barreiro, and Carrasquer, 2007; Tuncer, et al., 2009. Most recently, Tuncer et al. (2009) indicated the role of gender especially on two components of environmental literacy, attitude and uses. Their results indicated that female teachers tend to have more positive attitudes and more responsible actions toward environment than male teachers. Another factor, age, was studied by many researchers and analyses indicated different results. For instance Kışoğlu (2009) found that age has an effect only on the environmental knowledge component of environmental literacy of preservice teachers. On the other hand Erol (2005) indicated the effect of age factor on environmental attitudes of preservice teachers. Professional background was investigated by many researchers e.g. Tikka, Kuitunen, Tynys, 2000; Pande, 2001; Taşkın, 2004; Kaplowitz and Levine, 2005; Pe'er, Goldman and Yavetz, 2007. One of these studies, conducted by Tikka et al (2000), indicated the effect of educational background. They found that biology students exhibited the most positive environmental attitudes and have the highest environmental knowledge. Kaplowitz and Levine (2005), on the other hand, pointed the importance of academic level. Furthermore source of environmental knowledge is another factor investigated by environmental many researchers (e.g. Barraza, and Cuaron, 2004; Mert, 2006; Aydemir 2007; Çakır, İrez, and Doğan, 2010). Most of

the studies indicated television as the most popular environmental knowledge source for individuals. Although some of the related studies supporting the idea that source of environmental knowledge has an effect on environmental literacy, others do not support this view. Environmental activities was examined as another factor shaping EL. Aydemir, 2007; Ökeşli, 2008; and Tuncer et al., 2009 studied on this factor and indicated a significant correlation between environmental activity choices and environmental literacy components.

Moreover residence effect was analyzed by Goldman, Yavets and Pe'er, 2006; Taşkın 2004; Teksöz, Tekkaya and Erbaş, 2009. Taşkın studied with senior high school students and investigated the effect of geographical regions and found no significant effect on students' perception about the environment and related issues. On the contrary, Teksöz et al. (2009) indicated the effect of geographical regional differences on responsibility toward natural resources and environment. Economic status is another factor investigated by environmental researchers. Yılmaz and Andersen (2004) showed that students with high family income displayed more positive attitudes toward environment than students with low family income.

Negev, Sagy, Garb, Salzberg, and Tal (2008), on the other hand, found that children in the middle socioeconomic group scored higher than did children in the low or high socioeconomic group in terms of their environmental behavior.

The samples for the above studies conducted in Turkey mainly focused on the students and preservice teachers as their samples but only few studies were conducted by inservice teachers, and none of them conducted with a country wide sampling. As a result, the content of the current study is designed to fulfill this requirement by investigating the environmental literacy levels of inservice science and technology teachers throughout the country. Furthermore, effects of several factors on EL were investigated for this national sample.

As it is inferred from the literature that environmental issues are very crucial parts of education for today's world, and educating environmentally literate individuals

appears as an indispensable way to overcome environmental problems. The conducted studies also indicated that there are several factors like gender, perception of importance of environmental problems, age, income, source of environmental knowledge etc. which have the potential to effect the environmental literacy of individuals. As it was reported by several researchers, environmental education has quite a long way to go in Turkey. One of the features of the current study, providing a nationwide picture of the state of art for Turkish science and technology teachers in terms of their environmental literacy, is worth to be emphasized as supporting the related research in Turkey. Because, determining teachers' EL with a nation-wide sample is important on the way of developing environmentally literate individuals in Turkey, the result of which, on the other hand, is promising to serve as a source for a holistic social change and progress.

1.2 Purpose of the Study

The purpose of this study is to assess Turkish state schools science and technology teachers' environmental literacy level by considering four main components of EL (knowledge, attitude, use, and concern); to understand the relationships among the components of EL; to determine the relationship between environmental literacy level of science and technology teachers and the defined predictors of environmental literacy; and to understand the effect of regional differences in terms of environmental literacy. Besides, the study also seeks answers for the teachers' perceptions on the implications of EE in Turkey.

1.2.1 Problem Statements of the Study

The main problem of the present study is determined as;

1. What is the environmental literacy level of Turkish science and technology teachers working at state schools at both country and regional level?
2. What are the relationships among the four components (knowledge, attitude, use, and concern) of environmental literacy level of Turkish science and

technology teachers?

3. What are the characteristics affecting EL level of Turkish science and technology teachers?
4. What are the perceptions of science and technology teachers on environmental education?

Depending on this main problem, the present study investigated the answers of following sub-problems.

Sub-problems of the study were determined as follows;

1. What is the environmental literacy level of Turkish science and technology teachers working at state schools at both country and regional level?

1.1. What is the environmental literacy level of science and technology teachers in Turkey in terms of the following four dimensions of EL?

1.1.1. What is the environmental knowledge level of science and technology teachers in Turkey?

1.1.2. What is the environmental attitude level of science and technology teachers in Turkey?

1.1.3. What is the environmental uses level of science and technology teachers in Turkey?

1.1.4. What is the environmental concern level of science and technology teachers in Turkey?

1.2. What is the environmental literacy level of science and technology teachers at regional level for 12 subregions in terms of the following four dimensions of EL?

- 1.2.1.1.1. What is the environmental knowledge level of science and technology teachers at regional level for 12 subregions?
- 1.2.1.1.2. What is the environmental attitude level of science and technology teachers at regional level for 12 subregions?
- 1.2.1.1.3. What is the environmental uses level of science and technology teachers at regional level for 12 subregions?
- 1.2.1.1.4. What is the environmental concern level of science and technology teachers at regional level for 12 subregions?

2. *What are the relationships among the four components (knowledge, attitude, use, and concern) of environmental literacy level of Turkish science and technology teachers?*

Sub problem 1) Is there any relationship between science and technology teachers' EL components of knowledge and attitude?

Ho 1) There is no relationship between science and technology teachers' level of environmental knowledge and attitude.

Sub problem 2) Is there any relationship between science and technology teachers' EL components of knowledge and use?

Ho 2) There is no relationship between science and technology teachers' level of environmental knowledge and use.

Sub problem 3) Is there any relationship between science and technology teachers' EL components of knowledge and concern?

Ho 3) There is no relationship between science and technology teachers' level of environmental knowledge and concern.

Sub problem 4) Is there any relationship between science and technology teachers' EL components of attitude and use?

Ho 4) There is no relationship between science and technology teachers' level of environmental attitude and use.

Sub problem 5) Is there any relationship between science and technology teachers' EL components of attitude and concern?

Ho 5) There is no relationship between science and technology teachers' level of environmental attitude and concern.

Sub problem 6) Is there any relationship between science and technology teachers' EL components of use and concern?

Ho 6) There is no relationship between science and technology teachers' level of environmental use and concern.

3. *What are the characteristics affecting environmental literacy of science and technology teachers in Turkey for the components of environmental literacy?*

Sub problem 1) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to their **interests on environmental problems?**

Ho 1a) The environmental knowledge level of science and technology teachers do not differ according to the interests on environmental problems.

Ho 1b) The environmental attitude level of science and technology teachers do not differ according to the interests on environmental problems.

Ho 1c) The environmental uses level of science and technology teachers do not differ according to the interests on environmental problems.

Ho 1d) The environmental concern level of science and technology teachers do not differ according to the interests on environmental problems.

Sub problem 2) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to their **perception of the importance of environmental problems?**

Ho 2a) The environmental knowledge level of science and technology teachers do not differ according to the perception of the importance of environmental problems.

Ho 2b) The environmental attitude level of science and technology teachers do not differ according to the perception of the importance of environmental problems.

Ho 2c) The environmental uses level of science and technology teachers do not differ according to the perception of the importance of environmental problems.

Ho 2d) The environmental concern level of science and technology teachers do not differ according to the perception of the importance of environmental problems.

Sub problem 3) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to **self assesment on environmental knowledge?**

Ho 3a) The environmental knowledge level of science and technology teachers do not differ according to the self assessment on environmental knowledge.

Ho 3b) The environmental attitude level of science and technology teachers do not differ according to the self assessment on environmental knowledge.

Ho 3c) The environmental uses level of science and technology teachers do not differ according to the self assessment on environmental knowledge.

Ho 3d) The environmental concern level of science and technology teachers do not differ according to the self assessment on environmental knowledge.

Sub problem 4) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to **gender**?

Ho a) The environmental knowledge levels of science and technology teachers do not differ according to gender.

Ho 4b) The environmental attitude level of science and technology teachers do not differ according to gender.

Ho 4c) The environmental uses level of science and technology teachers do not differ according to gender.

Ho 4d) The environmental concern level of science and technology teachers do not differ according to gender.

Sub problem 5) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to **professional experience** (level of education; source of environmental knowledge, having environment related course; and experience in teaching)?

Ho 5a) The environmental knowledge level of science and technology teachers do not differ according to professional experience.

Ho 5b) The environmental attitude level of science and technology teachers do not differ according to professional experience.

Ho 5c) The environmental uses level of science and technology teachers do not differ according to professional experience.

Ho 5d) The environmental concern level of science and technology teachers do not differ according to professional experience.

Sub problem 6) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to **age**?

Ho 6a) The environmental knowledge level of science and technology teachers do not differ according to age.

Ho 6b) The environmental attitude level of science and technology teachers do not differ according to age.

Ho 6c) The environmental uses level of science and technology teachers do not differ according to age.

Ho 6d) The environmental concern level of science and technology teachers do not differ according to age.

Sub problem 7) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to the **environment related activity choices**?

Ho 7a) The environmental knowledge level of science and technology teachers do not differ according to the environment related activity choices.

Ho 7b) The environmental attitude level of science and technology teachers do not differ according to the environment related activity choices.

Ho 7c) The environmental uses level of science and technology teachers do not differ according to the environment related activity choices.

Ho 7d) The environmental concern level of science and technology teachers do not differ according to the environment related activity choices.

Sub problem 8) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to the **residence** in which they were grown up?

Ho 8a) The environmental knowledge level of science and technology teachers do not differ according to the residence in which they were grown up.

Ho 8b) The environmental attitude level of science and technology teachers do not differ according to the residence in which they were grown up

Ho 8c) The environmental uses level of science and technology teachers do not differ according to the residence in which they were grown up

Ho 8d) The environmental concern level of science and technology teachers do not differ according to the residence in which they were grown up

Sub problem 9) Does science and technology teachers' level of EL for four components (knowledge, attitude, use, concern) differ according to **income**?

Ho 9a) The environmental knowledge level of science and technology teachers do not differ according to income.

Ho 9b) The environmental attitude level of science and technology teachers do not differ according to income.

Ho 9c) The environmental uses level of science and technology teachers do not differ according to income.

Ho 9d) The environmental concern level of science and technology teachers do not differ according to income.

4. *What are the perceptions of science and technology teachers on environmental education?*

1. How do science and technology teachers evaluate themselves in terms of environmental issues?
2. What are the views of science and technology teachers on environmental education?
3. What are the most and the least frequently used environmental information source by science and technology teachers?

1.3 Definition of Important Terms

Environmental Education: refers to “*process aimed at making individuals and communities understand the complex nature of the natural and the built environments resulting from the interaction of their biological, physical, social, economic and cultural aspects, and acquire the knowledge, values, attitudes, and*

practical skills to participate in a responsible and effective way in anticipating and solving environmental problems, and the management of the quality of the environment (UNESCO, 1977)."

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

Environmental Knowledge: is defined as *"the information that enables someone to study and reach conclusions about the physical, social and cultural conditions that affect the development of an organism (DeChano, 2006)."*

Environmental Attitude: is defined as *"the predispositions that affect how someone perceives and interprets the physical, social, and cultural conditions that affect the development of an organism (DeChano, 2006)."*

Environmental Use: can be defined as *"the environmentally responsible behaviors that demonstrate a willingness to use environmental action strategies to have positive impact on the environment or to reduce the negative impact of one's behavior on the environment (Weiser, 2001)."*

Environmental Concern: is *"an emphatic (sympathetic) perspective towards the environment (Hungerford and Volk, 1990)."*

1.4 Significance of the Study

Recently, the increasing environmental problems and the demand for sustainable development put the environmental problems and effort of seeking solutions at the center of not only the scientific area but also the discussions of everyday life. This effort comes together with recognizing the individuals, understanding their effects on environment, and transforming them to transform the whole society in terms of

environmental issues, in short the educational process. In time, several studies from different parts of the World clearly introduced that environmental education requires not only knowledge but also the change in other elements of affective field like attitude and behavior.

The education on environment and sustainable development has a quite short history in Turkey. Especially the current new primary school curriculum prepared with a constructivist perspective increased the demand for such studies since the environmental issues are among the main attainments of the new curriculum of science and technology course.

This new approach of the primary school curriculum necessitates some additional studies for teachers who have the key role in education. Under this scope, the new educational program for universities (2006), “environmental science” course became a compulsory course for the candidate science teachers studying at faculties of education.

In the light of all these developments, the current study has serious importance in many respects.

First of all, the success of the students’ environmental attainments defined in the curriculum can only be successful in the condition with having competent teachers. By this study, the readiness of the science and technology teachers which are the key elements of environmental education at primary education level, on such attainments is going to be determined. This identification can be found at the list of the subjects that will be supported by MoNE Environmental Research and Development Department dated September 2009. The list includes two related items, item 8 and 213. Item 8 states that “the problems and the solution proposals on the implementation of revised education programs. On the other hand, item 213 stated that “determining the level of readiness of teachers for revised teaching programs. The study will contribute the cooperation between the Ministry and the universities.

Moreover determining the environmental literacy levels of science and technology teachers and understanding the affecting factors of their EL levels throughout the country and at regional level will introduce a clear picture for the inservice training needs for the Ministry.

The Program for International Student Assessment (PISA) 2006 that was previously implemented several times by Ministry of National Education (MoNE) had obtained some information on environmental awareness, perception, optimism, and responsibility development of students. According to the evaluation of these data by Teksöz, Tekkaya, and Erbaş (2009), regional differences have a significant effect on the responsibility toward environment and natural resources. The current study can also provide the data to determine the extent of the effects of teachers on these results. By this way, the real causes of such results will be seen clearly and a door will be opened for the studies on the possible solutions.

Another importance of the study is the contribution to the environmental education at universities. This contribution can be evaluated in two groups. The first one is the expectation that, after graduation, teachers are going to be active participants of the social and professional life so one of the important roles of them is to pass their environmental knowledge, skills, attitude, and values acquired during their university education, on the future generations. To provide the best education for the future students of teachers, the courses given during the university education of teachers must be well-designed, and renewed continuously in accordance with the new emerged needs. The current study will support the faculties of education to determine the gaps and problematic points on the issue, to develop new programs, and to determine the method to be used. The second important contribution of the study is to the holistic contribution of university graduates to the society as being free from faculties and departments. Starting from the idea of leading the society in all fields, these individuals trained with national sources for long years, they are expected to actively participate to protect the natural resources and to transfer them to the next generations. This study, with the other researches on the environmental issues with university students and graduates, may be a source to put into compulsory or elective

environmental courses to all departments of universities. By this way, it will be possible to determine the current situation. Besides that, the data is going to be provided for the renovation of environmental education at university level and for the guidance for inservice training organized by the Ministry of National Education.

The study also provided the opportunity to understand the relationship of environmental literacy and participants' gender, socioeconomic status, professional experience, environmental activity choices, residence in which they were grown up, age, income, for 12 subregions. The research also provided the explanations for the relationship between the EL components (knowledge, attitude, use, concern) of science and technology teachers.

Another significance of the current study came from its links with several other previous studies. In terms of their aims and the sustainability, this research has many common points with the Green Pack Education Project which was performed with the participation of Ministry of National Education, Ministry of Environment and Forestry, many NGO's and other related individuals and institutions in Turkey. The Green Pack (a multi-purpose education kit) Education Project was developed for the primary schools' teachers and students. The Green Pack Project aimed to increase the environmental awareness; to build the capacity for sustainable development in Turkey; transfer the methodology of environmental education and provide a base for further developments; and determine the needs by assessing the current situation. All of these aims are parallel with the aims of the present study and indicates a common approach with the Ministry of National Education in the field of environmental education.

The study can also be seen as the continuity of another research Project (Tuncer, Alp and Ertepinar, 2007) which was supported by The Scientific and Technological Research Council of Turkey (TÜBİTAK). By the Project, it was aimed to assess the environmental literacy level of university students studying at the faculties of education in Ankara. Moreover, the reliability and the validity studies of the

instrument that was used in the present study were evaluated under the scope of this Project. The Project supported by TÜBİTAK was limited with the preservice science teachers in Ankara. On the other hand, by the support of Ministry of National Education, the current study was broadened to cover all practicing science and technology teachers in Turkey.

In terms of the nationwide sample structure of the present study, it possesses a pioneering character in the field of environmental literacy studies of Turkey. The data collected from different regions help us to take a clear picture of the current situation in Turkey. In addition to other positive impacts, several scientific publications and presentations in congresses can be thought as the contribution of the present study to the scientific arena both at national and international level.

CHAPTER 2

LITERATURE REVIEW

This chapter of the study covers the previous researches in the literature connected with the present study. Three main sections were included in this chapter; environmental literacy, environmental literacy in Turkey, and the summary of the related literature. In the first part, historical development of environmental literacy was explained. Then the components and the determinants of EL were expressed and the roles of teachers and schools were stated in building environmental literacy section. Furthermore the ways of measuring EL were stated under the testing EL heading. After explaining the environmental literacy at a global perspective, the second main section covered the state of art on EL in Turkey. The historical development and current situation of EL were explained from a country perspective for Turkey. The last part includes a summary of this chapter.

2.1 Environmental Literacy

2.1.1 History and Development

Environment can be defined as “the totality of what we live in, natural or constructed, spatial, social and temporal. It is an extension of ourselves, the health of which requires the same care as our own health” (Smyth, 2006).

Although the age of environmental problems is the same with the age of planet “Earth”, the Industrial Revolution had drastically changed the shape and the nature of our environmental problems. As Saçlı (2009) stated, the desire of controlling the Earth and getting much more benefit from it, increased with the Industrial

Revolution. This greedy desire of human beings moved the environmental problems from their local forms to the new global forms. This increase in the problems produced environmentalist movements among the World Citizens.

Environmentalism is the term derived from the relations of individuals and societies with their environment. Palmer (1998) defines the characteristics of environmentalism as ecological sustainability and the notion of sustainable development. There are several meanings of environmentalism for people with different viewpoints. This difference resulted with many environmentalist ideas, influences and movements. As it is stated by Palmer (1998) one of them is called as “Deep and Shallow Ecology”. Deep ecology fundamentally rejects the dualistic view of humans and nature as separate and different. On the other hand shallow ecology considers that humans and nature are separate and that humans can dominate the world around them. An alternative distinction on environmentalism was developed by O’Riordan (1988); “Ecocentrism” and “Technocentrism”. The first term “ecocentrism” sees humankind as part of a global ecosystem, subject to ecological laws. Ecocentrics respect to nature in its own right (Palmer, 1998). The second term “Technocentrism” involves technocratic management, regulation and rational utilization of the environment. “Sustainable growth” and “sustainable development” are another categorization made by environmentalists (O’Riordan, 1988). Although sustainable growth is seen as a technical concept and needs only social reform with a modified economics by the policy that resource recovery/recycling, residuals management, waste reduction; sustainable development seen as a concept embracing ethical norms and needs social revolution with a completely new economics by the policy derived from theories like zero growth, steady state economy and bioeconomic equilibrium.

The step by step developmental history of environmental education gave the occasion of the development of three main views for environmental education among the environmentalists; Positivist, Interpretivist and Critical views. Palmer (1998) explained the positivist view of environmental education as learning “about the environment”, with externally imposed, taken-as-read goals. The interpretive view

was explained as externally derived, but often negotiated, and places emphasis on activities “in the environment”. The critical view, on the other hand, focuses on the action “for the environment”. As displayed in Figure 2.1, a holistic perspective for these three views got more attention due to the complex nature of environmental education.

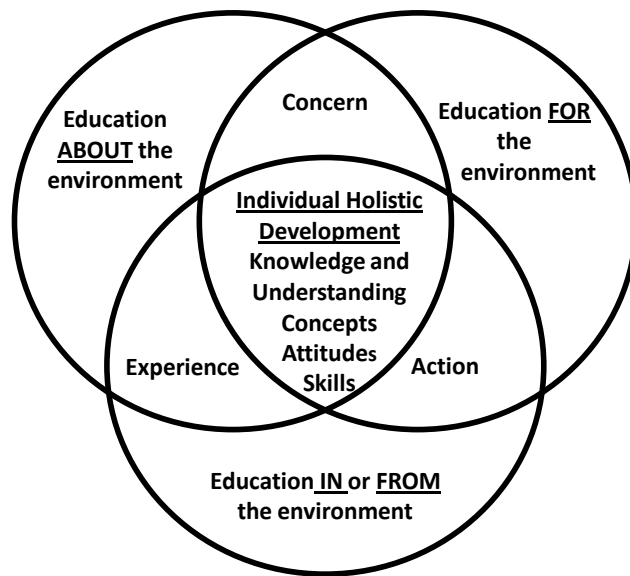


Figure 2.1. Model for Teaching and Learning Environmental Education (Palmer, 1998, p. 145)

All these conceptual approaches with the other unmentioned ones, gave rise to a new field where environment and education are together. The words “environment” and “education” both have long histories but “environmental education” is a relatively new concept. Several researchers (Palmer, 1998; Koury, 2005; Stevenson, 2007; MacKenzie, 2008) indicated the developing effects of some 18th and 19th century’s thinkers, writers and educators (e.g. Dickens, Goethe, Rousseau, Humboldt, Haeckel, and Dewey) on this field.

According to Palmer (1998), the term “environmental education” was first used in Paris, in 1948 at a meeting of the International Union for the Conservation of Nature and Natural Resources (IUCN). A remarkable step in the history of the definition of “environmental education” was an IUCN/UNESCO “International Working Meeting on Environmental Education in the School Curriculum” held in 1970 at the Foresta Institute, Carson City, Nevada, USA. Environmental education defined there as;

“the process of recognizing values and clarifying concepts in order to develop skills and attitudes necessary to understand and appreciate the inter-relatedness among man, his culture, and his biophysical surroundings. Environmental education also entails practice in decision-making and self formulation of a code of behavior about issues concerning environmental quality” (IUCN, 1970, p.11).

Another remarkable -probably the most important- step taken is The World’s first intergovernmental conference on environmental education. It was organized by the United Nations Education, Scientific, and Cultural Organization (UNESCO) in cooperation with the United Nations Environment Program (UNEP) in Tbilisi, Georgia, in 1977 and accepted as a benchmark for environmental education.

According to Tbilisi Declaration (UNESCO, 1977), “*environmental education;*

- *“Is a lifelong process*
- *Is inter-disciplinary and holistic in nature and application*
- *Is an approach to education as a whole, rather than a subject*
- *Views the environment in its entirety including social, political, economic, technological, moral, aesthetic and spiritual aspects*
- *Recognizes that energy and material resources both present and limit possibilities*
- *Encourages participation in the learning experience*
- *Emphasizes active responsibility*
- *Uses a broad range of teaching and learning techniques, with stress on practical activities and firsthand experience*

- *Is concerned with local to global dimensions, and past/present/future dimensions*
- *Should be enhanced and supported by the organization and structure of the learning situation and institution as a whole*
- *Encourages the development of sensitivity, awareness, understanding, critical thinking and problem-solving skills*
- *Encourages the clarification of values and the development of values sensitive to the environment*
- *Is concerned with building an environmental ethic”*

(UNESCO, 1977, p.27).

Hereafter the acceleration effect of the Tbilisi Conference on the development of environmental education, in 1980, the World Conservation Strategy was launched by IUCN, UNEP and World Wildlife Fund (WWF). It stressed the importance of resource conservation through sustainable development. It was also pointed the mutual interdependency between conservation and development. 1987 was another critical year for environmental education because of the holding of a “Tbilisi plus Ten” Conference, organized by UNESCO and UNEP, in Moscow. One of the major stresses of the Conference was on the vital importance of environmental education. In 1987, the main idea of World Conservation Strategy was substantially reinforced and expanded by the publication of Our Common Future (WCED, 1987) also known as the Brudtland Report, the outcome of the World Commission on Environment and Development. This report presented a major statement on a “global agenda” to combine environment with development.

1987-1988 was the European Year of the Environment within the European Community, and a resolution was passed on the Community agreed on “the need to take concrete steps for the promotion of environmental education” (Palmer, 1998). The community also indicated a need for EE as an integral and essential part of every European citizen’s upbringing”.

In 1992, United Nations Conference on Environment and Development, The Earth Summit, staged in Rio de Janeiro, Brazil, and resulted with an outcome named as “Agenda 21.” It was stated in the Report that environment and development education should be incorporated as an essential part of learning, within both formal and non-formal education sectors.

In December of 1997, an international conference organized by UNESCO and the Government of Greece was held in Thessaloniki, Greece, at the 20th anniversary of the Tbilisi Doctrine. More than 1,000 people from 81 countries came. In Thessaloniki, new citizenship approach was discussed in an environmental context. “The ultimate goal of EE was declared as to produce an environmentally literate and responsible citizen, one who can make decisions that will help check many of the environmental problems that will arise in the 21st century (Knapp, 2000).” Besides other developments, The Johannesburg World, 2002, underlined the importance of education for promoting sustainable development and emphasized the importance of “sustaining the countries’ educational infrastructures and programs, and the necessity to be integrated with sustainable development at all levels of education.

The high expectations from the EE are the result of its complex nature. The expectancies from EE start from just learning about the environmental concepts and goes to the action. It is closely related with the redefined citizen concept with a changing World’s conditions. This new citizen defined by Stapp et al. (1969) as “being knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solutions.” According to Roth (1992), “a major purpose of education is to provide people with the knowledge and skills to allow them to live successful, productive lives and to function as responsible citizens within society.” The new citizenship approach gave rise to the environmentally literate citizen concept and after several decades, environmental literacy (EL) positioned as the most fundamental goal of environmental education by UNESCO-UNEP in 1989. Several researchers (Dissinger and Roth, 1992; Culen, 2001) stated the development of environmentally literate citizens and promoting the responsible environmental

behavior as the primary goals of EE.

Although literacy is a term that originally referred only to the ability to read and write, it has been extended in scope by the addition of a variety of adjectives, science literacy, visual literacy, computer literacy, cultural literacy, etc. (Roth, 1992). Dictionary definition of literacy does not give a clear notion of the term “environmental literacy”. EL is a resource for linking experience to action and can never be a substitute for either (Clair, 2003). Clair also stated EL as “a powerful metaphor that contributes a great deal to thinking through the question of what each of us can contribute for a more just and more sustainable way of life for the planetary community.”

The belief that makes environmental literacy concept very popular in today’s World is that, environmentally literate citizens can make quality decisions. In spite of its current popularity, EL is not a new born concept. The notion of environmental literacy is generally agreed to have emerged in the late 1960s (Roth, 1992; Palmer, 1998; Hsu and Roth, 1998; Morrone et al., 2001; Moody et al., 2005 etc.). Since then there has been considerable interest in increasing environmental literacy of the general public to solve our complex environmental challenges (Moody and Hartel, 2007). Clair (2003) pointed the enormous potential of EL for radically changing the way environmental issues are conceived. This potential brings EL at the center of the studies conducted in the field of environmental education.

2.1.2 Components of Environmental Literacy

The given importance to EL brings the high amount of efforts to understand and define it. A variety of definitions of EL have been made over years.

Statement emerged from the Tbilisi Document on the features of an environmentally literate person has;

*“-an awareness and sensitivity to the total environment
-a variety of experience in and a basic understanding environmentally associated problems
-acquired a set of values and feelings of concern for the environment, and the motivation for actively participating in environmental improvement and protection
-acquired the skills for identifying and solving environmental problems
-opportunities to be actively at all levels in working toward resolution of environmental problems”*

(Federal Interagency Committee on Education, 1978, p.26-27).

Dissinger and Roth (1992) defined EL as “essentially the capacity to perceive and interpret the relative health of environmental systems and take appropriate action to maintain, restore, or improve the health of those systems”.

Environmental Literacy Committee (1992; cited in Moody et al., 2005) operationally defined EL as;

- “1. basic scientific principles that govern natural systems, using these to understand the limits and major factors associated with the earth’s capacity to sustain life*
- 2. linkages among all living things and their dependency on each other as well as the physical environment*
- 3. consequences of human activation local, regional, and global natural systems*
- 4. impact of changes within natural systems of life, health, and welfare*
- 5. cultural, economical, and political forces-both past and present- that affect environmental attitudes and decision making*
- 6. role of ethics and morality in individual and growth decision making related to the environment” (p.5).*

In addition to these attempts to define EL, Roth (1992) classified EL with three levels; nominal, functional and operational.

“Nominal EL: indicates a person able to recognize many of the basic terms used in communicating about the environment and able to provide rough, working basic definitions of their meanings. Individuals at this level are aware of environmental issues, sensitive to environment, have positive environmental attitude, and feel concern for the environmental problems.

Functional EL: indicates a person with a broader knowledge and understanding of the nature with its interactions between other systems. Individuals at this level are aware and concerned about the negative relationships among the systems and they can analyze, synthesize, and evaluate information on environmental issues.

Operational EL: indicates a person who has moved beyond functional literacy in understandings and skills. Those individuals evaluate the consequences of actions; synthesize information, choose among alternatives, and advocate and take actions for a healthy environment. Those people are likely to be acting at several levels from local to global in so doing” (Roth, 1992, p.26).

Dissinger and Roth (1992) defined environmental literacy with six major areas; environmental sensitivity, knowledge, skills, attitudes and values, personal investment and responsibility, and active involvement. Roth (1992) reorganized the areas of EL into four main categories; knowledge, skills, affect (including sensitivity, attitudes and values), and behavior (including personal investment, responsibility, and active involvement).

A comprehensive definition for EL components was realized by Hsu (1997) as shown below;

“Knowledge

- *Knowledge of ecology and environmental science*
- *Knowledge of interactions between natural and societal systems*
- *Knowledge of identifying, analyzing, investigating and evaluating environmental problems and issues*
- *Knowledge of using environmental action strategies*

Affect

- *Awareness of, sensitivity to, and feelings of concern for both nature and society*
- *Empathic, appreciative, and caring attitudes toward the environment*
- *Internal locus of control*
- *Personal responsibility and willingness to work toward the prevention and/or remediation of environmental problems*

Skill

- *Ability to identify, analyze, investigate, and evaluate environmental problems and issues*
- *Ability to develop and evaluate an environmental action plan for the resolution of environmental problems*
- *Skills in using environmental action strategies*

Behavior

- *Personal and/or group involvement in the following five categories of responsible environmental behaviors:*
- *Ecomanagement (direct physical intervention)*
- *Economic/consumer action*
- *Persuasion*
- *Political action*
- *Legal action” (p.34).*

Briefly, EL is the major goal of environmental education and includes several components. The main themes of EL can be listed as; what people know what they feel, what they think/worry about, and what they do. These four main EL components covered by the current study are called as knowledge, attitude, use, and

concern.

“Environmental knowledge” was regarded as the main goal at the beginning of environmental education researches. Today, although it is regarded just as a part of the education of environmentally literate individuals, it still has a high importance. It can be defined as knowing the most significant environmental principles and related problems, and indicating a rough understanding of their causes and solutions (National Environmental Education and Training Foundation & Roper Starch Worldwide, 2005),

Another component of EL named as “environmental attitude.” DeChano (2006) defined this concept as “the predispositions those affect how someone perceives and interprets the physical, social, and cultural conditions that affect the development of organism.” Pe’er et al. (2007), on the other hand, stated that “attitudes apply to general feelings toward ecology and the environment, feelings and concern for specific environmental issues, and feelings toward acting to remedy environmental problems.” Another statement on environmental attitude is that a set of values and beliefs functioning as the individual’s feelings, pro or con, favorable, toward some particular aspects of the environment (Hines et. al., 1986/1987, p.4).

The third component of EL covered by the current study is called as “environmental use”. The environmental use indicates the intention to take part in pro-environmental behavior (Tuncer et al., 2009). This component of EL can be seen as the core objective of environmental literacy and environmental education as a whole.

The last component of EL included by this study is called as “environmental use”. The term “concern” is defined by the dictionary as “a feeling of worry about something important or the thing that worries you” (Longman, 1998) so it can be said that the environmental concern indicates the level of concern about contemporary environmental issues.

Increasing number of studies has been conducting on “environmental literacy” for

several subject groups and for different aspects of the issue. Some of these researches were realized with students with different grade levels or citizens in general and some others with candidate or practicing teachers. The researches on the environmental literacy handled in a chronological approach at the following part of this section. Environmental researches are discussed first for students from several grade levels or citizens in general, and then candidate or practicing teachers.

One of the studies conducted with students was performed in Finland. Tikka, Kuitunen, and Tynys (2000) studied with 464 students who had completed comprehensive school at several levels. The research was conducted to establish whether students in a variety of educational establishments differed in their attitudes toward nature and the environment and to discover more about their nature and environment-related activities and knowledge. According to the results, students of biology exhibited the most positive attitudes and the greatest level of knowledge and they participated many nature-related activities. Students related to economy and technology adopted a more negative attitude toward the environment and had fewer environment related activities than students in general. Study also showed that attitudes, the quantity of nature-related activities, and knowledge about environment correlated with one another.

Hwang et al. (2000) conducted an interesting study with 523 visitors to the urban forest trail in Korea. Participants were asked to complete a questionnaire before they entered the trail. Researchers concentrated on the responsible environmental behavior in this study and they found that participants' attitude had a large effect on intention to act which has a huge importance in terms of EE goals. Moreover the study indicated the importance of internal locus of control to enhance responsible environmental behavior. This perception of control leads the expectation that one's own activities are likely to bring about changes. A comprehensive study was conducted with Ohio citizens by Morrone, Mancl, and Carr (2001). They investigated the ecological knowledge and opinions of the citizens. Results showed that participants were also most likely to pay their attention to environmental issues reported in the media, however, they believed that they were not very knowledgeable

about environmental issues. Minority respondents averaged the lowest scores for seven of the eight principles; indicate higher levels of concern about the environment; reflecting a more pessimistic view about environmental conditions.

High schools students' environmental positions in terms of their knowledge, attitudes, and behaviors were investigated in Lebanon by Makki, Abd-El-Khalick, and Boujaoude (2003). The study was conducted to explore environmental knowledge and attitudes; and the relationship between participants' knowledge and attitudes, biographical and academic variables, and commitment to environmental friendly behavior. They studied with 660 10th and 11th grade Lebanese secondary school students. The questionnaire used in the study assessed participants' knowledge of basic environmental concepts relating to broad topics like pollution, recycling, energy, water, animals, and soil, which were relevant to participants' everyday lives. Answers indicated that participants' knowledge of the target environmental topics was lacking. In particular, participants' mean scores on issues related to recycling (mean scores ranging from 41.59 to 46.38) and soil degradation (mean scores ranging from 33.84 to 45.52) indicate severely limited knowledge of these environmental topics. By comparison, participants' mean scores were relatively higher on issues related to animals and energy. As a result, this can be said that participants lacked a common knowledge base of the target environmental concepts and related issues. In addition to the environmental knowledge issue, participants seemed willing to take necessary actions to protect the environment. On the other hand, low correlations between participants' environmental knowledge and attitudes indicated that the effect of knowledge on attitude and behavior is not direct, but mediated by several factors. In contrast, high correlations between environmental behavior, intentions, and affect suggest that the latter could serve as determinants of proper environmental behavior.

Taşkın (2004) investigated the determinant factors on environmental attitudes of senior high school students in Turkey and the origins of these attitudes. Over 900 students participated in the questionnaire based surveys and 20 of the students were interviewed during the study. Results indicated that normal public high school

students, females, lower-middle class students with well educated parents in white color professions, and students with liberal parents have more pro-environmental attitudes than the others. Students from public technical high school get the lowest score on all surveys used in the present study. Interviews of the study showed students' perceptions about the environment and related issues are limited to their local habitat.

Jinliang, Yunyan, Ya, Xiang, Xiafei, and Yuanmei (2004) worked with primary and high school students in Kunming, China. The study analyzed the status and characteristics of environmental awareness and discusses issues related to environmental education in primary school and high school students of Kunming. 535 primary and 644 high school students enrolled the survey study. Results showed that 85 % of the students are willing to take part in activities relate to the environmental protection day and have a positive attitude but the level of both student groups' understanding of the environmental issue is low. Primary school students are more enthusiastic about participating in activities of environmental protection than high school students. Students have good inclination towards environmental-related behavior. Primary school students scored substantially higher than high school students in fair sense of environmental ethics.

A study on the familiarity and understanding of 10 environmental concepts amongst Mexican and English school children aged seven to nine was conducted by Barraza and Cuaron (2004). 246 Children from year 3 of primary education were chosen for the study. According to the results, children have a low to moderate level of environmental literacy. The mean number of words with which children were familiar in each country, school, and school ethos. Furthermore results indicated that the number of familiar words related with environment is different in favor of English children. The researchers tried to explain this difference by the education given both countries.

Another study conducted by Tuncer, Sungur, Tekkaya, and Ertepinar (2004) on the environmental attitude of sixth grade students from rural and urban areas of Ankara.

The study was conducted with 138 sixth grade students. The study showed that almost all the students agreed on the importance of self responsibilities but there is no general attitude observed for changing the life styles. There was a significant difference between students from rural and urban areas on the awareness for environmental problems, awareness of individual responsibilities, and awareness on the national environmental problems. In general, students from urban area had greater awareness. On the other hand, no statistically significant difference was found between these two groups with respect to general attitude about solutions. Interestingly the students in the urban area were slightly more optimistic about the solutions of the problems.

Shepardson (2005), dealt with the concept of “environment”. The study was conducted with a total of 81 students from seventh, eighth, ninth graders from general biology, and ninth graders from college preparatory biology. They were asked to define the concept of environment by drawing pictures. According to the results, students conceptualize environment from a limited ecological perspective; that is an environment is a location where animals live and or an area that supports animal life, with no human figures. The participants do not see human as part of the environment. The study can be interpreted as the students enrolled to the study do not possess enough environmental literacy. They mostly demonstrated a nominal level of environmental literacy which is the first step of EL and is far from higher levels of environmental literacy named as functional and operational literacy.

Alp (2005) conducted a study with 2536 6th, 8th, and 10th grade students from 18 different schools of Ankara. The aims were to determine the participants’ environmental knowledge and attitude levels, to understand the effect of gender on participants’ knowledge and attitude levels, and to examine environmental knowledge and attitudes of 10th grade students, exposed to “Human and Environment” course and those not exposed to this course, The study also investigated the relationship between knowledge and attitude levels of participants. Results indicated a significant effect of grade level on knowledge and attitude levels of students but the “Human and Environment” course given at 10th grade was found

as not significant for knowledge level of student. On the other hand, this course had found to be significant for students' attitudes toward environment in favor of their attitude level. The gender difference on environmental knowledge was found to be affective on 6th grade students in favor of males. On the other hand, females showed more favorable environmental attitudes than males for all grades. A small correlation was found between environmental knowledge level of students and their attitudes toward environment.

Kaplowitz and Levine (2005) focused on the level of environmental knowledge of Michigan State University students relative to the results of biannual national study of the environmental knowledge of the general population of the United States. The total sample size was to be about 19,890. According to the data, while the university students were found to possess higher levels of environmental knowledge than the general public, the students' overall environmental knowledge, an average, was deficient with only 66% of them receiving a passing grade and their overall environmental knowledge level was only "C". The findings suggest a positive correlation between academic level, field of study and environmental knowledge of the participants. The item most often answered correctly by the participants was the question concerning respondents' knowledge that batteries are a household hazardous waste (87.7% correct). Participants also scored well on questions related to household hazardous waste (82.8% correct) and biodiversity (86.4% correct). The questions on which participants least often answered correctly concerned electricity generation (55.8% correct) and nonpoint source pollution (43.5% correct).

A research on secondary and high school students' environmental concern was conducted with 1497 students from 6th, 7th, 8th, and 10th grades selected from ten schools located in Ankara (Tuncer, Ertepinar, Tekkaya, and Sungur, 2005). Results of the study revealed that students worry about the environmental problems and nature and believe in that; environmental pollution is not a temporary problem. They can make a correlation between economic growth, industrialization and environmental concerns. They believe in the need for conserving resources for future generations. They do not accept to leave the environmental solutions just to science

and technology because they think that individual responsibilities are very important in protecting the environmental pollution. A limited but smaller sample was the subject of another study.

Bostrom, Barke, Turaga, and O'Conner (2006) examined Bulgarian adults' environmental concerns with a focus on whether the new environmental paradigm (NEP) scale can reliably measure their environmental orientations. Three surveys conducted in Bulgaria in 1998, 1999, and 2000 to provide evidence of high environmental concern, and proximity to a major petrochemical plant is associated with greater concerns. Results showed that higher environmental risk perception and higher support for environmental protection are associated with higher scores. Interestingly, the association between scores and support for environmental protection was statistically significant in the first survey (climate change issues), but it was not in the other two surveys (government spending).

Another study was conducted with high school students performed by Mert (2006). The researcher conducted a test and 1341 students studying various high schools in seven different districts of Ankara participated to the study. The research measured the environmental knowledge and sensitivity levels of participants regarding environmental education and solid wastes. It was determined by the results of statistical analysis that the knowledge and sensitivity of high school students for environmental education and solid wastes show variations according to their living districts, their schools, their class level, and according to having daily newspaper and to watching ecological documentary films or not. In terms of gender, female participants were more successful than males at knowledge test but there were not any difference at sensitivity part between genders. Although mothers' educational level do not have any effect on environmental knowledge and sensitivity of their children, fathers' educational level have an effect on knowledge level of their children but not on environmental sensitivity of them. Furthermore, it was determined that the students who are more successful in environmental knowledge test have more sensitivity for environment than unsuccessful ones.

Alp, Ertepinar, Tekkaya, and Yılmaz (2006) performed a study to determine 6th, 8th and 10th grade students' environmental knowledge and attitudes in Turkey by considering the effect of gender and grade level of students and to explore the relationship among environmentally responsible behavior and environmental knowledge, affects, behavioral intentions, and demographic variables. 1,977 students completed the Children's Environmental Attitudes and Knowledge Scale. The results indicated a significant effect of grade level on environmental knowledge. Similar to many other studies gender makes a difference on environmental attitudes in favor of females but gender has no effect on environmental knowledge. On the other hand, gender, and age has a significant effect on environmentally responsible behavior of participants. It was also found that environmental knowledge does not have a direct effect on behaviors but it indirectly affects behaviors.

Another environmental attitude research was conducted by Fernandez-Manzanal, Rodriguez-Barreiro, and Carrasquer (2007) in Spain. They developed a questionnaire called as "EAU Scale" (Environmental Attitudes of the University Scale) and applied it to 952 university students. The research showed that a certain level of worry exists among the students regarding environmental problems, which is apparent in the need to increase environmental education and research. Some differences in environmental attitudes were also found between first year students and final year students and male- female students. The lowest scores obtained from the intention of behaving or the willingness to act in an environmentally sustainable way. The research was also investigated the environmental concern levels of the participants and found that the university students have certain level of worry regarding environment.

A total of 1235 elementary school students, and 334 pre-service teachers enrolled a study (Tuncer, Sungur, Tekkaya, and Ertepinar, 2007) which was conducted to assess Turkish elementary school students' and pre-service teachers' environmental attitudes, and to explore whether there was a significant difference in the attitudes towards the environment of these two groups. 45-item test adapted from the one used by Worsley and Skrzypiec (1998) which was originally developed from

Herrera's (1992) Questionnaire of Environmental Beliefs was used for the study . The study showed that the perception of the students towards the environment is high but they are not in the state of implementing the possible solutions and individual responsibilities into their own lives. Pre-service teachers and students of this study accept that environmental pollution is a serious problem of our times and they are of the view that it will not diminish in the future and they are aware of the importance of individual responsibilities in finding solutions Compared with those of the students, pre-service teachers display more favorable attitudes and more awareness of the importance, meaning and integration of individual responsibilities with lifestyles, consumption patterns and environmental problems. But both are unclear about the solutions;

Elementary school students' environmental knowledge and attitudes was investigated by Alp, Ertepinar, Tekkaya, and Yılmaz (2008). They conducted the study to determine the participants' environmental knowledge and attitudes, the effects of sociodemographic variables on environmental knowledge and attitudes, and how self-reported environmentally friendly behavior is related to environmental knowledge, behavioral intentions, environmental affects, and the students' locus of control. Children's Environmental Attitudes and Knowledge Scale and Locus of Control scale were used to obtained data. 1140 Elementary school students enrolled the study. Results showed that elementary school students' environmental knowledge level is low but they have favorable attitudes toward the environment. The study also indicated the effect of education level of fathers on environmental knowledge of their children. The gender difference regarding students' attitudes toward the environment was statistically significant in favor of girls. Moreover it was seen that participants' behaviors toward the environment were independent from their knowledge of environmental issues.

Ökeşli (2008) studied with sixth, seventh and eighth grades (n=848) primary school students in Turkey, to find out their environmental literacy levels in terms of knowledge, attitude, use, and concern components. According to the results, participants are found to be aware of the importance of interaction between humans

and the environment. It was also found that students had low levels of knowledge but had positive attitudes and concern toward the environment. The item that great majority of the respondents answered correctly (64%) concerned the trees as renewable resources. Furthermore, more than half of respondents correctly answered the questions concerning definition of biodiversity (58 %); batteries as household hazardous waste (59.5 %); and human activities of habitat as the major reason for animal extinction (53.5 %). On the other hand, the knowledge item most often answered incorrectly concerned the major source of carbon monoxide; 74.7% of the students chose factories and businesses as the largest contributor of carbon monoxide. The study also showed that there is a strong correlation between attitude and use, and use vs. concern variables among the components of the questionnaire. Students agreed on more than half of the items with over 60% evidencing pro-environmental awareness, values, cultural change, individual responsibility, life style changes, collective actions, technology, and protective laws. The study also pointed that students who were interested in environmental issues, who gave importance to environmental problems, who thought they had good knowledge about environmental issues, whose parents' were interested in environmental issues and involved in environmental activities had better knowledge about environmental issues, more positive attitude towards environmental issues, more positive view on environmental uses and service and concern environmental problems. Moreover female students had more positive attitudes towards environmental issues, more positive views on environmental use and more concern about environmental problems than male students' had but same level of knowledge on environmental issues.

Gökmen (2008) worked with 95 seventh grade students from a public elementary school in Nigde, Turkey. The purpose of the study was to investigate the relative effect of problem based learning with a non local perspective (PBL1), problem based learning with a local perspective (PBL2) and traditionally designed environmental education (TRD) lectures on elementary school (7th grade) students' environmental attitude; specifically by the 3 dimensions as; general environmental awareness, general attitude toward solutions, and awareness of individual responsibility. After 4-

week training, Environmental Attitude Questionnaire (EAQ) was administered to all groups. The results of the study revealed that, students in PBL2 group had significantly more positive environmental attitudes in general environmental awareness and general attitude toward solutions dimensions than TRD group and in all three dimensions of the questionnaire than PBL1 group. Moreover, TRD group had significantly more positive attitude than PBL1 group in students' awareness of individual responsibility determined after the treatment.

Another study (İstanbullu, 2008) dealt with the sixth graders' EL level. 681 Turkish sixth grade students at a private school participated to the study. The research was comprised of all four components of EL names as knowledge, attitude, use, and concern. Scores from the EL test was evaluated as acceptable and unacceptable in terms of environmental knowledge and more than half of the participants (%64) received a passing -acceptable- grade. The results indicated some problematic points with low percentage of answered correctly at; nuclear waste storage, garbage storage in Turkey, cause of river vs. pollution, the largest contributor of carbon monoxide. Data indicated that students have some concerns on environmental problems. The study was also introduced that there is a small positive correlation between attitude and concern but a medium correlation exist between attitudes and use dimension.

The same grade level was included into the study of Negev, Sagy, Garb, Salzberg, and Tal (2008). They worked with 1591 Israeli 6th-grade students in 39 schools. Besides sixth graders, 1530 12th-grade students in 38 schools also took part in the study. Participants composed a representative national sample of the formal education system. They completed grade-specific surveys. Neither group exhibited impressive scores for environmental knowledge. The result did not show a significant correlation between knowledge and behavior but it was shown that ethnic and socioeconomic characteristics were moderately associated with environmental literacy. On the other hand an interesting point was found that the presence of an adult who mediated children's relations to nature was strongly related to environmental attitudes and behavior and weakly related to knowledge.

The Program for International Student Assessment (PISA) 2006 was used as the data

source to investigate the effects of regional differences on responsible environmental behavior by Teksöz, Tekkaya and Erbaş (2009). They used data of the 4942 fifteen year-old students from 7th, 8th, 10th, and 11th grades and covers 78 provinces and 7 geographical regions of Turkey. In PISA 2006, Turkish students' levels of concern for environmental issues has been tested for 6 issues (air pollution, energy shortages, extinction of plants and animals, clearing forests by other land use, water shortages, nuclear waste). More than 85 % of the students declared all six issues as concern for not only themselves but also others. The findings implied that majority of 15 years old students had stronger belief about consequences of environmental damage for others. The results of the study also provided some evidence that the place where students live had an effect on their environmental awareness, concern, optimism and responsibility for sustainable development. One of the differences was on the awareness and concern. The students from the least industrialized regions displayed lower awareness and concern toward environmental issues but they are optimistic on the future environmental problems. On the other hand, students from Aegean region showed the highest level of responsibility for sustainable development but students from Mediterranean region showed the least responsibility on the same issue.

A similar study conducted by Varişlı (2009). She investigated the environmental literacy including their environmental knowledge, attitude, sensitivity, and concern levels of 437 eight grade public school students. Results indicated environmental knowledge level varies between low to moderate. Only 18 percent of the respondents gave the correct answer for the statement of “the most of electricity in Turkey was generated by “hydroelectric power plants”. On the other hand, the high percentages of the incorrect responses were given for the items on the cause of acid rain; the longest decomposed material in nature; the causes of the increase in the amount of carbon dioxide, methane and water vapor in the atmosphere; and the explanation of biological magnification. According to the results of this study, students have positive attitude and high degrees of concern and sensitivity toward environment but lower level of environmental knowledge.

Another important and comprehensive study was conducted by Erdoğan (2009). He

investigated the 5th grade Turkish students' environmental literacy level by considering six EL components, and explores the factors predicting the environmentally responsible behaviors (ERB). Elementary School Environmental Literacy Instrument (ESELI) including five parts and 81 items was used for the study. Results indicated that more than half of the students have moderate level of EL. More than 75 % of the respondents gave the correct answers to the at least half of the environmental knowledge questions. Additionally, the results of Erdoğan's (2009) study revealed that the analysis of the fifth grade students' affective dispositions toward the environment indicated the high level of the willingness to perform pro-environmental behaviors, environmental attitude, and environmental sensitivity. According to the findings, more than half of the students found to be totally passive on political environmentally responsible behaviors. It was also concluded that participants performed high level of physical environmental protection behavior, middle level consumer end economy behavior, and low level of individual and social persuasive behavior

Another study analyzing PISA 2006 data was conducted by Coertje, Pauw, Maeyer, and Petegem (2010). They studied with the PISA 2006 data of 4999 Flemish students and found a positive correlation between science ability and environmental attitudes. Results also showed that gender, immigrant status, socioeconomic status and educational track are important in explaining students' environmental attitudes and awareness.

A national survey study (Negev, Garb, Biller, Sagy, and Tal, 2010) was conducted with 1530 twelfth grade students from Israel. Participants indicated solid waste, open spaces, or air pollution as the main problems and their solution expectations were mostly focused on the governmental level including planning, infrastructure, legislation and enforcement. Analysis of the data also indicated that scoring exceptionally low on the overall score predicts lower knowledge scores, but is not substantially related to lower attitude and behavior scores.

Teksöz, Şahin, and Ertepinar (2010) conducted a study to determine level of pre-

service chemistry teachers' environmental literacy and their perceptions on environmental education. The study was realized during the fall semester of 2006-2007 academic year with the participation of 60 students enrolled in five-year chemistry teacher education program. Two instruments named as Environmental Literacy Test and Environmental Education Perception Survey were used to gather data. Results indicated that participants emphasized promotion of feelings of concern for the environment, development of awareness and sensitivity to the total environment, and gaining social values to protect the natural resources through teaching on environmental issues. They also showed favorable environmental attitude and feelings of responsibility to create a better environment. Results indicated low level of environmental knowledge but they were willing to integrate environmental issues into their teaching practice.

All of the above mentioned studies are focused on the students and citizens perspectives of the environmental issues. From now on, researches conducted with teachers, the main factor of environmental education, are going to be discussed. Most of the researches conducted with teachers are concentrated on the knowledge levels and the relation among the components of environmental literacy.

A study (Mosothwane, 1992) from a different country, Georgia, planned to evaluate preservice teachers' EL; environmental knowledge, attitudes toward EE and teaching and concern about environmental quality. Mosothwane (1992) worked with 112 preservice teachers from Georgia and the surprisingly found that the environmental content knowledge of preservice teachers was very weak or poor. Their average score was determined as 25.15 out of a total score of 45. On the contrary the study pointed that the preservice teachers possessed positive above average attitude towards environmental education. Their average score was 76.46 out of a total score of 100. According to the findings, the preservice teachers were moderately concerned about environmental quality. Their average score was 39.04 out of a total score of 60 on this issue. He could not find any correlation among environmental content knowledge, attitude towards EE and concern for environmental quality but a strong relationship was observed between attitude and concern. Individuals with positive

attitudes towards the environment are less concerned about the quality of the environment. Individuals who possess stronger environmental content knowledge understand the effect of pollution on the environment.

Another study on environmental literacy levels including knowledge, attitude, sensitivity, locus of control, and environmentally responsible behavior was conducted by Hsu (1997) with the participation of 1312 secondary teachers from Taiwan. Results of this comprehensive study indicated a positive environmental attitude for teachers. Their environmental sensitivity and environmental responsibility levels are found to be high. On the other hand, their level of internal locus of control is found to be moderate.

Summers, Kruger, and Childs (2000) interviewed with 12 practicing primary school teachers' to understand their perceptions on four different areas; biodiversity, carbon cycle, ozone and global warming. Two major findings were stated as teachers' poor awareness of the loss of diversity and of the evolutionary mechanism by which it enables adaptation and survival of species. The 'locking up' of carbon within fossil fuels, and the production of carbon dioxide from respiration and decay, were recognized by less than half of the teachers. Uncertainty was shown by a number of teachers about how much carbon dioxide is present in the atmosphere, what happens to the carbon in it after photosynthesis, and its role in respiration. Common misconceptions of the participants were that the 'holes' cause global warming and that ozone-destroying chemicals come from car exhausts. Unfortunately, there was little knowledge of Man's enhancement of the natural greenhouse effect, or awareness of the Earth as a system which both receives and radiates the Sun's energy.

EL levels of 292 teachers were also investigated by Owens (2000). He worked with urban middle school teachers and found that teachers scored highest on affective subscale but behavioral subscale scores were the lowest. According to the findings, a disconnection occurs when it comes to translating environmental concern into positive environmental behavior. Teachers participating to this study generally

believed that environmental problems can be solved and that they have a personal responsibility to help solve those problems. Additionally, taking preservice and inservice environmental courses appeared to play a role in impacting environmental behavior.

Biodiversity, carbon cycle, ozone, and global warming are the main focus of a study on knowledge level conducted by Summers, Kruger and Child, (2001). Total 170 practicing primary school teachers, 120 primary trainees, 88 secondary science trainees enrolled the study. Results showed that participants' knowledge level was best in biodiversity and global warming. Lack of understanding seen in groups about loss of diversity of species, carbon in the process of decay, increased-ground level ozone, its toxicity, energy exchange between the sun, and finally earth and space.

A two-step study was conducted by Cutter-MacKenzie and Smith (2003). The study was included a series of ethnographic interviews (26 primary school teachers) followed by the use of quantitative mail survey. 90 Primary school teachers were sampled in the pilot survey. 78 completed questionnaires were received. The researchers investigated Australian primary school teachers' knowledge about environmental education, and in so doing utilizes a combined methods approach and the theoretical concept of "ecological literacy" (eco-literacy) to assess primary school teachers' knowledge (and beliefs) about environmental education. Results showed that implementation of environmental education in primary schools is problematic and has had limited success. Findings of the study also indicated that; primary school teachers' are likely to be functioning at a "knowledge" level of ecological illiteracy and/or nominal ecological literacy. Furthermore, such primary school teachers tend to dismiss the importance of knowledge, preferring to focus upon attitudes and values in the teaching of environmental education. Participants displayed limited and simple understanding of EE. The majority of them openly expressed their lack of knowledge about EE. Participants held many misconceptions and simple understandings of various environmental concepts.

Another study indicating the misconceptions on environmental concept conducted by

Bal (2004) with the participation of 140 preservice teachers. The main focus of the study was the greenhouse effect. Results showed that preservice teachers had some misconceptions on the issue and they claimed that; nuclear pollution increases the effect of greenhouse and this increases the number of poisoned people due to the food that they consume. Results also indicated some other misconception on several greenhouse gases like CFC and methane.

Hughes and Estes (2005) studied to measure the influence of two different types of environmental education classes on the development of environmentally responsible behaviors of undergraduate students. The study sample consisted of three upper-division undergraduate courses at East Carolina University: (a) Environmental Science Education (traditional environmental education classroom and short field trip), (b) Outdoor Programming (Leave No Trace camping skills and extended field trip), and (c) Measurement of Physical Activity and Fitness (control group). Environmental Action Perceived Control Inventory (EAPCI) was used to measure the level of Environmentally Responsible Behaviors. Results showed no significant results on the overall EAPCI scores among groups. Patterns indicated the highest level of increase for the traditional setting class (Environmental Science Education), while the nontraditional setting class (Outdoor Programming) showed a moderate increase, and the control group showed little or no increase in environmentally responsible behaviors. The findings of the present study did not find that one teaching method was significantly better for increasing overall environmentally responsible behaviors in college students than the other. The one significant difference obtained from the data was that the traditional classroom setting was more effective at teaching students how to use legal action as an environmental action strategy.

An interesting result came from the study of Erol (2005). The research was conducted with 450 preservice teachers and findings pointed that, in general, preservice primary school teachers are not interested in environment. In addition to this interesting point, it was seen that they also had some confusion on concepts like greenhouse effect, habitat, ecosystem and global warming.

Tuncer, Tekkaya and Sungur (2006) conducted a study to determine the opinions of university students in Turkey on the general awareness of sustainable development. They worked with 334 students from three different subject areas as Early Childhood Education, Elementary Mathematics Education and Elementary Science Education. Pre service teachers found to be conscious about the concept of sustainability and they believe in the importance of conserving resources for future generations; they put environmental issues in front of the economic growth; they have an intention to take individual roles in solving environmental problems; they do not only aware of the importance of changing life styles to protect environment, but they also accept to make changes and they believe in that, solution of the environmental problems in Turkey is closely related with raising environmental awareness.

A study on the level of environmental behavior was conducted by Goldman, Yavets and Pe'er (2006). They focused on the environmental behavior level of new students in teacher-training collages in Israel and looked for the relationship between behaviors and background factors. 765 incoming students from three different Universities of Israel participated the study. Findings indicated that graduates of educational system who choose to prepare themselves to be teachers were characterized by a low level of environmental literacy, as reflected in their environmental behavior. According to the results, resource-conserving actions with personal financial benefit are the environmental action category representing the lowest level of environmental commitment. Results demonstrated a negative relationship between the frequency at which students engaged in each behavior category and the environmental commitment level of the respective category; the higher the commitment level, the less this behavior is carried out. Findings, pertaining to reported environmental behavior, indicate that new students in teacher-training programs in Israel are characterized by a relatively low level of EL. Students demonstrated limited performance of behaviors that require a high level of commitment and hence reflect a high level of EL and vice versa.

Spiropoulou, Antonakaki, Kontaxaki, and Bouras (2007) also worked with the 188

Greek primary school teachers' perceptions about the environmental issues and attitudes towards education for sustainable development. Analysis revealed that the participants have some misconceptions on the term "sustainability" and "renewable resources of energy" of teachers. They confuse renewable resources of energy with the non renewable ones.

A combined study was handled by Petegem, Blicek, and Ongevalle (2007). They investigated the teachers' and students' awareness and involvement in EE students from three colleagues in Zimbabwe. Results showed that students perceive the environment mainly in terms of biophysical issues whereas teachers also relate the environment to social, economic and political issues. Both students and teachers of environment-related subjects are significantly more concerned about the environment and are more involved than their fellow students and colleagues of other subjects. Environmental-related subjects are seen as the most suitable for inclusion of EE by the respondents.

Akbaş (2007) studied with first and fourth year students of science teaching department in Erzurum, and indicated that the participants had some serious gaps in their environmental knowledge. Similarly Aydemir (2007) worked with 183 inservice teachers from 91 selected elementary schools in Ankara and found that majority of the teachers possess average knowledge about environmental concepts and only small number of teachers had adequate knowledge level.

Pe'er, Goldman, and Yavetz (2007) conducted a study in 2003 with a heterogeneous group of 765 first year teacher-training students from three large colleges in Israel. They reported the environmental attitudes and knowledge of 765 1st-year students in 3 teacher-training colleges in Israel and examine the relationship between these variables and background factors and their relationship to environmental behavior. Study pointed that, although the students' environmental knowledge was limited, their overall attitudes toward the environment were positive. Results also indicated that beginning students had low ecological and environmental knowledge. Students were most knowledgeable in fundamental ecological processes and concepts,

although their knowledge was poor. They were least knowledgeable about environmental action strategies.

A comprehensive study was conducted by Tuncer, Tekkaya, Sungur, Çakıroğlu, Ertepinar, and Kaplowitz (2009) on EL of pre-service teachers at one of the largest public universities in Turkey. 684 pre-service teachers submitted a completed questionnaire for this study. The scores were categorized as acceptable or unacceptable regarding the respondents' overall level of environmental knowledge. According to this grading system, only 49% of the respondents had a passing environmental knowledge grade. The results showed that the participants have a lack of knowledge especially on the following issues; the largest contributor of carbon monoxide; the common method for storing nuclear waste throughout the world; the most common way of garbage storage in Turkey; batteries as the source of hazardous waste. According to the findings, majority of Turkish pre-service teachers do not possess enough knowledge but they expressed positive attitudes toward the environment as well as a high degree of concern about environmental problems. The study also showed a small correlation between pre-service teachers' environmental knowledge and use. On the other hand, any significant relation was seen between knowledge and attitude observed. Participants also introduced positive attitudes towards the environment. When the researchers checked the relation between environmental knowledge and attitude of preservice teachers, they could not observe any significant relation between these two components of environmental literacy.

Öztürk (2009) investigated preservice teachers' EL through their epistemological beliefs. He studied with 560 preservice teachers from a public university in Ankara. The study showed that environmental behaviors have a positive relationship with environmental attitude, concern, and knowledge. However, the relationship between behavior and knowledge was very low. It was concluded at the end of the study that increasing knowledge does not lead to an increase in attitude, concern, and behavior.

Another study (Eroğlu, 2009) was conducted in two steps; first step for the reliability study (328 preservice science teachers) and the second step for the application of the

questionnaire with 271 preservice science teachers. According to the results preservice science teachers' knowledge level about global warming is above average but they have lack of knowledge about some issues like chlorofluorocarbons, and causes and effects of global warming.

Çakır, İrez, and Doğan (2010) conducted a similar study with Eroğlu (2009) but their participants were inservice teachers. The study was performed to profile future science teachers' understandings of current environmental issues in the context of an education reform in Turkey. Totally 360 future science teachers (108 secondary science teachers, 252 elementary science teachers) from 6 universities enrolled the study. At the end of the research they found that the participants' knowledge and understanding on ozone layer depletion and global warming appeared critically weak and they have misconceptions on these issues.

Yavetz, Goldman and Pe'er (2009) studied on the environmental literacy of 214 students in three academic colleges of education in Israel. The pre-post test was administered with a 3-year interval. The post tests were administered at the end of their studies. The researcher found discouraging and insufficient EL for the participant future educators. In general, the knowledge level seemed as insufficient. According to the results, the positive attitude level does not mean high level of knowledge for the respondents. Moreover it was found that there is a high correlation between participants' attitudes and behavior.

In summary, there are many studies pointing the low or inadequate level of environmental literacy of preservice and inservice teachers. Researches indicated that neither students nor preservice or inservice teachers possess adequate environmental knowledge. Furthermore it is hard to say that their knowledge level has a strong positive correlation with other EL components. On the other hand, students and teachers generally demonstrate middle or high level of environmental attitude but the relationship of environmental attitude among other EL components needs more detailed investigations. Studies on environmental use component of environmental literacy display some connections with other components of environmental literacy

but there is still way to understand the connections among environmental use component and other descriptors. Differently, almost all researches indicated the same point that both students and teachers have some concerns on environmental issues but the level of concern and relationship of concern with other determinants are various.

2.1.3 Factors Affecting Environmental Literacy

There are several determinants of environmental literacy. In this part of the study, gender, professional background, age and grade level, socioeconomic status, and residential differences were handled. Related studies will be discussed in this part of the study.

2.1.3.1 Gender

Review of the related literature revealed the gender as one of the most important environmental literacy determinants. Several studies conducted on the effects of gender on different environmental literacy components.

One of the studies conducted on the effect of gender on EL was performed by Tikka, Kuitunen, and Tynys (2000). They studied with 464 students who had completed comprehensive school from central Finland. They showed that female students have more positive attitudes towards nature and the environment than male students. Female and male students, on the other hand, had approximately the same quantity of nature-related activities but the types of hobbies were different. Men go hunting and fishing, as their ancestors have done. A surprising finding exposed by the study was that gender had an even greater impact on knowledge than the educational establishment or the major subject being studied. A similar study was conducted in Lebanon (Makki, Abd-El-Khalick, and Boujaoude, 2003). The researchers worked with 660 Lebanese secondary school students from 10th and 11th grades. They found that the mean total knowledge scores for females and males were not significantly

different. On the other hand the scores showed that grade 10 females had significantly higher knowledge and attitude scores than males. Similarly, Yılmaz and Andersen (2004) investigated the effect of gender on support for environmental issues and found that elementary and middle school Turkish female students exhibited more support for environmental issues than male students did. Moreover, Taşkın (2004) investigated the high school students' pro-environmental attitudes with respect to their demographic variables in Turkey. Results displayed that females have more pro-environmental attitudes than males. Effect of gender on EL was pointed by the result of another study (Tuncer, Ertepinar, Tekkaya, and Sungur, 2005). Tuncer et al. investigated the environmental concern of secondary and high school students and found that girls are more environmentally active and conscious. Tuncer, Tekkaya and Sungur (2006) were also investigated the effect of gender on EL of students from three different departments (Early Childhood Education, Elementary Mathematics Education and Elementary Science Education). 334 students enrolled the study and results supported the effect of gender. They found that girls are more conscious about sustainable development than boys are. Similarly, the study of Fernandez-Manzanal, Rodriquez-Barreiro, and Carrasquer (2007) showed that female university students have higher scores on attitude scale and they tend to display a higher level of commitment and responsibility than males. As a result of the study with senior high school students Taşkın (2008) also supported the higher positive effect of females on environmentally consciousness than males have. Ünal (2008) examined Turkish elementary pre-service teachers perceptions about global versus local environmental issues and determined the gender and major effect on their perceptions of global and local environmental issues. Findings showed that gender had an effect on pre-service teachers' concerns and attitudes about global and local environmental issues except evaluation of their own environmental knowledge and perception of issue complexity. Female pre-service teachers had higher scores for both concerns and attitudes parts of the Environmental Perception Questionnaire. In other words, females had higher sensitiveness toward environment and environmental issues than males did. A different study indicating the effect of gender on EL was conducted by Ökeşli (2008). She worked on primary school students' environmental literacy levels and showed that female students had more positive

attitudes towards environmental issues, more positive views on environmental use and more concern about environmental problems than male students' had but males and females had the same level of knowledge on environmental issues. In parallel with many other studies, another research conducted by Tuncer, Tekkaya, Sungur, Çakıroğlu, Ertepinar, and Kaplowitz (2009) indicated the effect of gender on several EL components. They showed that female pre-service teachers found to have more positive attitudes and undertake more proenvironmental actions. Similarly, Öztürk (2009) showed that preservice teachers' EL is differ in terms of gender. According to his study, females have more intention to act environmentalist than males. Females also have more concern towards environmental problems than males. However, males reported significantly better knowledge than females according to results. Varışlı (2009) investigated the eighth grade public school students' environmental literacy and reached similar conclusion with many other researches that there is significant effect of gender on students' environmental literacy regarding to concern, in favor of girls. Yapıcı (2009) worked on with awareness, responsibility, concern levels of 240 prospective teachers from several departments of different universities. Results showed that a responsibility, awareness and concern level oriented towards environmental problems of the prospective female teachers were higher and different at an important level than the males were.

Although many studies pointed a significant correlation between EL levels of students and teachers and their gender, there are some other studies (e.g. Mosothwane, 1991; Akbaş, 2007; Ökeşli, 2008; Öztürk,2009; Coertjens, Pauw, De Maeyer, and Petegem, 2010;) indicating the ineffectiveness of gender or the difference in favor of males. For instance Akbaş (2007) conducted a study with science teacher candidates, and supported the view that gender does not make a difference on the environmental and ecological knowledge of the participants. Likewise, Ak (2008) also advocates the same point. Ak's study was conducted with primary school teachers and indicated that generally gender does not make significant differences on environmental consciousness but in some subgroups made small differences in favor of male. Another study on the fifth grade students' affective dispositions toward the environment was conducted by Erdoğan (2009) and

indicated the same irrelevance that there was not a significant difference between environmentally responsible behavior on males and females. Mosothwane (1991), on the other hand, assessed preservice teachers' EL and evaluated their environmental knowledge, attitudes toward EE and its teaching and concern about environmental quality. Results indicated that there are no significant differences in performing on the environmental content knowledge instrument between male and female participants. Furthermore males possessed more environmental concepts than females. There are no significant differences in attitude towards EE or concern for environmental quality between male and female participants.

In summary, there are many researches supported that gender has an effect on environmental literacy levels of individuals. Most of the studies indicated that females display higher level of environmental literacy especially for the attitude, use, and concern components than males do but males are more active on their environmental actions than females and do better on environmental knowledge tests than their counterparts.

2.1.3.2 Professional Background

The effects of professional background of individuals are seen as another important determinant of EL. This section covers the effect of experience in teaching, having environment related course or not, fields of education, and source of environmental knowledge. Several studies conducted on the effects of these factors. In Mosothwane's (1992) study on the assessment of preservice teachers' EL, showed that experience had a significant effect on content knowledge. Interestingly, preservice teachers without teaching experience performed higher than those with teaching experience. The same difference is found also for content knowledge. No significant differences were observed on performances on attitude or concern measures between preservice teachers without teaching experiences and those with teaching experiences. Similarly, Owens (2000) conducted a study on EL of 292 urban middle school teachers and indicated that years of teaching experience played

a strong role in environmental sensitivity, awareness and values, and environmental behaviors, but displayed no significant role in environmental knowledge and total EL. Daştan (2007) obtained different results. He worked with biology teachers and found that young teachers are more sensitive about and have more interest on environment than their older colleagues. Furthermore, Aydemir (2007) investigated the effects of professional experience effect on elementary school teachers' EL and concluded that the main predictor of teachers' environmental knowledge was teaching experience, class hours taught in a week and being a part of an environment project. Aydemir's study also showed that participants did not take adequate environmental education neither preservice nor inservice education.

Environmental education has a high importance for studies on education for several decades. Societies desire to have environmentally literate citizen and education seen as the way to develop environmental literacy among the future responsible citizens. This desire lead the development of environment related programs and courses for schools. As a result of the development of programs and courses on environment, a growing need appeared on the researches about the effect of environmental related courses and programs on EL of students. In this section, several studies related with this issue are listed. One of the studies on the issue was conducted by McMillan (2003). The researcher investigated the impact of an introductory environmental studies class on the environmental values of university students The evaluation was based on a triangulation of method used questionnaires, interviews, and observations. Through questionnaires, interviews, and observations it was determined that Dalhousie University's introductory environmental studies class was an effective environmental studies class that helped students' environmental values develop over the course of the year. The class was found to be value based and interdisciplinary and it taught critical-thinking skills and tried to engender an internal locus of control, satisfying the main points of an effective environmental education class, as called for in the literature. On the other hand, Mosoley, Huss, and Utley (2010) worked with 38 K-12 teachers to determine EE teaching efficacy beliefs before and after a two-week course. Researchers studied on the change in EE teaching efficacy beliefs of K-12 teachers who participated in two weeks of an intensive summer earth systems science

institute using the Global Learning and Observations to Benefit the Environment curriculum as the conceptual framework. They participated daily in eight hours of basic globe activities the first week and advanced globe activities the second week. Pre-Post test of EE Efficacy Belief Instrument (EEEBI) was used to investigate both the change in personal environmental teaching efficacy and environmental teaching outcome expectancy. At the end of the study teachers reported significant gains in both the change in personal environmental teaching efficacy and environmental teaching outcome expectancy immediately following the workshops but the increase in their scores were not significant. Aydın (2008) investigated the self efficacy beliefs through EE of 80 elementary teachers and 320 undergraduates from primary school teacher education program. She concentrated on the “guidance perception” and “academic efficacy perception” in her study. According to the results “guidance perception” and “academic efficacy perception” of the undergraduates who have taken a course in environmental science are relatively higher. Another study conducted by Owens (2000). The research indicated partial effectiveness of environmental courses on EL. Urban middle school teachers enrolled Owens’ study and results indicated that taking preservice and inservice environmental courses have a positive impact on environmental behavior, sensitivity, awareness and values but has no effect on knowledge. Akbaş (2007) performed an interesting study with first and fourth year students of science teaching department in Erzurum, Turkey. The result revealed that taking environmental related course before the university do not have any effect on conceptual knowledge but their university education made a significant effect on their environmental knowledge. An environmental course was designed by Pande (2001) in Indian’ central Himalayas. Pande designed an experimental environmental education coursed in rural schools. The course was designed to introduce environmental and livelihood issues into mainstream curriculum. This practical course focused on land degradation, which was the region’s major environmental problem. Students learned how to manage their village ecosystem to ensure maximum sustainable productivity. Results showed that a separate course on EE is feasible and teachers with a science background are not necessarily more effective in teaching EE. A 16-week course Web-based (28 participants) versus in-class (58 participants) learning environments was conducted

by Wright (2008). The aim of the study was to explore how instructional methods influence postsecondary students' environmental literacy. Web-based versus in-class learning environments indicated that student's environmental knowledge, beliefs, opinions, and self-perceptions were equivalent prior to participating in an introductory environmental science course. However, by the end of the 16-week course, students from the in-class group had significantly improved their environmental knowledge and expressed more environmentally friendly opinions compared with students from the Web-based group. Results indicated the need for the improvements of web-based environmental education. An interesting result came from the result of Ak's (2008) study. Ak worked with primary school teacher students from different departments, on environmental consciousness. When the Environment Conscious Scale (ECS) total analysis considered, in some subgroups and between Primary School Departments (Science and Technology Education, Social Science Education, Maths Education, Pre-School Education) significant differences obtained. Although this difference was expected in favor of the Science and Technology Education students that taking environmental lessons a lot, the significant differences were obtained from the other departments' students who did not take environmental lessons.

The source of environmental knowledge is another point on which several studies conducted so far. One of the studies was realized with students by Barraza and Cuaron (2004). They planned a study and investigated the source of environmental information of 246 third grade children from England and Mexico. They focused on several environmental concepts and the source of their knowledge that participants used. The concepts in research were habitat, pollution, recycling, global warming, extinction, solar energy, endangered species, deforestation, nuclear power station, and ozone layer. According to the data obtained, in general the most popular information sources are school, television and parent. Interestingly participants stated the "publication" as the least frequently used information source. A study on the fifth grade students' affective dispositions toward the environment was conducted by Erdoğan (2009) also investigated the students' source of environmental knowledge and found that they obtain their environmental knowledge from school, family,

internet, television, books, magazines, and encyclopedias. Another study conducted with the participation of eight grade public school students by Varışlı (2009). Varışlı investigated the source of environmental information and its effect on EL of eight grade public school students. Results indicated that television, school and journals were the main source for the participants to obtain information about environment. Another finding of the study was that, there was not a statistically significant effect of source of information about environment on students' environmental literacy. Besides the studies on the environmental information sources of students, several researches conducted on the environmental information sources of preservice and inservice teachers. One study conducted with teachers by Hsu and Roth (1998) found that the most popular sources of their environmental information are newspaper, television, books and magazines. Aydemir (2007) realized a study on the same issue. Elementary schools teachers participated the study and results showed that participants in the study used media (visual or printed) to reach environmental information. Aydemir's study also indicated a remarkable point that participants did not take adequate environmental education neither preservice nor inservice education. 360 future science teachers from 6 universities (108 secondary sci. teachers, 252 elementary science teachers) enrolled the study of Çakır, İrez, and Doğan (2010). They found that mass media, were reported to be often consulted by participants for their environmental information. Turkish pre-service teachers perceptions about global versus local environmental issues investigated by Ünal (2008). The information was collected from Elementary Education pre-service teachers (213 female and 55 male) from Middle East Technical University. Their concerns and attitudes toward 9 global and 5 local environmental issues were measured by using a survey questionnaire. Results pointed that academic major had an effect on pre-service teachers' concerns and attitudes about global and local environmental issues except evaluation of their own environmental knowledge and perception of issue complexity. Pre-service teachers who study department of Early Childhood Education had the highest scores on the concerns and attitudes dimensions of Environmental Perception questionnaire for both issues than pre-service teachers those study departments of Elementary Science Education and Elementary Mathematics Education.

In summary; although there are several studies indicating the effect of having environmental related course on EL, many other researches pointed the ineffectiveness or no relationship of the courses on EL. This thought provoking results point out the need for well-developed environmental related programs and courses so as to have environmentally literate students and teachers. Moreover the effect of experience on EL is not clear. There are many studies indicating the effects of professional experiences in favor of both more and less experienced participants. These results introduce the need for the new researches that more detailed information on the issue must be gathered. As it was indicated by the researches on the EE area, school and media are the major source of environmental knowledge. These results generate the need for special care for these sources to increase their benefits on educating environmentally literate citizens.

2.1.3.3 Age

Many researchers conducted studies on the effects of participants' age on EL. Although most of such studies are not dealing with teachers, the following section attempts to review the impact of age difference on the EL in general terms. One of such studies was realized by Tikka, Kuitunen, and Tynys (2000). The researchers studied with students from Finland, and dealt with the effect of participants' age on EL. Results indicated that the older the students, the more active and aware on biological and environmental facts. Erol (2005) focused the attitude dimension of environmental literacy for her study. She conducted a research on preservice teachers' attitudes toward environmental problems and found that preservice teachers which are 22 years old and older possess more positive environmental attitudes than their younger friends. Another study on environmental attitude dimension of EL was conducted by Negev, Sagy, Garb, Salzberg, and Tal (2008). The researcher studied with the elementary high school students. According o the results, younger high school students were found to be better in terms of their environmental behavior and attitudes than the older ones. Similarly, Kışoğlu (2009) investigated the preservice teachers' environmental attitude, behavior and perception and found that they were

not affected by age, but age had an effect on their knowledge level.

In summary, research related to effect of age difference on EL displayed no particular pattern. While several studies indicated a higher level of EL in favor of younger participants, some others support the reverse; older ages with high levels of EL. Those difference points the need of further detailed studies distinguishing the causes underlying these differences among the results. Therefore, it is necessary to conduct more research to further evaluate the effect of age on EL.

2.1.3.4 Socio-Economic Status

Another determinant of EL investigated by the environmental education researchers is socioeconomic status to understand whether there is a difference on EL of individuals from several socio-economic status or not. Yılmaz and Andersen (2004) worked with 4-8 grade students to identify the intensity of Turkish students' views with regard to environmental issues presented in the national curriculum and to determine how these views differ by several demographic characteristics. Socio-economic status is one of the characteristics investigated during the study. Results revealed that students with high family income displayed more positive attitudes toward environmental issues. Uzun, and Sağlam (2005) also investigated the effects of socioeconomic factors on environmental awareness and environmental academic success. The study realized by means of implementing two scales titled "Scale for Environment Awareness" and "Scale for Environment Academic Success" to 258 students from high schools in Ankara. Differences among the groups regarding their environmental awareness and environmental academic success were investigated in the study. The results pointed that there was a significant difference in the average environmental consciousness between the middle socio-economic group of students and high and low socioeconomic groups, with the "middle socio-economic group" showing more consciousness. However, no significant difference was observed between other two groups. Students with high socioeconomic backgrounds, on the other hand, were more successful compared to the others in terms of their environmental academic success. Tecer (2007) obtained different results from the

research conducted with primary and elementary school students. A questionnaire designed by researcher on “environmental consciousness and active participative scale (ECAPS) was used and it was concluded that the ECAPS score of the students whose parents had higher socio-economic status were higher than other students. Coertjens et al. (2010) worked on the Flemish data of Organization for Economic Co-operation and Development’s Program For International Student Assessment-PISA 2006. They worked on several determinants and revealed that high income, well educated, city dwelling, politically liberals and autochthon have more proenvironmental attitudes. Taşkın (2008), on the other hand, worked with high school students and used a scale titled “The General Environmental Attitudes and Perceptions (GAP)” The results indicated that middle and lower middle class students had the highest scores on the GAP. Another similar result was obtained from the study of Negev, Sagy, Garb, Salzberg, and Tal (2008). Sixth and twelfth grade students participated to their study and both groups answered grade specific surveys. Participants in the middle socioeconomic group got higher scores compared to the children in the low or high group. Whereas, the results of Erdoğan’s (2009) study on the fifth grade students’ affective dispositions toward the environment indicated that there was not a significant difference between environmentally responsible behaviors of participants from different socioeconomic status.

In summary, research on the effect of socioeconomic status on EL pointed out similar results with few exceptions. Most of the studies indicated that participants from middle or high socioeconomic status have higher level of EL with respect to participants from lower socio-economic status. Thus, designing studies that focus on the underlined reasons of this difference may enhance the understanding of EL.

2.1.3.5 Residential Differences

Residential differences have been investigated as a factor that potentially affects the level of EL. The researches on the effect of residential differences on EL have been focused on both the region that participants live currently and the region in which they were grown up. One of the studies on the effect of residential difference was

conducted by Tikka, Kuitunen, and Tynys (2000). They studied with students from Finland. Results indicated that the most positive attitudes were found among students coming from the metropolitan area in southern Finland, where population levels are the densest. At the end of the study, Tikka et al. (2000) concluded that; “as a rule, people coming from the most densely crowded regions seem to be the most worried about the state of the environment; whereas students who grew up on farms spend the greatest proportion of their time on nature-related activities and therefore they are not worried about the state of the environment.” Taşkın (2008) reached a similar conclusion by his study realized with more than 900 high school students from several geographical regions. He found as a result that, students who live in shantytowns were more aware of environmental problems than the other students. Tuncer, Sungur, Tekkaya and Ertepinar (2004) conducted an interesting study with 138 sixth grade students. Results indicated that, students from urban area seemed to be much more aware of the economical and academic aspects of the environmental problems. The students from the urban area, on the other hand, were found to be strongly against the economical growth and industrialization, whereas rural area students were mostly unsure. Another study indicating the effect of residential area on environmental knowledge was conducted by Gökdere (2005). A case study approach was used in Gökdere’s study (2005) and data gathered from sixth, seventh, and eighth-grade students from six different schools. The purpose of the study was to detect the effects of environmental factors (geographical factors) on environmental knowledge level of primary students in Turkey. The results indicated that environmental factors in the living area had an effect on children’s environmental knowledge level. Moreover, Goldman, Yavets and Pe’er (2006) investigated the level of environmental behavior of students in Israel and looked for the relationship between behaviors and background factors. 765 Incoming students from three different teacher training Collages of Israel were participated the study. Results showed that students who grew up in an urban environment were less active in most of the behavior categories (i.e., environmental consumerism, nature-related leisure activities, citizenship action, and environmental activism) as compared with students who grew up in a rural environment. Teksöz, Tekkaya and Erbaş (2009) analyzed the data which was obtained from the Program for International Student Assessment

(PISA) 2006. The data of PISA 2006 covered 78 provinces and 7 geographical regions. The results of the study provided some evidence that the place where students live had an effect on their environmental awareness, concern, optimism and responsibility for sustainable development. Although the students of the least industrialized regions (Southeast Anatolia and East Anatolia) displayed lower awareness and concern toward environmental issues, they displayed highest degree of optimism concerning the development over the next 20 years of the problems associated with air pollution, energy shortages, extinction of plants and animals, clearing forests by other land use, water shortages, and nuclear waste. On the contrary to many other researches, Mosothwane (1991) found no difference in performing on the content knowledge instrument between urban and rural preservice teachers. As a result of his study, it was stated that there were no significant differences in performing on the attitude or concern instruments between urban and rural preservice teachers.

In summary, most of the researchers evaluated regional differences as an important determinant on environmental literacy but still there are some other researches indicating no relationship between the residence and EL of participants. More investigations may lead to obtain explanations for this inconsistency on the effect of residential differences on EL.

2.1.4 Building Environmental Literacy

EL is built on the belief that if we educate environmentally literate citizens, they will take more responsible environmental actions. This assumption also requires the assumption that teachers are ready for this controversial mission. As it is stated by Knapp (2000), EE's ultimate aim of changing environmental behavior is a formidable goal that cannot be accomplished easily. Although education professionals (teachers, department heads, as well as non-teaching staff) and students are the key players in EE, teacher education for EE is lacking in several countries (Petegem, Blicke, Imbrecht and Von Hout, 2005). Many studies conducted to determine the environmental literacy levels of educators and their training needs that

help to enhance their efficiency on environmental education. Therefore, this section is about the research on the teachers' opinions on the EE, depending on the fact that, teachers are the key elements in EE and building EL is possible with environmentally literate teachers who value EE and can develop an idea on the effective EE.

One of the studies performed on EE indicated teachers' perception on environmental education and inadequacy of EE for teachers. Gayford and Dillon (1995) studied with 51 secondary school teachers from England. The teachers of the study defined their role in relation to their own attitudes to the environment, the relationship between local and global concerns and their understanding of nature of EE and its contribution to the curriculum. The majority of the participants considered themselves to be environmentally aware, and indicated a balance between the local and the global issues. A striking result also came from the study that only about 12 percent of those participants had received professional training on environmental education.

Integration of theory of environmental education into practice in teacher education was the subject of a research conducted by Powers (2004). She interviewed with 18 professors of education on the ways in which EE theory and practice which were incorporated into preservice elementary education by means of "science and social studies methods courses". After interviewing the professors, Powers (2004) suggested that all preservice teachers should be prepared to infuse EE into their classroom teaching and EE should be an important part of elementary school children's' school curriculum. Infusion of EE into method courses was preferred to offering a separate course by the participants. Moreover the time limitation was expressed as an important problem for EE.

Additionally, Heimlich, McKeown-Ice, Braus, Barringer-Smith and Olivolo (2004) conducted a six-question mail survey representing 42 states. 499 institutions on EE and preservice teacher preparation were chosen for this national study. More than half of the respondents offered a single course on EE. Their perceived barriers to EE are time, not being mandated by the state, education of EE teachers, students'

interests and place were stated as the most important barriers. Research also indicated that the participants have a very low awareness on the printed EE resources.

Another remarkable study was conducted by Mastrilli (2005) with a mail-questionnaire by sending mails to 42 preservice elementary teacher education institutions in Pennsylvania. Mastrilli asked about teachers' opinions on EE. Only 10% of responding institutions indicated that they require a specific EE course. The most often used methodology for EE was expressed as educating about environmental issues. The least often used ones were stated, on the other hand as, history and philosophy of EE. Most frequently cited positive factor influencing the inclusion of EE into the program was state certification guidelines and standards.

Tamkan (2008) realized a group interview with nine high-school biology teachers from four different schools in Istanbul. According to the results teachers were found to be interested in the environment; however, they did not exactly understand the concept of sustainability and natural resources. Results also indicated that teachers applied teacher centered education in which they taught only the terminologies and definitions on ecology. They did not use the student centered strategies and they reported the need on improvement of curriculum to include projects and researches. As a conclusion it was stated that teachers need in-service training on education for sustainable development and on student centered methods for EE.

There are some other studies indicating the effect of EE of preservice teachers' performance in EE. One of them was conducted with elementary school teachers in -400-Wisconsin and -400-Ohio by the researchers Plevyak, Bendixen-Noe, Henderson, Roth, Wilke (2001). Elementary school teachers from Wisconsin had received EE and had experience in EE, whereas the level and experience of the teachers from Ohio were much more less. Results showed that attitudes toward EE were similar for both groups, but the teachers from Wisconsin seemed more confident about teaching EE concepts.

Bennet and Matthews (2005), on the other hand, worked on the effect of EE certification on teachers' effectiveness in EE. They studied with 101 K-12 teachers in North Carolina who had received their EE certification. Results indicated the positive effect of the certification program. The study showed that EE certified teachers made use of effective pedagogical methods, including hands-on activities, problem-solving exercises, and field experiences.

Besides other studies with teachers, Yavuz (2006) conducted a study to investigate the effect of a project-based learning by 25-day training of preservice chemistry teachers. The results were obtained from the "Environment Attitude Scale." Pre and post test scores were compared and a difference was found in favor of the post test. Therefore, it was concluded that, Project-based learning applications, enhance preservice chemistry teachers' environmental attitudes.

To sum up, several studies have been conducted on the EL levels of teachers, on their perceptions on EE and their experience on the implementations of EE. In addition, they have been asked about the problems they face during their EE experience. Although such research pointed out needs and the ways to develop teachers' effectiveness on EE, as well as developing their efficacy on EE, more research is needed to support their improvement for raising environmentally literate generations.

2.1.5 Testing Environmental Literacy

It is not easy to test environmental literacy of participants in a scientific research. Several dimensions included by EL like knowledge, attitude, concern, use etc. and many determinants of EL are the subject of such researches. This complicated nature of EL researches gave rise to the increasing number of instrumentation and method studies.

One of the instruments that are widely used in EL studies is called as "The New Environmental Paradigm Scale". It was developed by the social scientists Dunlop

and Van Liere in 1978. It was originated from the notion that dominant social paradigm which emphasized human ability to control and manage the environment, limitless natural resources, private property rights, and unlimited industrial growth had changed. Instead, a new environmental paradigm (NEP) became valid for the individuals. This new paradigm emphasized environmental protection, limited industrial growth, and population control etc. The NEP Scale includes 12 items. Many researchers (Gambro, 1995; DeChano, 2006; Lalonde, 2002; Taşkın, 2008;) used this scale to measure the participants' environmental attitude.

Another instrument was developed by Berberoğlu and Tosunoğlu (1995). It is an 18-item multidimensional attitude scale with dimensions; attitude toward population growth (5 items), the use of nuclear energy (4items), importance of environmental problems (5 items), and energy conservation (4 items).

On the other hand Wisconsin Environmental Literacy Survey (WELS) was developed to assess the general level of EL of Wisconsin 11th grade students. Owens (2000) used its modified version by Todt (1995). WELS (WCEE, 1994b) contains scales for three of the four components of environmental literacy. Affecting learning outcomes, environmentally responsible behavior, and cognitive learning outcomes or knowledge is measured by WELS.

Yılmaz and Andersen (2004) developed a 51-item Attitude Toward Environmental Issues Scale (ATEIS) to measure elementary and middle schools students' attitudes toward selected environmental issues in Turkey. They intended to identify the intensity of Turkish students' views with regard to environmental issues presented in the national curriculum.

The questionnaire that is called as Sustainable Development Questionnaire was developed by Summers, Corney, and Childs (2004). It consisted of (i) items designed to collect purely factual information, (ii) one five-point scale self-rating item and (iii) several free response boxes with space for students to write no more than a short paragraph. The conceptualizations of sustainable development, the

relationship between education for sustainable development and environmental education, and the stance teachers take when handling controversial topics were all known to be key issues in the field. All of these areas were covered in the full questionnaire.

Moreover Tuncer, Sungur, Tekkaya and Ertepinar (2004) developed a questionnaire based on the one used by Worsley and Skrzypieck (1998), which was originally developed from Herrera's (1992) Questionnaire of Environmental Beliefs. It is comprised of awareness for environmental problems, general attitudes about solutions, awareness for individual responsibility and awareness on the national environmental problems.

Another widely used instrument is focused on the knowledge component of EL. The questionnaire consisted of multiple choice items aimed at assessing respondents' knowledge of current environmental issues and developed by National Environmental Education and Training Foundation (NEETF) and Roper Starch Worldwide (Roper) survey of adult Americans, (Coyle, 2005). Many researchers (Kaplowitz and Levine, 2005; DeChano, 2006; Ökeşli, 2008; Tuncer, Tekkaya, Sungur, Çakıroğlu, Ertepinar, and Kaplowitz, 2009; Varışlı, 2009;) conducted their studies by using this instrument either using its all items or using only some.

Environmental Perception Questionnaire (EPQ) was focused on the examination of the pre-service teachers' perceptions about global and local environmental issues. The questionnaire design was realized based on the one which was used by Duan and Fortner (2005). There are nine items in the questionnaire and each item seeks answers for 9 global and 5 local environmental issues. Nine- items, on the other hand, separated into two dimensions as Dimension 1; concerns (5 items) and Dimension 2; attitudes (4 items). The concerns dimension is designed to test participants' concern on the certainty, tangibility, complexity, significance and danger related to environmental issues. Attitudes, on the other hand, includes participants' evaluation of their own knowledge about each environmental issue, their perceptions about the importance of human activities as the causes for

environmental problems, their concern about the effect of change of environmental problems on their life styles and their perceptions about the state of the environmental problems in 20 years. The global issues tested under both dimensions are the same as original questionnaire and are; (1) climate change, (2) water pollution, (3) water scarcity, (4) deforestation, (5) desertification, (6) loss of biodiversity, (7) ozone depletion, (8) waste disposal and (9) energy production and usage.

An addition to the other instruments, Uzun and Sağlam, (2006) developed and tested a 27-item scale called as “environmental attitude scale” and the analysis showed that the scale includes “behavior” and “attitude” dimensions and it can be used safely through determination of behavior and attitude on environment. Another instrument related to the environment is named as The Organization for Economic Co-operation and Development’s Program for International Student Assessment 2006. It is another data collecting source of several environmental researches (Teksöz et al., 2009; Coertje et al., 2010). Environmental Conscious Scale (ECS) formed by Milfont and Duckitt (2006) is another instrument. It consists of 12 sub dimensions like environmental attitude, support for politics, and environmental actions, etc. Another one developed in English and translated into Chinese by Duan and it was revised for the study of Duan and Fortner (2005). Three parts of the questionnaire relate to the research was reported in Duan and Fortner’s (2005) study. Section I concerns demographics (gender, age, academic background and voluntary activities related to environmental topics); section II assesses perception of the five internal characteristics for each environmental issue by using 5-point scales; and section III assessed concerns about the external issue characteristics of the same issues with section II. A newly developed instrument is called as Elementary School Environmental Literacy Instrument (ESEL). It was developed by Erdoğan (2009) and includes five parts (personal information, environmental knowledge, affective dispositions toward the environment, environmentally responsible behaviors, and cognitive skills on the environmental protection) and 81 items.

There are many other instruments developed by several researchers Environment

Knowledge Test” and “Environment Behaviors Test” by Yavuz, 2006; “environmental consciousness and active participate scale (ECAPS) by Tecer, 2007; “Environmental Literacy Instrument” Wilke, Hungerford, Volk, and Bluhm, 1995; Environmental Attitude Scale by Fernandez-Manzanal, Rodriquez-Barreiro, and Carrasquer,2007; etc.) to investigate the environmental literacy of individuals from different ages, grade levels, socioeconomic status, different subject areas, and other unmentioned determinants.

Due to the complicated nature of environmental literacy, the studies on EL are resulted with the development of many instruments in the field. Although some of them were proved to be valid and reliable in many different conditions, many others still need more investigation to attain their estate in EL research area.

2.2 Environmental Literacy in Turkey: The State of the Art

Environmental movements have become a popular issue with the rise of industrial revolution in the world. Before that, “environment” was not a subject of the problem list of the societies in which the individuals have the direct relations with nature and the production-consumption balance was not exceeded. Since the foundation of Republic of Turkey, environmental concern of the society has increased in time.

Republic of Turkey’s 1982 Constitution (still in act), number 56 states that “everyone has the right to live in a healthy and balanced environment”. By this statement, Turkey’s Constitution guarantees a life in a healthy environment for its all citizens.

Although all the 5-year development plans prepared by Turkey’s State Planning Organization have given more or less a place for the concept of environment”, this place has been increased in the 7th 5-year development plan covering the years 1996-2000. This plan was broaden to cover the “environmental education”. The Plan express the importance of education for environmental issues and it was stated in the Plan that awareness raising studies are going to be conducted with a lifelong learning

perspective during the implementation period of the report. This development plan can be seen as a milestone for environmental education in Turkey.

State Planning Organization prepared a “National Environment Action Plan” in 1998 to develop effective environmental policies for taking investment decisions, developing environmental priority hierarchy, and developing strategies for environment to guarantee a sustainable development.

An early remarkable step in environmental education history of Turkey is “Village Institutes”. They were founded by the decision of Grand National Assembly dated 17th of April 1940 and numbered 3803 and functioned till 1954. Students came to these institutes after 5-year primary education and they stay there for 5 years. During their education, they had to have agricultural education for 58 weeks (Arslan, 2006). These educational institutions where education and environment were harmonized together, has a special importance in environmental education history of Turkey because they educated the educators those have the capability to lead the whole society.

Although environmental education was not a main component of Turkish educational system for a long time, the importance given to this education has increased with emerging environmental problems. These growing problems resulted with the growing support and awareness among the decision makers. Evidences for this increased awareness can be seen from the 1982 Constitution and the 7th five year development plan prepared by the State Planning Organization of Turkey. Together with the need for the reform in education system, this movement cause a new period for environmental education at the beginning of 21th century. During the first decade of 21st century, Turkish educational system renewed with a constructivist perspective. As a result of this renewal in education system, environmental education became a main component for the curriculum.

It is possible to evaluate Turkish educational system in two categories; formal and informal education. Formal education includes preschool, primary and secondary

education, and as the last step, university education.

Environmental education in Turkey is taken in hand with an interdisciplinary approach. Current formal education programs include topics and subjects which are integrated in several courses. This education is started from preschool levels. “Environmental sensitivity training” is diffused into the all educational activities for the students from this grade level. Preschool education program were updated in 2005-2006 academic year as a result of reform attempts in primary education. As a result of these reforms, environmental issues got a broader place in the system.

The above mentioned recent curriculum reform has made fundamental changes in primary education programs. As a result of interdisciplinary feature of environmental education, it became a part of several compulsory and elective courses like life sciences, social sciences, science and technology, knowledge for culture of religion and moral, language, arts, sports and agriculture. Besides being part of several courses, environment became main components of some courses due to their nature and scope; “life sciences” (for 1st-3rd grades) and “science and technology” (for 4th-8th grades). The course “Life Sciences” aims for students to develop the awareness for environment and to have the ability to use resources effectively. The course also includes a heading “effective use of resources” under which there are some expected behaviors about the development of awareness for environmental issues and use of resources effectively. During these courses, students are expected to understand the mutual interaction of people, animals, plants and physical environment.

On the other hand Science-Technology-Society-Environment is one of the main attainments of “science and technology” course. Organization structure of Science and Technology is defined under four attainments. Science-technology-society-environment is one of these attainments besides “knowledge”, scientific process skills”, “values and attitudes” attainments. Science-technology-society-environment attainments focuses on three basic dimensions; nature of science and technology, relationship between science and technology, and finally social and environmental context of science and technology. Some of the science-technology-society-

environment attainments stated at the course program are listed below;

- To understand the need for recycling or destruction of wastes in an appropriate way to avoid the possible negative effects against environment;
- To recognize the management of wastes resulted from technological systems as an important problem for society
- To explain how to protect natural resources and habitats and how to decrease the hazardous waste caused by several products and systems by the help of using technological products and systems.
- To determine the relation between modern technological systems and the global environmental problems; and to propose some solutions to overcome such problems.
- To know the local/national/global environmental problems and discuss them.
- To know the ways of protection of environment and the wild life.
- To recognize the responsibility of individuals and the society on the protection of environment and the wild life.
- To comprehend the necessity of protection and development of natural resources.
- To understand the negative effects of both natural and artificial products on to nature
- To know the effects of people and society on environment
- To understand the importance of environmental protection activities and to participate them
- To comprehend the positive and negative effects of science and technology applications on individuals, society and environment.
- To explain the possible “positive-negative or expected-unexpected” effects of a specific scientific or technological development on environment.
- To understand his/her own responsibility to him/herself, society, environment and laws while developing or using any technology.

The curricula for the secondary education started had been implemented step by step starting from 2005. Secondary school education programs were renewed in line with

the renewed primary school curriculum. Both primary and secondary education programs have the same constructivist perspective. Implementation of science-technology-society-environment attainments at primary level has a great reflection on the secondary education programs. All science courses (physics, chemistry, biology, science) have the programs including science-technology-society-environment attainments. All subjects were selected and all the training activities were determined according to this general perspective including environmental issues. Interdisciplinary feature of environment again makes this component as part of several other courses like geography, knowledge of culture of religion and moral, philosophy, economics, language, health sciences etc.).

Besides formal educational program activities, some special projects developed and conducted with the cooperation of non-governmental organizations and the Ministry. One of the projects was “Green Box Project” conducted between 2005 and 2007. It was a cooperative study among Ministry of National Education, Ministry of Environment and Forestry and three non-governmental organizations. Green Box is a training kit for primary school teachers and students and focused on environmental protection and sustainable development. Project intended to develop some environmentalist behaviors and values among the students.

Another project is called as “limitless blue project” and dealing with the cause and effects of sea pollution and our responsibilities on ecological problems. Under the scope of this project, 30.000 teachers trained on the subject. “Environmental adaptation project (eco-schools project)” is another project example. It has been in progress since 1995 to increase the awareness of students on the importance of environmental issues, how to solve environmental problems and change the consumption habits. There are many other studies that display the increasing importance on environmental subjects. In addition to the other studies, social and cultural Club activities such as protection of environment clubs, saving animals clubs, and saving green clubs are some additional activities conducted on environmental issues in schools.

When it is looked to Turkey's university education in general, environmental issues cannot be seen as the main part of the system. On the contrary, departments directly related to the environment like agricultural sciences, forestry, biology, architecture, environmental engineering and education faculties, have some separate courses or topics integrated to several courses on environment. Apparently, teacher education has a central location for the environmental future for the societies. An important movement was observed in 2006 in this critical area of education. The Council of Higher Education decided to change the teacher education program and by this was "environmental science course" became a part of Science and Technology Teachers' Education Program. Although this change does not have any remarkable effect for the whole university system in a short time, it is an important step and its effects will be observed in a long period of time.

Apart from the formal education, several trainings are delivered both by the formal institutions and non-governmental organizations in Turkey. Public education centers, unions, media, environment related bodies are several agencies giving environmental education for individuals in Turkey but at present they are far from being adequate.

2.3 Summary

Environmental education is an important domain of today's education. The emergence of the term EE dates back to 1948. According to the world first intergovernmental conference on EE, Tbilisi Declaration (UNESCO, 1977), the goals of environmental education are;

- To foster clear awareness of economic, social, political and ecological inter-dependence in urban and rural areas.
- To provide every person to acquire the knowledge, values, skills and attitude to protect the environment.
- To create new patterns of behavior of individuals and society toward the environment.

Environmental education creates environmentally literate individuals which are stated as the bottom-line goal of environmental education (Dissinger and Roth,

1992). According to the related literature, Hsu (1997) defined four main components for this complex concept EL, as; knowledge, affect, skill, and behavior.

EL is built on the belief that if we educate environmentally literate citizens, they will take more responsible actions when it is needed. This assumption also requires the assumption that teachers, the key actors on EE, are ready for this controversial mission. For this reason, several studies were conducted on their EL level and many controversial points identified on their inadequacy. This inadequate EL level of teachers' gave birth to the researches on the problems in teachers' environmental education. Although those researches pointed some needs and the effectiveness of some methods for EE of teachers, more researches may support the improvement of some controversial points in their education and EE as a whole due to teacher trainings' multiplier effect. Many studies conducted to determine the environmental literacy levels of educators and their trainings that should enhance their efficiency on environmental education.

Several studies conducted on the components of EL and those studies indicated some common points;

- There are serious gaps and misconceptions in environmental knowledge of both students and teachers.
- Participants of the studies indicated relatively acceptable level of environmental attitude and concern but middle or low level of environmental use.
- Most of the studies indicated no or low relationship between knowledge and other components but it was found relatively high positive relationships between attitude-concern, attitude-use, and concern-use components.

Related literature indicated several determinants of environmental literacy such as gender, professional background, age and grade level, residential difference, and socioeconomic status which have significant effect on EL. Their effects on different EL components varies.

Furthermore it is not easy to test environmental literacy of participants in a scientific research. Complicated nature of EL researches gave rise to the increasing number of instrumentation and method studies.

Environmental education in Turkey is taken in hand with an interdisciplinary approach. Formal education programs include topics and subjects which are integrated in several courses. This education is started from preschool levels. Preschool education program were updated in 2005-2006 academic year as a result of reform attempts in primary education. “Environmental sensitivity training” is diffused into the all educational activities for the students from this grade level.

The 2005-2006 curriculum reform has made fundamental changes in primary education programs too. As a result of interdisciplinary feature of environmental education, it became a part of several compulsory and elective courses like life sciences, social sciences, science and technology, knowledge for culture of religion and moral, language, arts, sports and agriculture. On the other hand Science-Technology-Society-Environment is one of the main attainments of “science and technology” course. The curricula for the secondary education started to be implemented step by step starting from 2005. When it is looked to Turkey’s university education in general, environmental issues cannot be seen as the main part of the system. On the contrary, departments directly related to the environment like agricultural sciences, forestry, biology, architecture, environmental engineering and education faculties, have some separate courses or topics integrated to several courses on environment. An important movement was observed in 2006 in this critical area of education. The Council of Higher Education decided to change the teacher education program and by this was “environmental science course” became a part of Science and Technology Teachers’ Education Program.

Researches conducted in Turkey on EL levels of students and teachers are seemed as inadequate. Most of them are focused on the environmental knowledge and attitude and conducted with small samples. There is a need for more comprehensive studies with national sampling.

CHAPTER 3

METHOD

This chapter of the study is comprised of eight parts; design of the study, population and sample, instrument, variables, procedure, analysis, assumptions and limitations, and external and internal validity of the study.

3.1 Research Design

The study was designed as a survey research. Survey research was defined by Frankel & Wallen (1996) as “an attempt to obtain data from members of a population (or a sample) to determine the current status of that population with respect to one or more variables.” The current study aimed to investigate the environmental literacy levels of science and technology teachers in Turkey, the regional differences in terms of environmental literacy, as well as the relationship between environmental literacy level of science and technology teachers and the defined predictors of environmental literacy. Moreover, the study also examines the relationship among the four components of environmental literacy (knowledge, attitude, concern, and use). Depending on the rationale presented in the Introduction part of this thesis, the factors affecting EL were determined as gender, environmental interest, importance dedicated to environmental problems, self assessment on environmental knowledge, experience, education level, outdoor activities, residential area, source of environmental knowledge, importance dedicated to environmental education, age, income, and attendance to an environment related course.

The research was designed to generalize the results to all science and technology teachers in Turkey. For this reason, science and technology teachers were selected to cover all over the country. The details of the sampling procedure will be explained in the following sections in this chapter.

The study was supported by the Department of Educational Research and Development (EARGED) of Ministry of National Education (MoNE). Instrument adaptation, sample determination and implementation of the study were designed by the suggestions of EARGED upon several meetings realized between the researcher and EARGED during research design period. One of the suggestions was repiloting the instrument. Although the instrument was piloted previously for several researches and found to be reliable, none of those studies had been conducted with inservice science and technology teachers. Moreover some changes on the instrument were suggested by EARGED and, the instrument was revised by four experts, and some changes were made on language, directions of questionnaire sections, and answer choices.

The multiphase stratified sampling was determined as the sampling method. Since it was suggested by EARGED to use the Level 1 of “Classification of Statistical Regional Units” developed by Turkish State Planning Organization (SPO) for the classification of regional units of Turkey, this approximation was used as the base for the sample selection procedure. Details of the process will be explained in the next section.

After agreement on the basic points of the research design, a proposal was submitted to EARGED. After the final proposal was approved, (Appendix C), permission (Appendix A) was taken from the provincial directorate of national education of Ankara to conduct the pilot study. The schools for the pilot study were selected by using convenient sampling procedure. The researcher visited to the schools and the pilot study was realized with 62 science and technology teachers. The instrument

reevaluated according to the reliability analysis that will be explained in the proceeding section of this chapter.

After all, the instrument was prepared as optic forms and 1500 forms were produced for distribution. They were distributed by EARGED to 1119 teachers working in 569 primary schools in 34 provinces of Turkey. The instruments were sent according to the assumption that the average number of science and technology teachers for each school is two. About 10 extra forms were sent to each province. The forms were posted to the provincial directorates of 34 provinces and they were asked to send them to the schools in their area. The instruments were distributed to the teachers and sent back to the provincial directories by school administrations between June 2010 and July 2010. It took about two months to obtain all the feedbacks. The return rate, on the other hand, was about 105%. The reason for this high return rate was because some of the schools have more than two science and technology teachers. Data entry was realized with the support of a private company. Depending on the directions of the researcher, the company entered the data in electronic format. The answers for the last item asking the general views of participants on the environmental issues, on the other hand, were evaluated by the researcher.

3.2 Population and Sample

The target population of the current study consists of all science and technology teachers working at state schools in Turkey during 2009-2010 academic year. The rationale for choosing science and technology teachers working at state schools in Turkey as the target population is that;

- Due to its content, the course of science and technology is at the center of environmental education at primary education level in Turkey. Science and technology teachers have the core importance for this course so the competence of them on environmental literacy has a direct impact on the achievement of environmental attainments by their students.

- One of the main components of the new science and technology curriculum, which is a part of new primary school curriculum developed with a constructivist perspective, is “environment.” In line with this perspective that sees the teachers as one of the main component of education, it is important to know teachers’ competence levels on environmental literacy both for the Ministry and for the teacher training institutions. The Ministry of National Education may use this information to develop its inservice education strategy. Similarly, the results obtained from this study may be used by universities and teacher training institutions to improve preservice teacher training programs and methods.
- Such a research that is conducted on the environmental literacy level of teachers from all over the country, and on the factors affecting their environmental literacy level can provide several feedbacks for the next developmental researches on the area.

Since it was not possible to reach all of the science and technology teachers working at the public schools of Turkey in 2009-2010 academic year, the accessible population was determined with the procedure explained below.

The sample of the study was determined by a multiphase stratified sampling. Fraenkel and Wallen (1996) described stratified sampling as “a process in which certain subgroups are selected in the same proportion as they exist in the population”. This method was preferred to increase the possibility of representativeness in the sample.

Sample selection procedure, was based on the Level 1 of Classification of Statistical Regional Units (2002) developed by Turkish State Planning Organization (SPO) under the scope of the adaptation process to the regulations applied at the regional level by European Union. There are 3 different levels defined in the classification as statistical regions;

1. Level 1 with 12 subregions,
2. Level 2 with 26 subregions,
3. Level 3 with 81 provinces as sub-regions.
4. Therefore, according to SPO classification, provinces are defined as “level 3” and the neighboring provinces which are similar in terms of their economical, social, and geographical aspects were defined as “level 1” and “level 2”. Regional development plans and population size of the regions were also taken into consideration during the classification process of Statistical Regional Units.

Sampling Procedure;

1. As the first step of the sampling procedure, population was divided into 12 subregions depending on the Level 1 of Classification of Statistical Regional Units.
2. Secondly, the provinces in each subregion were classified as the most developed, the least developed, and the one in between, depending on the “List of Socioeconomical Development Level of Provinces (2003)” prepared by State Planning Organization.
3. Therefore three provinces were selected from each subregion being most, least and medium developed depending on the list referred above. Since İstanbul subregion is composed of only one province (İstanbul) the sample was structured as comprised of 34 provinces. The list of selected provinces can be seen in Table 3.3.
4. After determining the provinces, the total number of science and technology teachers working in that province was determined. The researcher officially asked to General Directorate of Personnel of MoNE, the number of science and technology teachers for each province. According to the given data there are 20.838 science and technology teachers (both permanent and contracted)

in Turkey. On the other hand, the total number of science and technology teachers working at public primary schools in the selected 34 provinces was stated as 12.019.

5. The representative percent of the sample, on the other hand, were calculated for each selected provinces. The total number of the science and technology teachers (12.019) from 34 provinces was handled as a 100 percent and the rest of the representative proportion was calculated for each province and region accordingly. The number of the selected participant for the subregion with the lowest proportion (East Black sea Subregion) fixed as 30 teachers to reach at least 30 participants from each subregion to be able to compare the regions at the end of the study.
6. After determining the total number of the participants for each region, they were distributed to the provinces of the same region proportionally. To be on the safe side and to prevent any inconvenience may be faced during the data collection, number of sample for each province were increased by 2. The number of the participants for each province and subregion were displayed at Table 3.3.
7. Finally, the schools of each province were selected by the researcher from the official school list of MoNE by considering their regions, accessibility in terms of transportation and communication, and the time at which the study was conducted. During the selection procedure, special attention was made to choose schools from the regions representing different socioeconomic status.
8. As a result of all, the total number of sample of this study is determined as 1119 science and technology teachers from 569 public primary schools in 34 provinces, in 12 regions of Turkey.

The details of the overall research design were displayed in Figure 3.1.

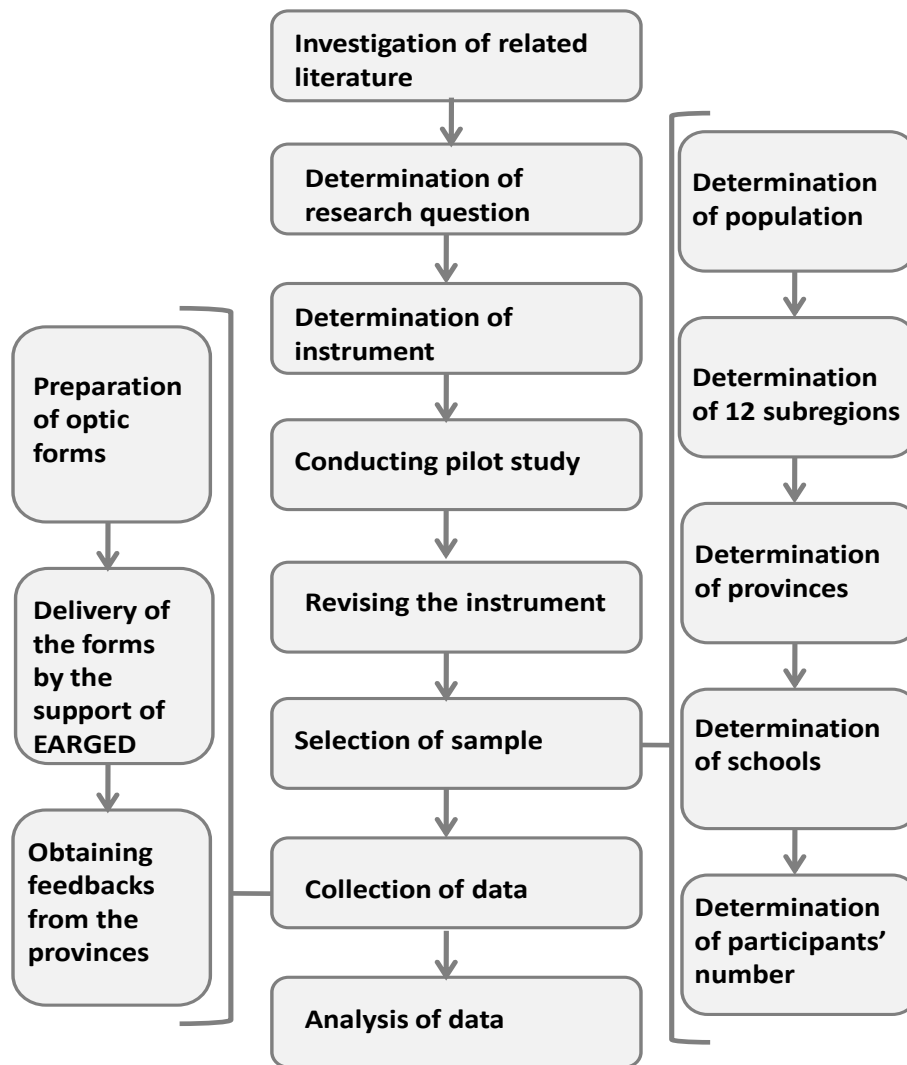


Figure 3.1 Overall Design of the Study

Another remarkable point of the study was the ethical issue. The instrument and the research as a whole approved by Middle East Technical University Ethic Committee (Appendix B) and all the steps of the study implemented in line with this permission and ethical consideration in general.

3.3 Instrument

The instrument (Appendix E) of this study is titled as “Environmental Literacy Questionnaire (ELQ)”, and originally used by Kaplowitz and Levine (2005). The Environmental Literacy Questionnaire was originated as a part of Michigan State University project. It addresses four components of pre-service teachers’ environmental literacy with distinct sets of questions for each component; knowledge, attitudes, uses, and concerns. It also includes self assessment and personal information sections. The items of the instrument are closed-ended. The general structure of the instrument was summarized in Table 3.1. The questionnaire used in a shorter form that had previously been successfully implemented and tested that focused on environmental literacy.

ELQ was translated and adapted into Turkish by Tuncer, Tekkaya, Sungur, Çakıroğlu, Ertepinar, and Kaplowitz (2009). The instrument was peer-reviewed by three experts in the field of science education and by another expert in environmental education. According to the pilot study conducted with preservice teachers, the internal consistency of the knowledge, attitudes, uses, and concern item sets were found to be 0.88, 0.64, 0.80, and 0.88, respectively.

Table 3.1 Content of Environmental Literacy Questionnaire

Component	Number of Items
Participant Characteristics (gender, age, income, childhood residence)	4
Professional background (source of environmental knowledge, level of education, attendance to an environmental course, professional experience)	4
Environmental activities	9
Thoughts on environmental education	1
Perceived needs for environmental education	1
Environmental training activities	5
Self evaluation on environmental issues	3
Knowledge	11
Attitudes	12
Uses	19
Concern	9
Total	78

3.3.1 Validity and Reliability of *ELQ*

Validity

Fraenkel and Wallen (1996, p.153) defines validity as “the appropriateness, meaningfulness, and usefulness of the specific inferences researchers make based on the data they collect.” Several evidences can be used as the proofs for the validity of an instrument. One of the types of evidences for validity is called as **content related evidences**. Content related evidences can be defined as the degree to which an instrument logically appears to measure an intended variable and can be determined by expert judgment (Fraenkel and Wallen, 1996, p.580). Environmental Literacy

Questionnaire has been partially or entirely used for several times by several researchers at different parts of the world (Kaplowitz and Levine, 2005; DeChano, 2006; Dunlop and Van Liere, 1978; Tuncer, Tekkaya, Sungur, Çakıroğlu, Ertepinar, and Kaplowitz, 2009; NEETF/Roper, 2005; Bostrom, Barke, Turaga, and O'Connor, 2006 etc.). Although the instrument was reviewed for several times by many experts and proved as valid in terms of its content; it was checked before the present study by three science educators and one environmental science expert. The other aspect of the content validation is about the format of the instrument. In the present study, the instrument designed as optic forms and checked by 4 experts one of which from the area of environmental sciences, two of which are science educators, and one from the area of measurement and evaluation.

Another type of evidences for validity is called as **construct related evidences**. Fraenkel and Wallen (1996, p.580) defined it as “the degree to which an instrument measures an intended hypothetical psychological construct, or nonobservable trait. Balcı (2009), defined two ways to get this type of evidences; factor analysis, and the second way is the comparison with a previously investigated group or another instrument that was proved as valid before. In the present study, the second way was preferred to prove the instrument as valid in terms of its construction. To assess that firstly, the variables of the study were defined, then hypothesis in line with the theory underlying the variables were formed, and the hypothesis tested by comparing with the results of previous studies.

Reliability

Before conducting the study, the questionnaire was analyzed by four experts, two of them were from the area of science education, one from environmental education and one from the area of measurement and evaluation. According to the experts' suggestions, several changes were realized, especially on language, section directions of the questionnaire, and answer choices. Since previous researches used the same questionnaire, were realized with students and preservice teachers, the new sample

structure of the current study required some changes on the personal information part of the instrument. Instead of asking fathers' and mothers' education level of the participants, teachers were asked some other questions like; having environment related courses during their university education, perceived needs on environmental education, environmental training activity choices, residence in which they grown up, and education level. After the revisions had been completed, a pilot study was conducted with the science and technology teachers in Ankara. The pilot study was conducted with 62 science and technology teachers in spring semester of 2009-2010 academic year. As a result, cronbach alpha value for the inner consistency of knowledge and attitude tests were found to be relatively low but cronbach alpha for use and concern tests were 0.70 and 0.90

In the light of this result, use and concern dimensions of the questionnaire were used in the same forms that were used in the pilot study. Knowledge and attitude dimensions, on the other hand, were preferred to be used with the contents with acceptable cronbach alpha values. That is to say knowledge dimension was taken as the same as that were used by Tuncer et al. (2009) and; the adapted and Turkish translated version (Taşkın, 2004) of the New Environmental Paradigm (NEP) Scale was taken as attitude dimension.

As a result, the cronbach alpha values for the 4 dimensions of the questionnaire were as follows: knowledge, 0.88; attitude, 0.88; use, 0.70; and concern, 0.90.

Table 3.2 General Structure of Environmental Literacy Questionnaire

Items of the Instrument	Item Description	Reference	Cronbach Alpha
Knowledge	Teachers' knowledge about current environmental issues and basic ecological concept.	Developed by the National Environmental Education and Training Foundation (NEETF) and Roper survey of adult Americans (Coyle, 2005) and adapted to Turkish by Tuncer et al. (2009).	0.88
Attitude	Teachers' feelings and values about environment relationship between humans and environment	New Environmental Paradigm (NEP) developed by Dunlop and Van Liere (1978) and adapted to Turkish by Taşkın (2004)	0.88
Use	Teachers' responsibility toward environment	Developed by Kaplowitz and Levine (2005) and adapted to Turkish by Tuncer et al. (2009). Revised under the scope of the present study.	0.70
Concern	Teachers' sensitivity towards environmental problems	Developed by Kaplowitz and Levine (2005) and adapted to Turkish by Tuncer et al. (2009). Revised under the scope of the present study.	0.90
Self assessment	Teachers' self evaluation on environmental issues	Developed by Kaplowitz and Levine (2005) and adapted to Turkish by Tuncer et al. (2009). Revised under the scope of the present study.	
Personal Information	Teachers' personal information	Developed by Kaplowitz and Levine (2005) and adapted to Turkish by Tuncer et.al.,(2009). Revised under the scope of the present study.	

As was stated before, the Environmental Literacy Questionnaire has four dimensions. Following sections give details on these dimensions.

3.3.2 Dimensions of the ELQ

3.3.2.1 Knowledge

The knowledge component of the questionnaire consisted of multiple choice items aimed at assessing respondents' knowledge of current environmental issues in the same way done by Kaplowitz and Levine (2005). Those questions originally developed and used by National Environmental Education and Training Foundation (NEETF)/Roper Starch Worldwide (Roper) survey of adult Americans (Coyle, 2005). The knowledge part of the Environmental Literacy Questionnaire aims to assess the respondents' knowledge of current environmental issues in the same way done by NEETF/Roper (Coyle, 2005). The NEETF/Roper studies defined adults as individuals who are 18 years old or older. As it was stated by Coyle (2005), these items have been used over a 10-year period in different kinds of studies and have been found to be a reliable measure of environmental knowledge. The survey questionnaire presented to respondents with a relatively short set of questions that had previously been successfully implemented and tested that focused on environmental literacy. 11 questions out of 12 questions that were originally developed were used in the study. Each of the answer choice set was designed to have one correct answer. Each set of answer choices also included a 'don't know' choice. The items were focused on the issues; biological diversity, source of CO₂, ways to produce electricity, pollution of streams, rivers and oceans, renewable resource, ozone layer, solid waste storage, state institution responsible from environmental problems, hazardous household waste, extinction of animal species, disposing of nuclear waste.

3.3.2.2 Attitude

The environmental attitude items targeted respondents' feelings and values related to the environment. Item in this section of the questionnaire were asked for responses using five point Likert-type scales ranged from 1 to 5. Five points were assigned to "strongly agree", and one to "strongly disagree". The NEP Scale used, considers

human beings as only one component of the ecological network and subject to the rules of interdependence and diversity. As Thapa (2001) stated, the NEP has three focus; balance of nature, limits to growth, and man over nature. There are 12 questions in this dimension, and it includes 4 reversed items numbered as 17, 18, 20, and 24. The attitude dimension of the questionnaire was developed by Dunlop and Van Liere (1978) and called as “the New Environmental Paradigm Scale (NEP)”. The NEP scale has become the most widely used measure of environmental worldview (Gambro, 1995; Thapa, 2001; Schuett and Ostergren, 2003; Sherburn and Devlin, 2004; Taşkın, 2004; Bostrom, Barke, Turaga, and O’Connor, 2006; Hvenegaard, 2007; Bun Lee, 2008; Varışlı, 2009). Turkish version of the NEP attitude was taken from the Taşkın’s (2004) study due to its high reliability.

3.3.2.3 Use

The environmental use items measured respondents’ intention to take part in pro-environmental behavior. The environmental use questions of the instrument were taken from the study of Kaplowitz and Levine (2005). There are 19 five-point Likert-type items ranging from strongly agree to strongly disagree and five of those items were reversed (item no; 29, 30, 31, 33, and 40).

3.3.2.4 Concern

The concern items, which were taken from the study of Kaplowitz and Levine (2005), target to collect data on participants’ sensitivity toward environmental problems and issues. This dimension of the Environmental Literacy Questionnaire included 9 items dealing with the environmental concerns of the participants on environmental problems like air pollution, noise pollution, hazardous wastes, global warming etc. The concern items with Likert-type response scale, 5 points were assigned to “very concerned”, 4 to “somewhat concerned”, 3 to “undecided”, 2 to “a little concerned” and 1 to “not concerned”. Therefore, the maximum score of concerns dimension was 45, the minimum score was 9. The higher score means the higher concern toward environmental problems.

Besides knowledge, attitude, use, and concern dimensions, Environmental Literacy Questionnaire also asks participants' demographic information (e.g. gender, socioeconomic status, professional experience, age, places in which participants grown, involvement of environmental activities, and source of environmental information).

Accordingly, three items on self assessments of participants (items 1, 2, and 3) on environmental issues were covered by the instrument. And at the last part of the instrument, participants were asked to write if they have something to indicate about the environmental issues.

3.4 Variables

Dependent and independent variables of the study are as follows.

3.4.1 Independent Variables

Independent variables are the variables which affect (or presumed to affect) the dependent variable under study and are included in the research design so that their effects can be determined (Fraenkel and Wallen, 1996, p.583). Depending on this definition, independent variables of this study are; environmental interest, importance dedicated to environmental problems, self assessment on environmental knowledge, experience, education level, outdoor activity choices, difference in childhood residence, source of environmental knowledge, importance on perception of environmental education, age, income, and attendance to an environment related course, and gender.

3.4.2 Dependent Variables

Dependent variables are the variables that affected or expected to be affected by the independent variables (Fraenkel and Wallen, 1996, p.581). Dependent variables of this study are the environmental literacy levels of science and technology teachers for four components of environmental literacy as knowledge, attitude, concern, and use.

3.5 Procedure

As was reported in Section 3.1., this study was supported by the Department of Educational Research and Development (EARGED) of Ministry of National Education (MoNE). Therefore, the design of the study was realized along with the suggestions of EARGED. The suggestions, on the other hand, were related to i. revision of some of the items of ELQ ii. Pilot testing of the instrument and iii. Sampling procedure. Therefore, the steps followed during the implementation of the study are as follows:

1. Setting up the research design,
2. Preparing a proposal for EARGED,
3. Proposal evaluation by EARGED,
4. Successive meeting on the suggestions of EARGED,
5. Revisions of the project proposal (revisions in the instrument, and sampling technique; please see Section 3.1)
6. Resubmitting the project proposal to EARGED,
7. Second evaluation of the project by EARGED,
8. Project approval by EARGED,
9. Application for permissions from METU Ethical Committee and MoNE for implementation,
10. Pilot testing of ELQ (please refer to Section 3.1 for details),
11. Implementation (data collection procedure) supported by EARGED
12. Data recording

13. Evaluations

Since the above mentioned steps were presented in detail in Section 3.1, here the major points were reported for reminding. Twelve subregions of the Level 1 of “Classification of Statistical Regional Units” and the “List of Socioeconomical Development Level of Provinces (2003)” which were developed by Turkish State Planning Organization were described as the bases for the present study. The provinces in each of 12 subregions were classified as the most developed one, the least developed one, and the one between these most and least developed ones. Therefore, three provinces were selected from each subregion. After that, schools in the provinces were determined by the researcher from the official school list of MoNE declared at official web site of the Ministry. As a result, 1119 teachers from 569 public primary schools in 34 provinces were determined. Data were collected by the support of EARGED: Questionnaires, prepared in optical forms were sent to the provinces, managers those took part in the implementation were informed by “implementation guideline” (Appendix D). And they were also asked to handle the guideline (informed consent forms) to the participants. Completed questionnaires were sent to EARGED and EARGED delivered the questionnaires to the researcher on July 2010. Data collection procedure ended up with 1182 completed questionnaires, instead of 1119 as planned. Therefore, the total return rate was calculated as about 105%. This situation had been occurred since more teachers other than planned requested to fill the questionnaire. Return rates exceeded 100 % in nine subregions; West of Marmara, East of Marmara, West Anatolia, Middle Anatolia, West Black Sea, East Black Sea, Northeast Anatolia, Middle East Anatolia, and Southeast Anatolia. On the other hand, number of participants in several subregions were lower than calculated, thus the return rates were smaller than 100%. These subregions were, İstanbul, Aegean, and Mediterranean (Table 3.4).

Table 3.3 List of selected provinces and participants for each subregion

Name of the Subregion	Selected Provinces From the Region	Number of Participants Selected for the Study	Number of Teachers Participated to the Study
İstanbul	İstanbul	183	129
West of Marmara	Tekirdağ	18	25
	Balıkesir	33	40
	Çanakkale	14	16
Aegean	İzmir	81	45
	Aydın	32	14
	Afyon	25	16
East of Marmara	Kocaeli	33	36
	Bolu	7	15
	Düzce	12	34
West Anatolia	Ankara	105	122
	Konya	66	69
	Karaman	9	14
Mediterranean	Adana	56	42
	Hatay	46	28
	Kahramanmaraş	35	45
Middle Anatolia	Kayseri	39	47
	Niğde	16	26
	Yozgat	22	23
West Black Sea	Zonguldak	17	29
	Çorum	20	36
	Tokat	23	25
East Black Sea	Rize	13	15
	Giresun	16	26
	Gümüşhane	7	28
Northeast Anatolia	Erzincan	9	20
	Kars	13	22
	Ağrı	15	25
Middle East Anatolia	Elazığ	22	33
	Van	26	11
	Muş	16	30
Southeast Anatolia	Gaziantep	41	37
	Şanlıurfa	34	34
	Şırnak	15	25
TOTAL		1119	1182

Therefore, the highest return rate was obtained in East Black Sea subregion, it was followed by Northeast Anatolia, East of Marmara, Middle Anatolia and West of Marmara subregions. The lowest representative percentage is possessed by Aegean (Table 3.4).

Table 3.4 Return rate of the questionnaire for each subregion

Subregion	Return Rate (%)
İstanbul	70.49
West of Marmara	124.61
Aegean	54.34
East of Marmara	163.46
West Anatolia	113.88
Mediterranean	83.94
Middle Anatolia	124.67
West Black Sea	150
East Black Sea	191.66
Northeast Anatolia	181.08
Middle East Anatolia	115.62
Southeast Anatolia	106.66
Total	105.63

Other than the return rates, “representative percentages” were also calculated for each sub region, in order to present the contribution of each sub region to the total number of completed questionnaires (1182). Thus, when the % return rates were calculated over 1182 total returns, it was seen that, West Anatolia was participated the study with the highest number of teachers, (Figure 3.2), the number of teachers participated the study was also higher than the other sub regions. Whereas, the number of teachers participated the study is the least in East Black Sea(69 participants) although the return rate was calculated within the region itself as 191.66 %).

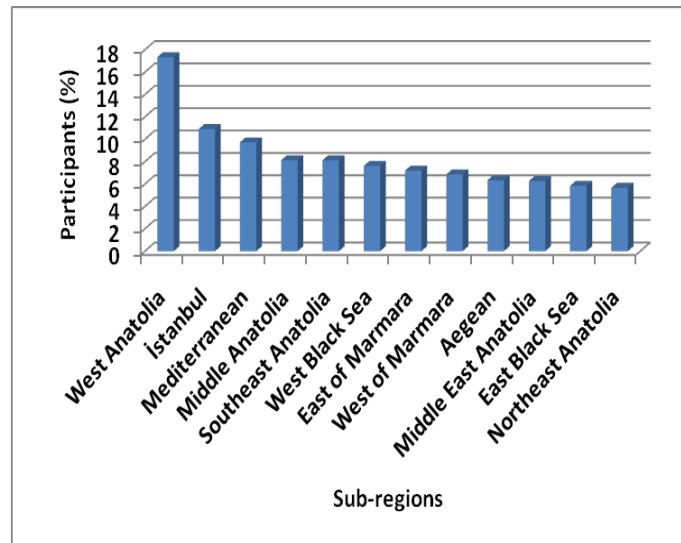


Figure 3.2 Distribution of all participants by subregions

3.6 Analysis

Data Analysis was conducted by using “Statistical Package for Social Sciences 16.0” (SPSS). Analysis was performed in two parts; descriptive statistics and inferential statistics.

3.6.1 Descriptive Statistics

Frequencies and percentages were evaluated for dimensions of EL (knowledge, attitude, use, and concern), self evaluation items, and for the items on demographic information. Moreover, means and standard deviations were also evaluated for all dimensions of EL both at country and regional levels. Graphics and charts were also used for the above mentioned analyses.

3.6.2 Inferential Statistics

SPSS 16.0 (Statistical Package for Social Sciences) was used to conduct the inferential analyses of the research. Three inferential analyses were performed; Canonical analysis, zero order correlation, and multivariate analysis of variance.

Canonical analysis was performed to investigate effect of defined predictors (environmental Interest, importance of environmental problems, self assessment on environmental knowledge, outdoor activity choices, age, and income) on environmental literacy of the participants.

Moreover zero order correlation was used to understand the relationships among environmental literacy dimensions (environmental knowledge, attitude, use, and concern).

Finally, the effect of gender, experience, education level, residential difference, environmental knowledge source, importance of environmental education, and having environment related course on environmental literacy components was investigated by using multivariate analysis of variance (MANOVA).

3.7 Assumptions and Limitations

3.7.1 Assumptions

1. The subjects of the study were sincere while responding to the test items and questions.
2. Teachers from the same school did not interact and communicate on the questions.
3. The differences of the managers as implementers have no effect on the results of the study.

3.7.2. Limitations

1. The sample of the study is limited to 1182 public schools' science and technology teachers from the selected 34 provinces working at the 2009-2010 academic year.
2. The results of the study are limited to the population with similar characteristics.
3. Validity of the study is limited to reliability of the instrument used in this study.

3.8 External and Internal Validity of the Study

External validity is “the degree to which results are generalizable, or applicable, to groups and environments outside the research setting (Fraenkel and Wallen, 1996).” External validity can be discussed in two categories; population generalizability and ecological generalizability. In the present research, sample was drawn from 34 provinces from 12 subregions of the country. Several factors (developmental ranking of the provinces in the country, location of the school in the province, representative percentages of the sample in the region, etc.) were taken into consideration while selecting the sample. Consequently, the research can be generalizable to science and technology teachers working at state schools of 34 provinces in Turkey during 2009-2010 academic year.

Internal validity is “the degree which observed differences on the dependent variable are directly associated with the independent variables and not some uncontrolled variables (Fraenkel and Wallen, 1996, p.583).” Threats to internal validity can be defined as the alternative explanations of the results. Fraenkel and Wallen (1996) indicated four main threats to internal validity in survey researches as; mortality, location, instrumentation, and instrument decay. A list of possible threats to internal validity of the study and how they were minimized or controlled is discussed below.

Mortality refers to loss of subject during the treatment. The study was conducted with the participation of teachers from schools at certain location and at certain time. During the subject determination period, it was possible to the teachers to be absent due to several reasons like retirement, changing their schools, absence due to illnesses at the time of implementation of the study. Moreover, subjects may intend to ignore the importance of the research and may not participate. Since this study was conducted by the support of the Department of Educational Research and Development of MoNE, the official cover letter was sent to the provinces and the questions administered via school managers. The data was obtained by an official procedure so it can be said that mortality threat was decreased.

Another internal validity threat is called as the location. The location, in which data were collected, could provide an alternative explanation for the outcomes of the study. The questionnaires were distributed to the participants during the last two weeks of the semester, and the end of the summer seminar studies. This interval includes the time at which teachers have extra time for completing a questionnaire due to their decreasing work load. They can also find silent places at schools to answer the questions. Hence participants were supposed to be concentrated on the questionnaire in an appropriate location. Besides that, several regional differences were also taken into consideration by looking at the differences among 12 subregions in terms of environmental literacy components.

An instrumentation threat can be in the form of instrument decay, data collector characteristics and bias. Since the items of the questionnaire are closed-ended, they are easy to score them objectively. Furthermore, in this study, provincial directors of MoNE and school managers can be thought as data collectors in provinces. Since this was a nationwide survey, it was not possible to collect the data by trained collectors. For this reason, to minimize the effects of data collector characteristics and bias, an implementation guideline was prepared and delivered to the Ministry to inform the school managers and provincial directors about the application of the instrument.

Some other threats, different from the listed ones by Fraenkel and Wallen (1996), were also considered before the implementation procedure. The present study was carried on science and technology teachers working at state schools. Some characteristics of the subjects, which can potentially affect the outcomes of the study, were determined by investigating the related literature. In this respect, teachers' gender, socioeconomic status, professional experience, age, residence in which they were grown, and some other features were included into the study and they were determined as independent variables for the research.

In summary, it is clear that it is not possible to eliminate all the threats of external and internal validity of a study, but the present study was conducted by putting an effort to minimize those threats as much as possible.

CHAPTER 4

RESULTS

Results of this thesis are going to be presented in line with the schedule outlined in the Figure 4.1 below. The chapter begins with introducing the participants of the study by means of the results of descriptive analysis of the data on participants' characteristics. Afterwards, answers for the research questions were investigated in two sections as, descriptive analyses of the data, inferential analyses of the data. Finally, the summary of the findings has been presented in the 3rd section.

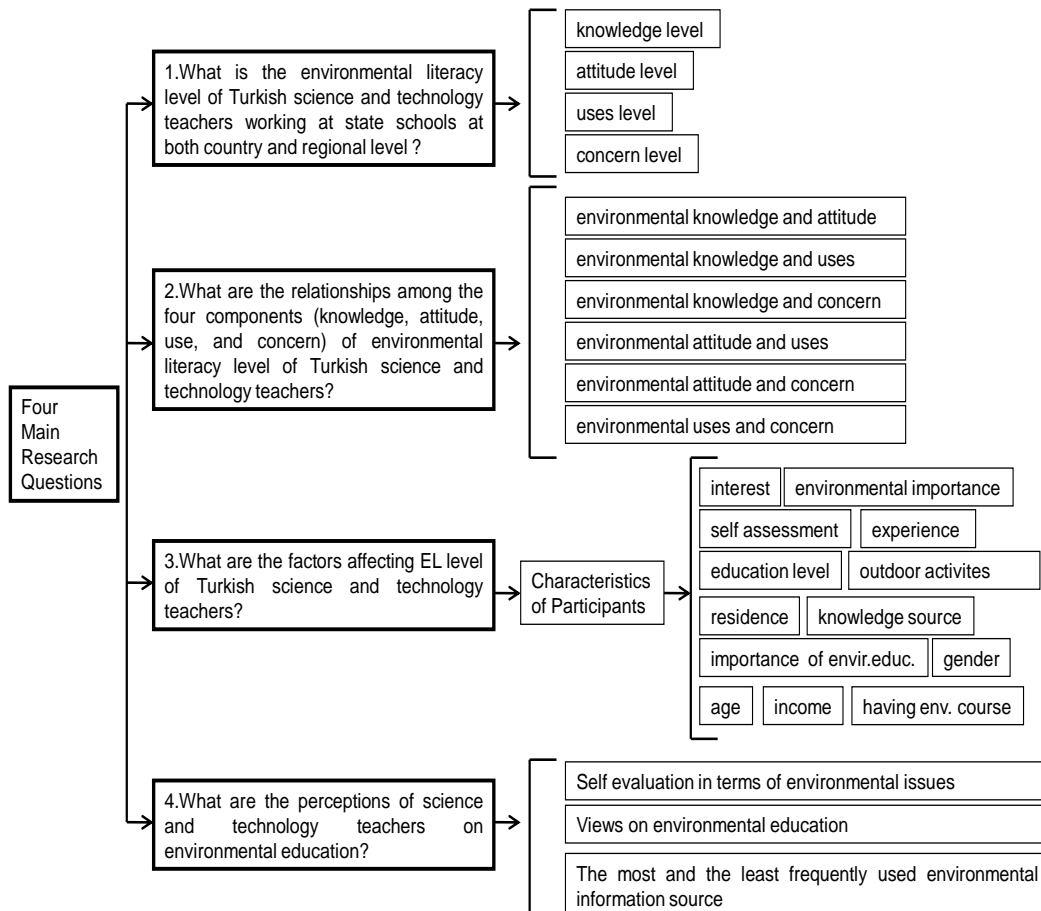


Figure 4.1 The schedule for the Results Evaluation

4.1. Descriptive Analyses

This part of the result section includes three main sections as; characteristics of participants, self assessment of science and technology teachers' about environmental issues, and environmental Literacy of Science and Technology Teachers both at country and regional levels.

4.1.1 Characteristics of the Participants

The number of science and technology teachers participated to the study is 1182. The participants were selected by the procedure explained in Chapter 3. The countrywide distribution of the selected provinces and the number of participants for each province are shown in the figure below (Figure 4.2).



Figure 4.2 Distribution and number of participants according to the provinces.

Age

The age profile of the science and technology teachers of the study can be summarized as follows: more than half of them (58.1%) are below 40 years old and almost one fifth of them (23.3%) are above 50 years old and the rest is between 40-50 years old (Figure 4.3)

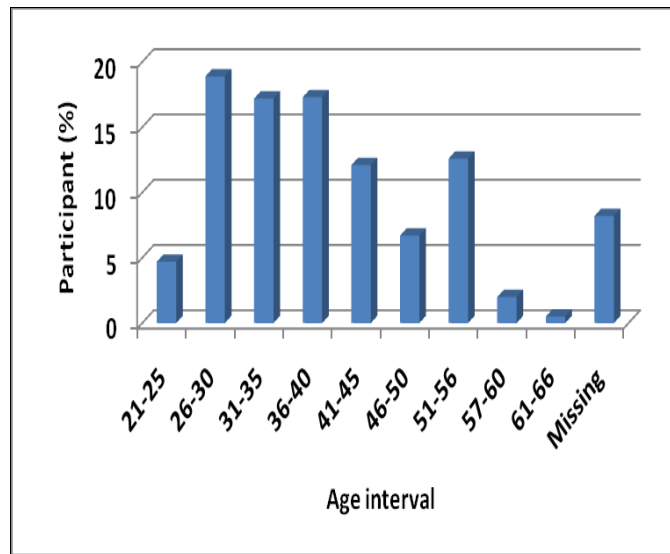


Figure 4.3 Participant characteristics: age

Gender

Results revealed that the percentage of female science and technology teachers enrolled to the study were 48.6% (f:575) and that of male teachers was 43.4% (f: 513) (Figure 4.4).

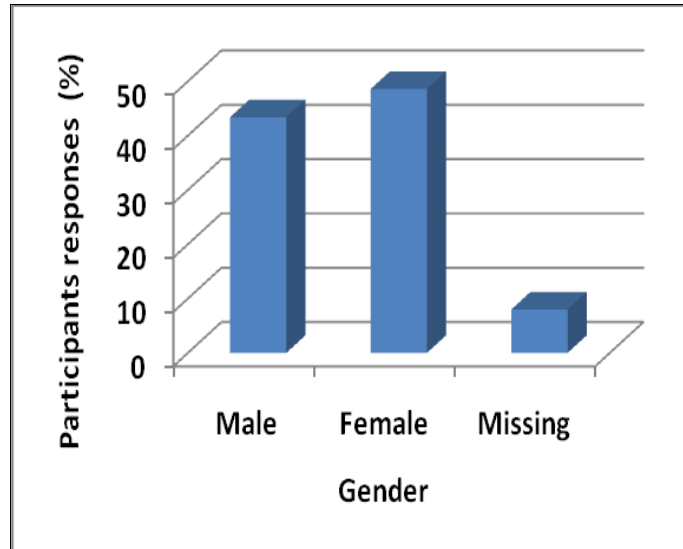


Figure 4.4 Participant characteristics: gender

Professional Background

Professional background of science and technology teachers has been described by means of their experience, source of environmental knowledge, level of education, and their attendance to an environment related course.

Experience: As is displayed in Figure 4.5, almost 62% of the science and technology teachers of this study have over 10 years experience, 20.1% have more than 21 years experience and 1.8% has less than 1 year experience.

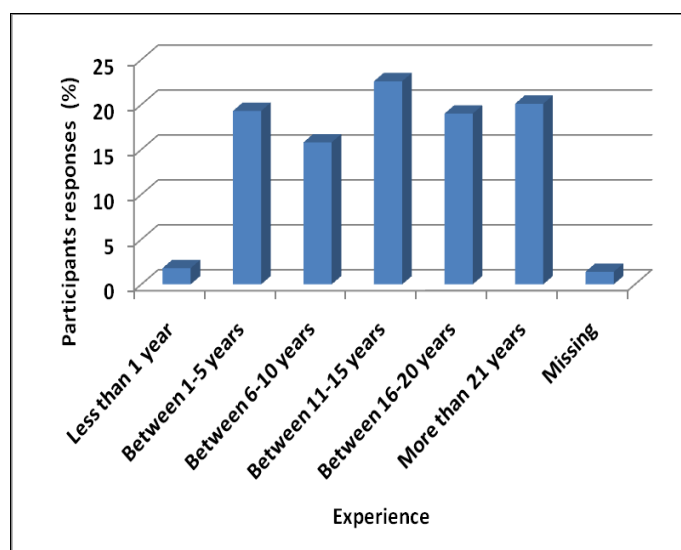


Figure 4.5 Participant characteristics: experience in their field

Source of Environmental Knowledge: The most popular sources of environmental information stated by the science and technology teachers of this study were internet (37.6%), radio and TV programs (35.0%), and magazines and newspapers (15.7%). Results indicated that social environment and Non Governmental Organizations are rarely used (2.6% and 2.7 %) as a source for obtaining environmental knowledge (Figure 4.6).

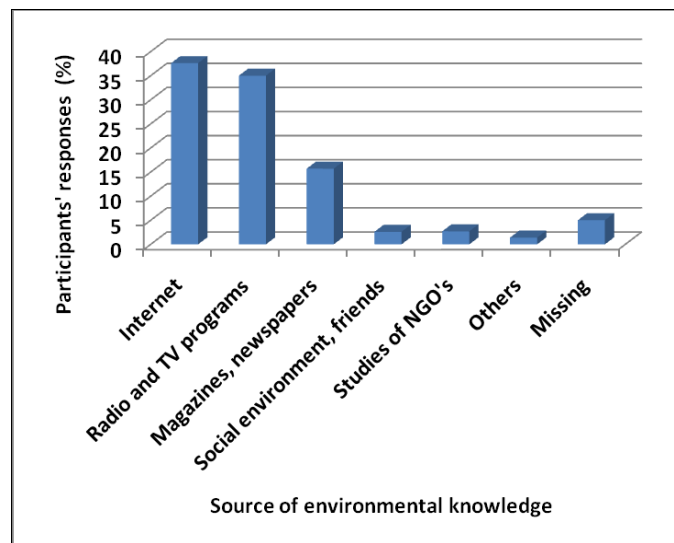


Figure 4.6 Participant characteristics: environmental information sources

Level of Education: Level of education of the science and technology teachers of this study is classified as 2 years university degree, 4 years university degree, Masters degree and PhD Degree. As the results indicate, more than half (60 %) of the teachers participated in the study has a BS degree from an education faculty, 20 % has BS degree from other faculties and, almost 4% has two years university degree. Percentage of the teachers having MS degree, on the other hand, is 5.6% and that of the Ph Degree is about 0.1% (Figure 4.7).

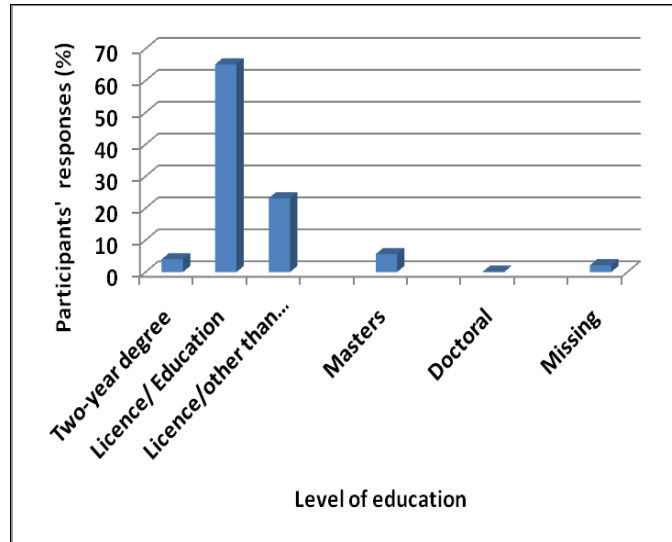


Figure 4.7 Participant characteristics: level of education

Having an Environment Related Course: As they reported, more than half of the science and technology teachers of this study (51.8%) did not attend any course on environment during their education. Thus, 45.6 % of the science and technology teachers stated that they attended an environment related course during their education (Figure 4.8).

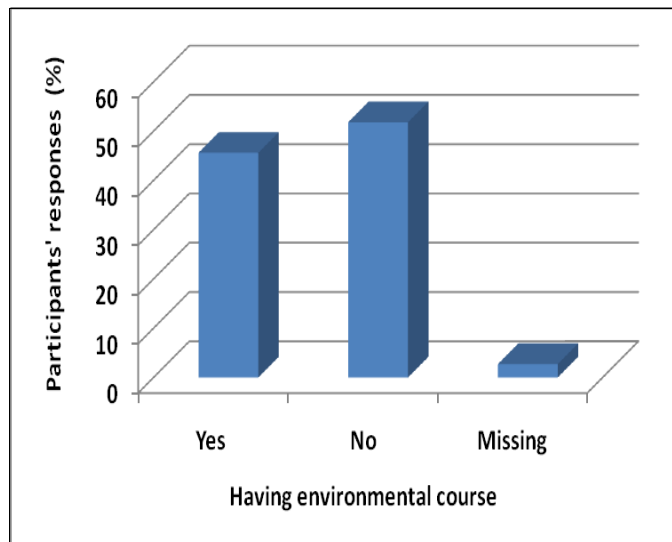


Figure 4.8 Participant characteristics: having environment related course

Income

Monthly family income of the 63.0 % of the science and technology teachers is reported as between 2000-5000 TL. Whereas, almost 30.5 % indicated their monthly income as below 2000 TL (Figure 4.9).

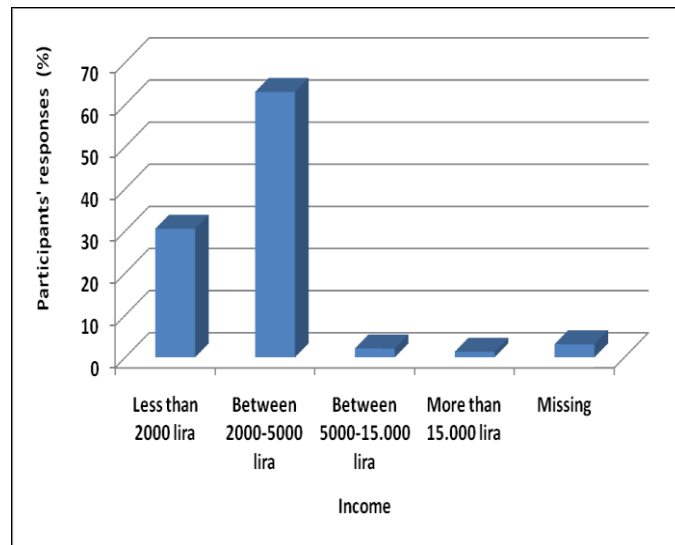


Figure 4.9 Participant characteristics: Income

Childhood Residence

One questions related to science and technology teachers' characteristics is the place which they spent most of their childhood (till the age 18). Results revealed that 31.1% of the science and technology teachers spent most of their childhood in metropolitan areas (population more than 100,000 people) and other 30% of them spent most of their childhood in an urban area (population between 25,001 and 100,000 people). Thus, we can say that, more than half of the respondents spent their childhood in a city. The rest 36.1%, on the other hand, reported their childhood residence as a small town (population between 2,501 and 25,000 people), rural non-farm (2,500 people or fewer), and rural farm (Figure 4.10).

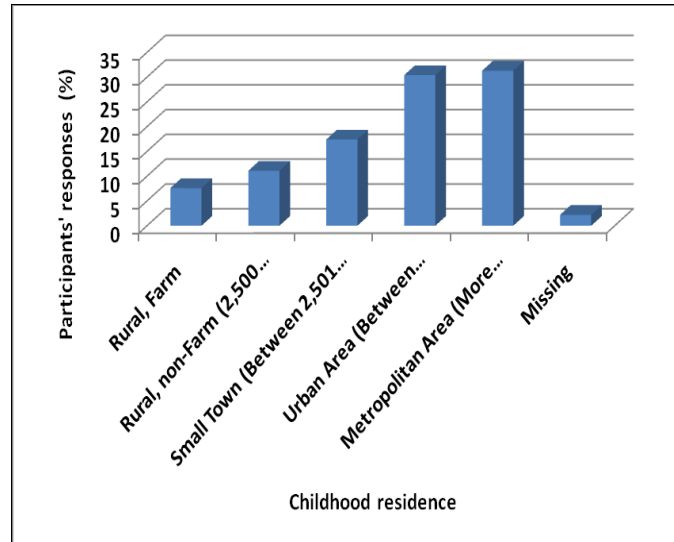


Figure 4.10 Participant characteristics: childhood residency

Outdoor Activities

According to the data presented in Table 4.1, the most popular outdoor activity choice of the science and technology teachers of this study is walking (94.7%). They rarely engage in activities like, camping, bird watching and fishing. Whereas, 47.4% of the science and technology teachers watch documentaries once a week, 50.1% participate Non Governmental Organizations' (NGO) activities ones or twice a year, 25 % read books and magazines ones a week and 27 % visit environment related web sites ones a week.

Table 4.1 Participant characteristics: environmental activity choices

Q 57- 65. How often do you engage in each of the following activities?					
	Once a week	Once a month	Once or twice in a year	Not at all	Missing
Outdoor activities					
Q57. Camping	1.3	1.9	24	69.2	3.9
Q58. Outside walking	69.5	17.5	7.7	2.7	2.6
Q 59. Bird Watching	12.8	12.1	25.5	46.3	3.3
Q 60. Fishing	2	5.8	25.3	64.6	2.2
Q 61. Hunting	1.9	2	6.2	87.1	2.9
Other activities related to environment					
Q 62. Watching documentaries	47.4	34.7	13.6	1.9	2.4
Q63. Reading books/magazines etc.	25.5	45	25	1.9	2.6
Q64. Visiting websites	27	38.2	25.4	7.2	2.3
Q65. Participating NGO activities etc.)	2.6	8.1	50.7	35.4	3.2

Perceptions on environmental education

There are 2 questions in the ELQ related to science and technology teachers' perceptions on environmental education. Answers given to the Item no.68 that asks the teachers' opinion about environmental education, displayed that almost all the teachers emphasized the importance of environmental issues and environmental education (Table 4.2). Whereas, 19 science and technology teachers out of 1182 (1.6 %) reported that environmental issues were important but education was not. The percentage of teachers who found education unnecessary, on the other hand, is 0.1%.

Table 4.2 Participant characteristics: perceptions on environmental education

Q 68. What is your opinion on environmental education?		
	f	%
The environment issue is very important and its education must be given	1146	97.0
The environment issue is very important but it is not essential to give its education	19	1.6
Environmental education is unnecessary	1	.1
Undecided	0	0
Missing	16	1.4
Total	1182	100.0

In addition to their perception on EE, science and technology teachers were also asked about their comments on the lacking points related to their EE practice, According to the answers given to this question, 34.6% of science and technology teachers of the current study stated that, they did not have enough knowledge on the effective methods for EE and 13.6 % stated that they could not reach the related material. Moreover, 9.9 % stated that they do not have enough information to give environmental education and other 12.2 % the “others” option to state the lacking points related to their EE practice (Table 4.3).

Table 4.3 Participant characteristics: comments on EE practice

Q 69. What are the issues that you feel their absence related with environmental education?

	f	%
There is no issue that I feel its absence	238	20.1
I do not have enough information on environmental education	117	9.9
I do not have enough information on effective methods for environmental education	409	34.6
I can not reach necessary materials for environmental education	161	13.6
Others	144	12.2
Missing	113	9.6
Total	1182	100.0

Activity Choices for EE

Science and technology teachers were asked about their preferences related to activities for EE. As it is illustrated in Table 4.4, the most popular activity (74.1%) among teachers is projects. It was followed by trips (65.1%), contests (45.9%), and museum visits (37.7%).

Table 4.4 Participant characteristics: activity choices for EE

Q 74-78. Do you use any of the following activities in your classes for EE?						
	Yes		No		Missing	
	f	%	f	%	f	%
Q 74. Museum visits	44 6	37.7	666	56.3	70	5.9
Q 75. Environmental trips	770	65.1	350	29.6	62	5.3
Q 76. Extracurricular environmental projects (including research projects)	876	74.1	247	20.9	59	5.0
Q 77. Contest	542	45.9	572	48.4	68	5.8
Q 78. Others	653	55.2	297	25.1	232	19.6

4.1.2 Science and Technology Teachers' Self Assessment about Environmental Issues

Science and technology teachers' were asked to evaluate themselves on their environmental perception and environmental knowledge. Their perception on the environment was asked by 2 questions related to their concern on environmental problems and the level importance they give to environmental problems (items 1 and 2). As a result it was found that, 67.7% of them were "fairly" concerned about environmental problems, almost 22% "a great deal" concerned about environmental problems and less than 10% of somewhat concerned about environmental problems (Figure 4.11).

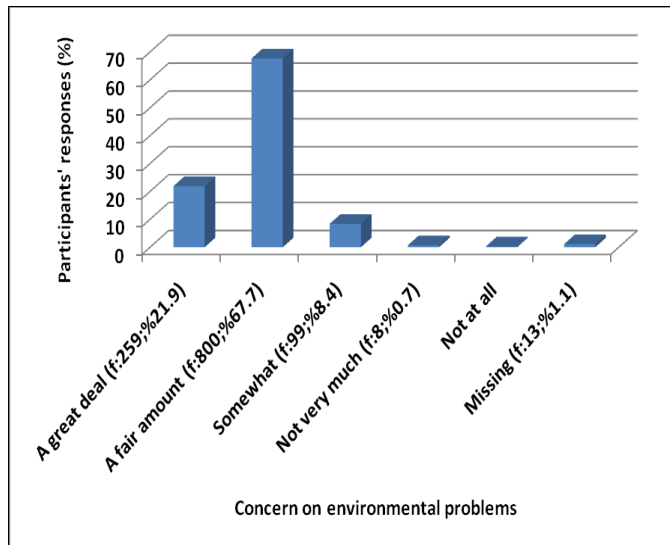


Figure 4.11 Participants' self evaluation on environmental concern

Science and technology teachers were also asked about their views on the importance of environmental problems. As the answers display, about 82% of the teachers indicated environmental problems as one of the 2 or 3 most important problems that people currently face and 14.4 % stated the environmental problems as an important problem, but there were other more important problems (Figure 4.12).

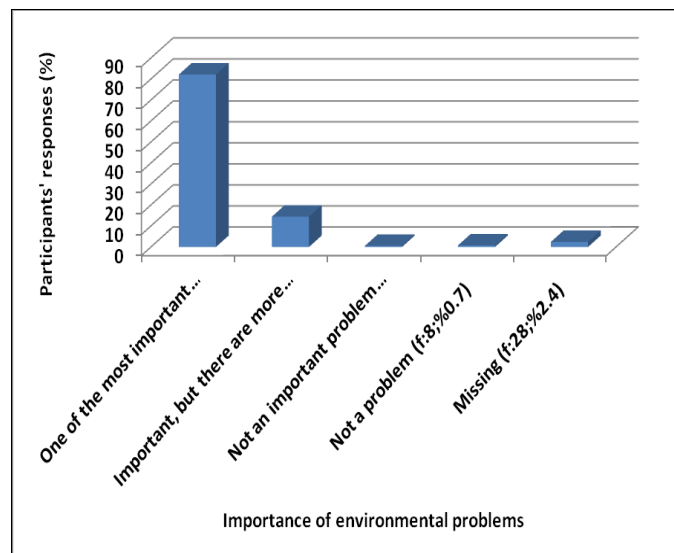


Figure 4.12 Participants' views on importance of environmental problems

The last self evaluation question was about the knowledge on environmental issues. Science and technology teachers were asked about how much they feel they know

about environmental issues and problems. According to the results, 14.6% of the science and technology teachers feel they know “a lot” about environmental issues and problems while 73.9% feel they know “a fair amount. Moreover, 10% of the teachers reported their knowledge level as “a little” (Figure 4.13).

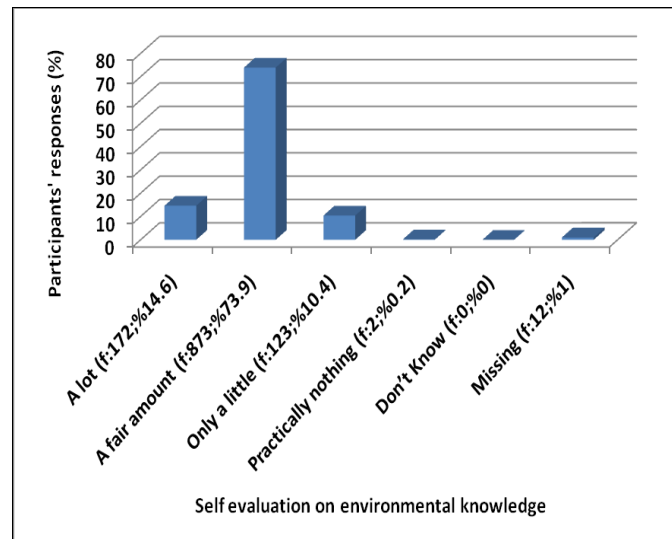


Figure 4.13 Participants’ self evaluation on their environmental knowledge

Science and Technology teachers’ self evaluation about environmental knowledge has been graded according to the scale done by Kaplowitz and Levine (2005). Responses were coded like “a lot” as “A”, “a fair amount” as “B”, “only a little” as “C”, “practically nothing” as “D”, and “don’t know” as “F”. Therefore as a result of their self evaluation, 75 % of the science and technology teachers got “B”, 10 % got “C” and 15 % got “A” (Figure 4.14). Figure 4.15, on the other hand, displayed the participants overall grade distribution obtained from the knowledge component of the questionnaire which will be discussed at next sections.

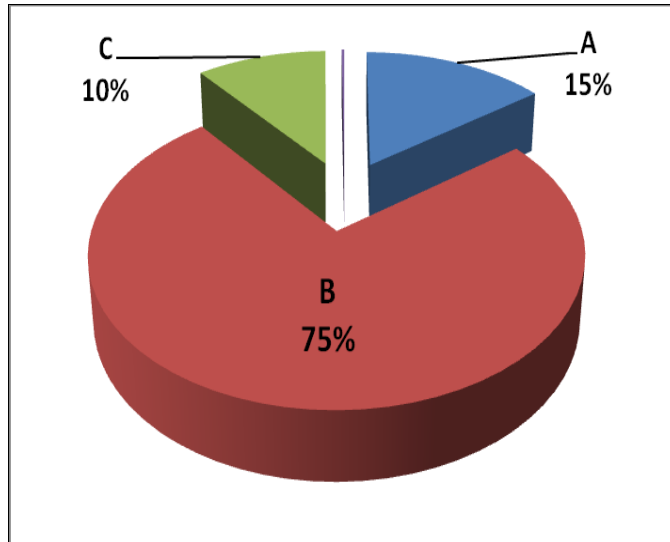


Figure 4.14 Science and Technology Teachers' Self evaluation on environmental knowledge - grading

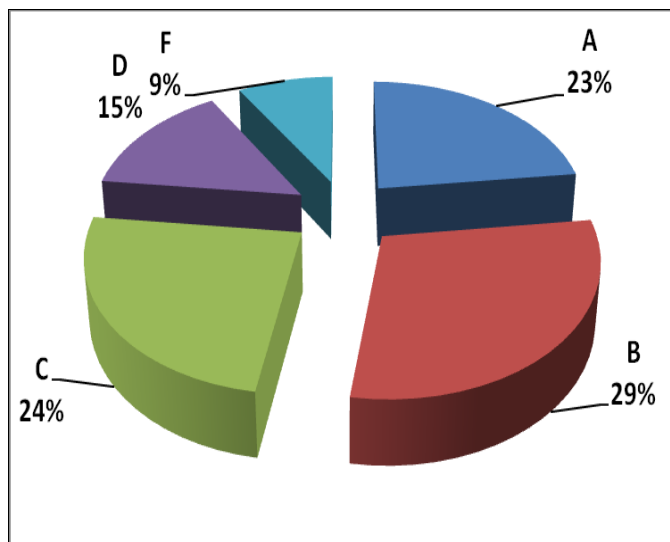


Figure 4.15 Participants' overall grade distribution for environmental knowledge

4.1.3.1 Environmental Literacy of Science and Technology Teachers

4.1.3.1 Environmental Literacy of Science and Technology Teachers at Country Level

4.1.3.1.1 Environmental Knowledge

One of the four main components of Environmental Literacy Test is environmental knowledge. In “knowledge” section of the ELQ, each item has a correct response and a “don’t know” choice. Data were evaluated according to coding correct responses as “1” and the other alternatives as “0”. Participants’ knowledge levels – grades - were stated by sum of the correct answers for 11 environmental knowledge items and ranged 11 to 0 for each participant. Then the results were categorized as displayed in the Table 4.5. The categorization of environmental knowledge is based on the method used by Kaplowitz and Levine (2005) and NEETF & Roper (2005). According to this categorization, environmental knowledge of the science and technology teachers were graded as A, B, C, D, and F and classified as adequate or inadequate accordingly.

Table 4.5 Environmental knowledge levels of the science and technology teachers

Number of questions answered correctly	Score percentage range	Percent of respondents per score	Grade	Adequacy of score
10 or more	90%-100%	23.1	A	Adequate
9	80%-89%	29.4	B	Adequate
8	70%-79%	24.4	C	Adequate
7	60%-69%	14.5	D	Inadequate
6 or fewer	59% or less	8.7	F	Inadequate

As the results indicate, 77 % of the science and technology teachers are said to be possessed acceptable levels of environmental knowledge based on this categorization. Another noteworthy point is that 23% of science and technology teachers of this research could not get adequate grades from the knowledge component of the questionnaire (Figure 4.16).

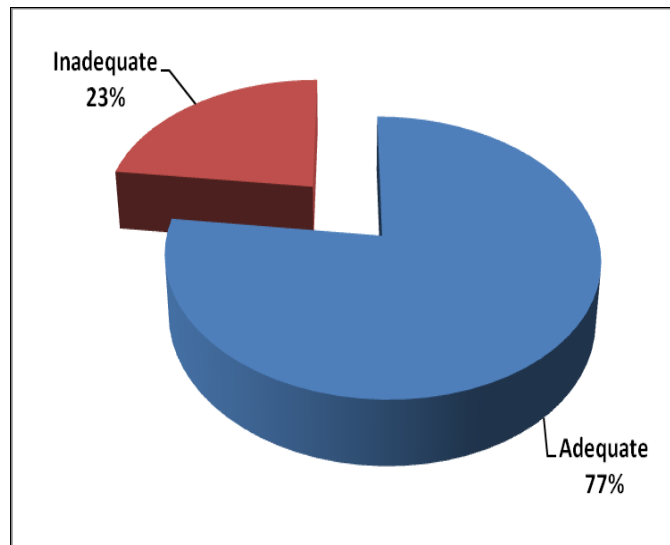


Figure 4.16 Environmental knowledge levels of science and technology teachers

Details about environmental knowledge of the science and technology teachers from 12 different regions of Turkey have been presented in Table 4.10 by means of 11 knowledge items and percent frequencies.

As is seen clearly from the Table 4.6, biodiversity is one of the well known concepts among science and technology teachers; the % frequency for the true answer is 96. Whereas, 66% of the science and technology teachers are failed to give a correct answer to the question related to major source of carbon monoxide. The percentage of the teachers who gave the right answer was about 32. Sixty four percent of the science and technology teachers of this study answered the question related to the way of electricity generation in Turkey as advocated hydro electric power plants, while the one third chosed the option related to burning oil, coal and wood as the main way to generate electricity in Turkey. Almost all of the science and technology

teachers of this study gave the correct answer to the item related to the most common cause of pollution of streams, rivers and oceans: more than 96% of the teachers stated untreated waste waters from domestic, industrial and agricultural sources as the main polluter of streams, rivers and oceans. The item on renewable energy sources indicated shortage that, although majority stated the correct answer by indicating trees as renewable energy sources (79.5%), almost 12% marked “iron ore” as a renewable source. Science and technology teachers answered the item on the protective feature of ozone layer correctly, 86% of them stating the feature of ozone layer as “protection from harmful, cancer-causing sunlight”. However, about 10% of the teachers indicated that ozone layer protects us from global warming. Moreover, almost 83% of the teachers know about the garbage problem in Turkey; they indicated that most of the garbage ends up in landfills in Turkey. The distribution for other choices were as follows: Seas (8 %), incinerators (3.8%) and recycling centers (2.4%). Likewise, majority (83.3%) of the science and technology teachers answered the item, related to the name of primary governmental authority responsible for the environmental protection of Turkey, correctly, yet 10 % pointed a well-known non-governmental organization, TEMA, as the governmental authority.

Answers for hazardous household wastes varied as; batteries (70.1%) and plastic packaging (24.7%). 1.7 % of the teachers defining spoiled food as hazardous waste, on the other hand, is a notable point. What is more, the most common reason for animal extinction was defined correctly by 87% of the participants as the humans’ destructive effect on their habitats. Lastly, more than 62 % of the science and technology teachers gave correct response to the question related to the most common method for disposing nuclear waste, while more than 10% of them marked the “Don’t Know” alternative.

Table 4.6 Answers for the environmental knowledge questions

Item Number	Item	%
4	There are many different kinds of animals and plants, and they live in many different types of environments. What is the word used to describe this idea?	0.2
	<input type="checkbox"/> Multiplicity	96.0
	<input checked="" type="checkbox"/> Biodiversity	0.3
	<input type="checkbox"/> Socio-economics	0.3
	<input type="checkbox"/> Evolution	0.1
	<input type="checkbox"/> Don't Know	1.3
	<input type="checkbox"/> Missing	
5	Carbon monoxide is a major contributor to air pollution in Turkey. Which of the following is the biggest source of carbon monoxide?	
	<input type="checkbox"/> Factories and businesses	66.1
	<input type="checkbox"/> People breathing	0
	<input checked="" type="checkbox"/> Motor vehicles	31.7
	<input type="checkbox"/> Trees	0.2
	<input type="checkbox"/> Don't Know	0.1
	<input type="checkbox"/> Missing	1.9
6	How is most electricity in Turkey generated?	
	<input type="checkbox"/> By burning oil, coal and wood	31.8
	<input type="checkbox"/> With nuclear power	1.0
	<input type="checkbox"/> Through solar energy	0.6
	<input checked="" type="checkbox"/> By hydro electric power plants	64.5
	<input type="checkbox"/> Don't Know	0.2
	<input type="checkbox"/> Missing	1.4
7	What is the most common cause of pollution of streams, rivers and oceans?	
	<input checked="" type="checkbox"/> Untreated waste waters from domestic, industrial and agricultural sources	96.4
	<input type="checkbox"/> Surface water running of yards, city streets	0.2
	<input type="checkbox"/> Don't Know	0.5
	<input type="checkbox"/> Trash washed into the ocean from beaches	1.4
	<input type="checkbox"/> Waste washed into the ocean from beaches	0.4
	<input type="checkbox"/> Waste dumped by factories	1.2

Table 4.6 Continued

Item Number	Item	%
8	Which of the following is renewable resource?	
	<input type="checkbox"/> Oil	1.2
	<input type="checkbox"/> Iron Ore	11.9
	<input checked="" type="checkbox"/> Trees	79.5
	<input type="checkbox"/> Coal	0.8
	<input type="checkbox"/> Don't Know	2.8
	<input type="checkbox"/> Missing	3.7
9	Ozone forms a protective layer in the earth's upper atmosphere. What does ozone protect us from?	0.9
	<input type="checkbox"/> Acid rain	9.8
	<input type="checkbox"/> Global warming	1.4
	<input type="checkbox"/> Sudden changes in temperature	86.3
	<input checked="" type="checkbox"/> Harmful, cancer-causing sunlight	0
	<input type="checkbox"/> Don't Know	1.8
	<input type="checkbox"/> Missing	
10	Where does most of the garbage in Turkey end up?	
	<input type="checkbox"/> Seas	7.9
	<input type="checkbox"/> Incinerators	3.8
	<input type="checkbox"/> Recycling centers	2.4
	<input checked="" type="checkbox"/> Landfills	82.9
	<input type="checkbox"/> Don't Know	1.7
	<input type="checkbox"/> Missing	1.3
11	What is the name of primary governmental authority responsible for the environmental protection of Turkey?	
	<input checked="" type="checkbox"/> Ministry Environment and Forestation	83.3
	<input type="checkbox"/> TEMA	10.4
	<input type="checkbox"/> Nature Protection Agency	0.6
	<input type="checkbox"/> Turkish Environmental Education Agency	2.9
	<input type="checkbox"/> Don't Know	0.9
	<input type="checkbox"/> Missing	1.9

Table 4.6 Continued

Item Number	Item	%
	Which of the following household wastes is considered a hazardous waste?	
12	<input type="checkbox"/> Plastic Packaging	24.7
	<input type="checkbox"/> Glass	0.3
	<input checked="" type="checkbox"/> Batteries	70.1
	<input type="checkbox"/> Spoiled Food	1.7
	<input type="checkbox"/> Don't Know	0
	<input type="checkbox"/> Missing	3.2
	What is the most common reason that an animal species becomes extinct?	
13	<input type="checkbox"/> Pesticides are killing them	3.5
	<input checked="" type="checkbox"/> Their habitats are being destroyed by humans	87.0
	<input type="checkbox"/> There is too much hunting	2.4
	<input type="checkbox"/> There are climate changes that affect them	4.8
	<input type="checkbox"/> Don't Know	0.2
	<input type="checkbox"/> Missing	2.2
	Scientists have not determined the best solution for disposing of nuclear waste. What is the most common method for disposing of nuclear waste in the World?	
14	<input type="checkbox"/> Use it as nuclear fuel	6.9
	<input type="checkbox"/> Sell it to other countries	10.0
	<input type="checkbox"/> Dump it in landfills	5.9
	<input checked="" type="checkbox"/> Store and monitor the waste	62.4
	<input type="checkbox"/> Don't Know	12.4
	<input type="checkbox"/> Missing	2.4
MEAN : 8.4027		SD: 1.5093

: Indicates the correct answer

Figure 4.17 shows the overall picture of the correct responses given for 11 environmental knowledge items. A great majority of the participants gave correct answers for item 1 and 4 but most of them failed at item 2. Mean value for

environmental knowledge dimension of the Environmental Literacy Questionnaire is 8.4027 with a standard deviation of 1.5093.

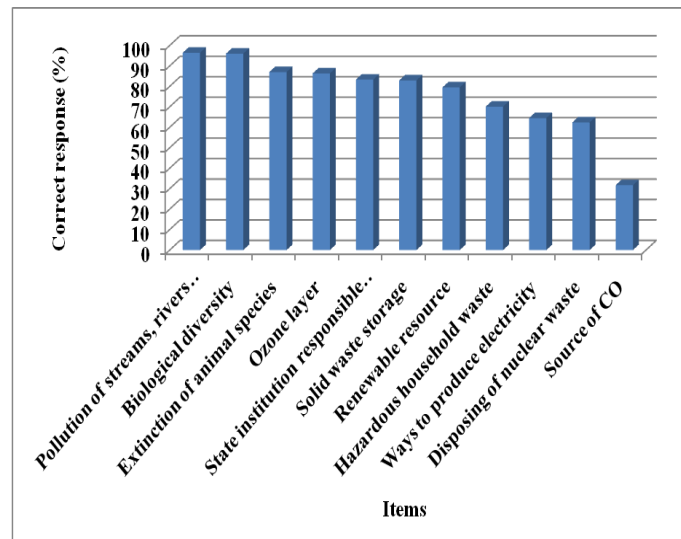


Figure 4.17 Percentages of correct responses

4.1.3.1.2 Environmental Attitude

The second component of environmental literacy is environmental attitude. The environmental attitude items targeted to evaluate science and technology teachers' feelings and values related to the environment. For this research, environmental attitude of the respondents assessed with 12 items, four of which are reverse items (item numbers 17, 18, 20, and 24). Science and technology teachers are asked to state their attitude by "Strongly disagree", "Disagree", "Unsure", "Agree", and "Strongly agree" options. In the Table below, frequencies for the responses were presented by summing up "Strongly disagree - disagree and "strongly agree - agree" results. According to the frequencies (Table 4.7) science and technology teachers' environmental attitudes were evaluated as follows: Almost all of the teachers (92.4 %) agreed on the idea that humans must live in harmony with nature; about 89 % of them claimed that mankind is severely abusing the environment; more than 87 % of the science and technology teachers of this study agreed that a steady-state economy

have to be developed to maintain a healthy economy; 84.4 % agreed that there are limits to growth beyond which our industrialized society cannot expand; 78 % thought that the Earth is like a spaceship with only limited room and resources and more than 77 % of the teachers defined this balance as very delicate and can be easily upset. Science and technology teachers' agreement on several items were relatively lower, as far as the frequencies for their answers were considered. For example, 36.1 % of the teachers were agreeing on the item "We are approaching the limit of the number of people the earth can support" and 13.3 % were unsure about the statement. They were also disagreeing with the item related to disastrous consequences of the human interface with nature and some 15.6 % was unsure about this item.

While the statements expressing negative views are considered it has been observed that, 83.5 % of the science and technology teachers did not support the idea that humans have right to modify the natural environment to suit their needs. In addition, 74.4 % of them disagreed with the statement that "humans were meant to rule over the rest of nature" and almost 85 % disagreed that humans need not adapt to natural environment because they can make it to suit their needs. Whereas, only about 21% of science and technology teachers disagreed with the item that, plants and animals exist primarily to be used by humans.

The mean score calculated for the environmental attitude items is 3.79 with standard deviation 0.69. Therefore, it can be concluded that, science and technology teachers of this study displayed a positive attitude toward human and environment relationship as described by the items of the ELQ, that, they believe in the necessity of humans to live in harmony with nature and that mankind is abusing the environment.

Table 4.7 Environmental attitudes of science and technology teachers

Item Nb	Item	Disagree %	Unsure %	Agree %	Missing %	Mean	SD
15	We are approaching the limit of the number of people the earth can support	47.8	13.3	36.1	2.9	2.87	1.268
16	The balance of nature is very delicate and easily upset	16.3	4.6	76.3	2.7	3.96	1.152
17	Humans have right to modify the natural environment to suit their needs	83.5	2.9	10.7	2.9	4.30	1.111
18	The overall goal of mankind is to rule over the rest of nature	74.4	4.8	18.5	2.4	4.18	1.068
19	When humans interface with nature it often produces disastrous consequences	26.5	15.6	55.4	2.6	3.41	1.147
20	Plants and animals exist primarily to be used by humans	20.8	4.1	73.1	2	2.12	1.316
21	To maintain a healthy economy we will have to develop a steady-state economy where industrial growth is controlled	4.7	5.1	87.1	3.1	4.28	.857
22	Humans must live in harmony with nature in order to survive	4.2	0.9	92.4	2.6	4.63	.831
23	The Earth is like a spaceship with only limited room and resources	14.1	4.9	77.9	3	4.06	1.164
24	Humans need not adapt to natural environment because they can make it to suit their needs	84.8	4.1	8.8	2.3	4.28	1.022
25	There are limits to growth beyond which our industrialized society cannot expand	9	2.2	84.4	4.5	4.30	1.030
26	Mankind is severely abusing the environment	6.3	0.6	88.7	4.4	4.48	.965
Average		32.7	5.2	59.12	2.95	3.79	0.69

4.1.3.1.3 Environmental Uses

The third component of environmental literacy is defined as “uses” in this study. This component measures science and technology teachers’ intention to take part in pro-environmental behaviour. For this research, environmental uses of the respondents were assessed with 19 items five of which are negative statements (items 29, 30, 31, and 40). Teachers were asked to state their environmental use preferences with “Strongly disagree”, “Disagree”, “Unsure”, “Agree”, and “Strongly agree” choices. Frequencies for strongly disagree and disagree and strongly agree and agree items were summed for an easy interpretation Table 4.8. The results were evaluated according to the percent frequencies as follows: most of the science and technology teachers were agree on the items related to plants and animals’ role in the environment (95.1 %); necessity of the laws regarding water quality to be stricter (94.9 %); importance of the environmental awareness (93.8 %); necessity of laws to make recycling mandatory (93.7 %); necessity of setting special areas for endangered species (93.4 %); positive and negative effects of technological changes on the environment (92 %); responsibility for helping to solve environmental problems (91.8 %); importance of feeling responsible for any damages people cause to the environment (90.9 %); impact of lifestyle changes (i.e., consumption) on solving environmental problems (90.5 %); the role of science and technology in solving environmental problems (88 %); impact of people’s values in solving environmental problems (87.6 %); and government’s role in regulating the use of private land to protect wildlife habitat (85.5 %).

When the responses given to the negative statements were investigated, on the other hand, it was observed that most of the participants display a conscious and respectful approach toward the nature. Accordingly, science and technology teachers were disagree with 79.8 % that, poisonous snakes and insects that pose a threat to people should be killed; they did not support to idea with an 80.9 percent that individuals should be allowed to use private land as they see fit. Moreover, almost 81 % of the science and technology teachers seemed as if that do not not satisfied with the laws on air pollution. Whereas, less than half of the participants (41 %) disagreed on the

item that land owners should be allowed to drain wetlands for agricultural or industrial uses, but some 38.3 % of the teachers agreed on this statement and almost 18 % of them stayed unsure for this item. Unlikely, only 29.8 % of the science and technology teachers were disagreed on the item number 29, which is about primary protection of wild animals that provide meat for people. By the way, almost one fifth of the participants were unsure about this item.

The mean value calculated for environmental uses component of the ELQ is 4.12 with a standard deviation of 0.64. Therefore, it can be inferred as a result that, science and technology teachers of this study are intended to use natural resources in a responsible, protective manner and they believe in the importance of individual responsibilities as well as the governmental precautions.

Table 4.8 Environmental uses of the science and technology teachers

Item Nb	Item	Disagree %	Unsure %	Agree %	Mean	SD
27	Special areas should be set aside for endangered species.	3.8	1.3	93.4	4.55	.793
28	Laws regarding water quality should be stricter.	2.2	1.4	94.9	4.54	.703
29	Wild animals that provide meat for people are the most important species to protect.	29.8	19.6	47	2.74	1.182
30	Poisonous snakes and insects that pose a threat to people should be killed.	79.8	3.8	14.2	4.07	1.233
31	Land owners should be allowed to drain wetlands for agricultural or industrial uses.	41	17.9	38.3	3.12	1.308
32	It is important that everyone be aware of environmental problems.	4	0.4	93.8	4.67	.799
33	Individuals should be allowed to use private land as they see fit.	80.9	5.9	11.1	4.06	1.069
34	I feel personally responsible for helping to solve environmental problems.	5.1	1.2	91.8	4.45	.862
35	Government should regulate the use of private land to protect wildlife habitat.	5.6	6.9	85.5	4.21	.878
36	People should be held responsible for any damages they cause to the environment.	4	3.0	90.9	4.45	.833
37	All plants and animals play an important role in the environment.	2.4	0.7	95.1	4.73	.662
38	Technological changes often do as much harm to the environment as they do good for the environment.	4	2.2	92	4.42	.813
39	Government should pass laws to make recycling mandatory.	3.8	0.8	93.7	4.59	.784
40	Air pollution laws are already strict enough.	80.7	10.6	6.9	4.07	.932
41	Science and technology will be very important in solving our environmental problems.	4.3	3.8	88	4.32	.807
42	Cultural changes will be very important in solving environmental problems.	16.5	12.5	69.1	3.73	1.082
43	Changes in people's values will help solve environmental problems.	4.3	6.3	87.6	4.18	.777
44	Collective action (i.e. movements) is central to solving environmental problems.	2.1	1.4	95	4.55	.691
45	Lifestyle changes (i.e., consumption) will help solve environmental problems.	4.3	3.4	90.5	4.32	.805
	Average	9.69	5.42	82.91	4.12	0.64

4.1.3.1.4 Environmental Concern

The forth and the last component of environmental literacy is environmental concern. The 9 concern items collected data on participants' sensitivity toward environmental problems and issues. Science and technology teachers were asked to state their environmental concern by means of "Not at all concerned", "A little concerned", "Unsure", "Somewhat concerned", and "Very concerned" choices (Table 4.9).

When "somewhat concerned" and "very concerned" options of this section were assessed together, results indicated that participants have a very high concern level for all of the items. As presented in the Table **, hazardous wastes (94.7 %), industrial pollution (94.6 %), global warming (94.6 %), ozone depletion (93.8 %), poor drinking water quality (90.0 %), automobile emissions (88.6 %), indoor air pollution (86.5 %), and noise pollution (78.5 %) are the problems that science and technology teachers were concerned . Among these environmental problems, global warming was the most frequently "very concerned" item, automobile emissions, on the other hand, was the least concerned item. The mean value for the environmental concern for the science and technology teachers was calculated as 4.40 with a 0.82 standard deviation. Accordingly, it is inferred that, science and technology teachers' most concerned environmental problems are, global warming, hazardous wastes and industrial pollution.

Table 4.9 Percentages for the answers of environmental concern questions

Item Nb	Item	Not and little concerned %	Unsure %	Somewhat and very concerned %	Mean	SD
46	Smoke pollution	8.5	1.0	88.7	4.37	1.00
47	Noise pollution	15.2	4.7	78.5	3.94	1.08
48	Automobile emissions	4.6	4.6	88.6	4.40	.85
49	Industrial pollution	2.5	1.0	94.6	4.74	.68
50	Hazardous wastes	2.2	0.9	94.7	4.75	.67
51	Poor drinking water quality	4.5	3.0	90.5	4.49	.85
52	Indoor air pollution	8.8	2.6	86.5	4.27	.99
53	Ozone Depletion	3.6	0.9	93.8	4.70	.75
54	Global warming	2.6	1.0	94.6	4.76	.67
	Average	5.83	2.18	90.05	4.40	0.82

4.1.3.2 Environmental Literacy of Science and Technology Teachers at Regional Level

The sampling population of the study was explained at Chapter 3. As it was reported, sample population was selected through 12 subregions depending on the Level 1 of Classification of Statistical Regional Units developed by State Planning Organization. Then three provinces were selected from each subregion being most, least and medium developed depending on the “List of Socioeconomical Development Level of Provinces (2003)” prepared by State Planning Organization. Since İstanbul subregion is composed of only one province (İstanbul), total number of the provinces were determined as 34. Up to this point, results of the study were reported for the regions as a whole. In this section environmental literacy

components of the science and technology teachers are going to be evaluated according to subregions to see the regional differences.

Mean values and standard deviations for the components of environmental literacy (knowledge, attitude, uses and concern) are presented in the Table 4.10 below according to regions defined for this research. As it is seen from the table, there are differences in the mean values of the EL components according to regions.

When the mean values for environmental knowledge for the regions were compared with the average mean value it was observed that, science and technology teachers living in the Aegean, East of Marmara, East Black Sea, Northeast Anatolia, Middle East Anatolia and Southeast Anatolia subregions have higher means for environmental knowledge compared with the the average mean (8.40). Those living in İstanbul, Mediterranean, Middle Anatolia, West Black Sea subregions, on the other hand, displayed lower mean values for environmental knowledge compared to the average mean value. As is shown in the Table 4.10, science and technology teachers from West of Marmara has got the highest environmental knowledge score and it was followed by East of Marmara, Northeast Anatolia, and Middle East Anatolia regions. The lowest environmental knowledge scores possessed by science and technology teachers of İstanbul.

Table 4.10 Environmental literacy levels for 12 subregions

Regions	Knowledge		Attitude		Uses		Concern	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
İstanbul	8.17	1.87	3.68	0.89	4.07	0.64	4.40	.86
West of Marmara	8.79	1.17	3.81	.61	4.18	.47	4.52	.57
Aegean	8.44	1.20	3.82	.53	4.06	.70	4.46	.79
East of Marmara	8.60	1.35	3.83	.74	4.11	.74	4.47	.74
West Anatolia	8.40	1.51	3.82	.59	4.15	4.15	4.44	.83
Mediterranean	8.30	2.14	3.66	.91	4.01	.93	4.23	1.19
Middle Anatolia	8.21	1.50	3.62	.76	4.05	.72	4.30	.94
West Black Sea	8.28	1.28	3.86	.50	4.09	.58	4.52	.39
East Black Sea	8.43	1.29	3.95	.39	4.29	.36	4.39	.76
Northeast Anatolia	8.55	1.31	3.85	.83	4.22	.51	4.45	.72
Middle East Anatolia	8.50	1.18	3.83	.65	4.14	.64	4.41	.79
Southeast Anatolia	8.41	1.33	3.85	.51	4.09	.56	4.32	.78
Average	8.40	1.51	3.79	0.69	4.12	0.64	4.40	0.82

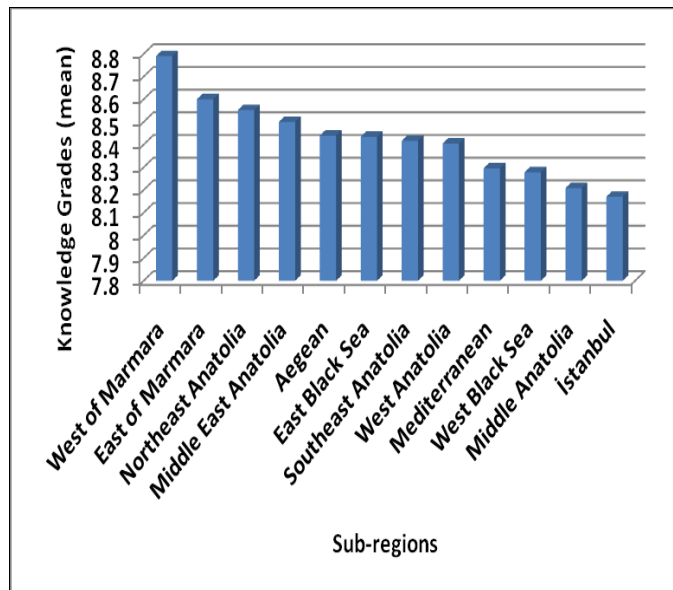


Figure 4.18 Environmental knowledge levels of science and technology teachers – regional differences

Similar assessment has been realised with the environmental attitude mean values. Mean values for the environmental attitude component of the science and technology teachers for the nine of the twelve regions (West of Marmara, Aegean, East of Marmara, West Anatolia, West Black Sea, East Black Sea, Northeast Anatolia, Middle East Anatolia, and Southeast Anatolia) were found to be above the average mean value of 3.79. Environmental attitudes for the science and technology teachers from three regions, İstanbul, Mediterranean, and Middle Anatolia, on the other hand, were observed to be below the average mean. As it was displayed in Figure 4.19, teachers from the West of Marmara subregion who had the highest environmental knowledge score got the ninth highest score from the attitude component. Whereas, science and technology teachers from the East Black Sea subregion obtained the highest mean score from the environmental attitude component. As for the case of their environmental knowledge score, science and technology teachers from the Middle Anatolia subregion has the lowest mean scores for the environmental attitude component. Except four subregions (East Black Sea, İstanbul, Mediterranean, and Middle Anatolia), science and technology teachers displayed a similar performance related to their environmental attitudes.

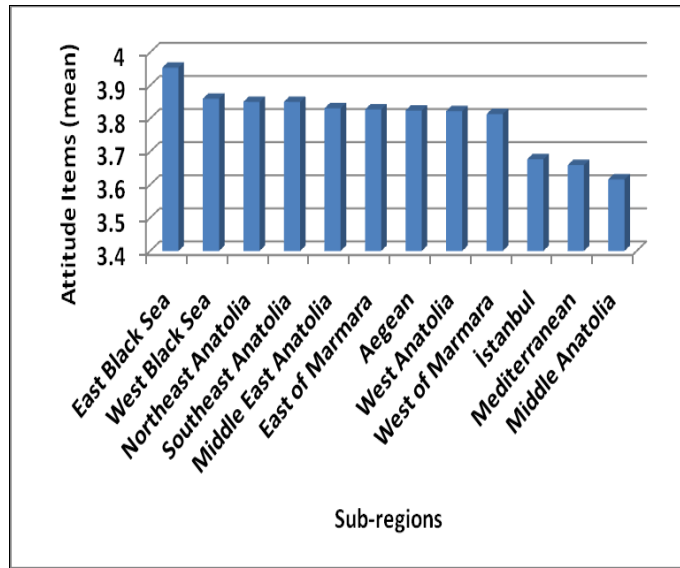


Figure 4.19 Environmental attitudes of science and technology teachers:
regional differences

The average mean value for the environmental uses component of the EL was found as 4.12. This value has been exceeded by the environmental uses mean values of science and technology teachers from four subregions; West of Marmara, West Anatolia, East Black Sea, Northeast Anatolia, and Middle East Anatolia. Teachers from the East Black Sea subregion displayed the highest performance among the other subregions related to environmental uses component. Moreover, teachers from the Mediterranean subregion showed the lowest performance among the other teachers (Figure 4.20).

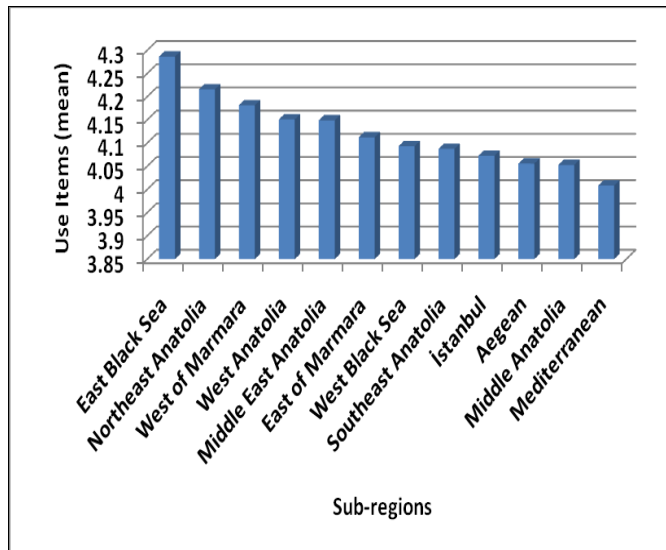


Figure 4.20 Environmental uses levels for science and technology teachers regional differences

Science and technology teachers' had displayed a quite high mean value (4.40) for concern component of the ELQ. When the regional differences were concerned, mean values for concern for the science and technology teachers from five subregions (Mediterranean, Middle Anatolia, East Black Sea, Southeast Anatolia) stayed below the average mean value. As for the case for the knowledge component, teachers from West of Marmara had the highest mean score for environmental concern. It was closely followed by the teachers from West Black Sea region. As it was also observed for the other components of environmental literacy, science and technology teachers from the Mediterranean and the Middle Anatolia regions' got lowest mean scores for environmental concern for environmental problems.

As far the regional differences in components of environmental literacy were considered, , science and technology teachers from the West of Marmara subregion placed among the top three in terms of the mean scores they obtained, except attitude component. Similarly, science and technology teachers from the Northeast Anatolia subregion located at the first five for all environmental literacy components in terms of the mean scores they obtained. Science and technology teachers from the Middle

East Anatolia subregion was also placed among the first five for all components of the environmental literacy, except concern.

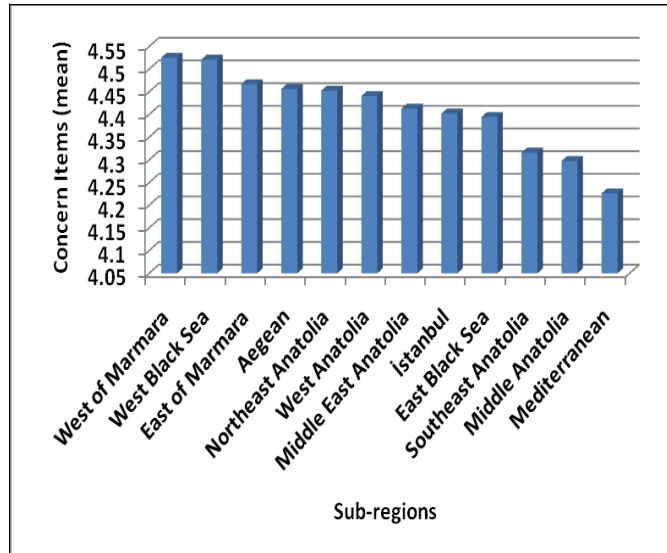


Figure 4.21 Environmental concern of science and technology teachers: regional differences

Science and technology teachers from İstanbul, Middle Anatolia, and Mediterranean subregions, on the other hand, placed among the lowest five regions for all the environmental literacy components as far as the mean scores they obtained were concerned.

4.2. Inferential Analyses

Inferential analyses were realised in parallel to the research questions of this study and will be presented in three main sections as: Relationships among environmental knowledge, attitude, use, and concern by zero order correlation analysis; Effect of gender, experience, education level, residence, environmental knowledge source, perception of the importance of environmental education, having environment related course on environmental literacy by MANOVA, and Effects of some background characteristics like environmental interest, importance of environmental

problems, self assessment on environmental knowledge, outdoor activity choices, income, and age on environmental literacy by Canonical correlations.

4.2.1 Relationships among environmental knowledge, attitude, use, and concern

The correlation among the four main components of environmental literacy is analyzed by using zero order correlation statistics. The assumptions those should be checked before conducting this analysis are reported below section.

In addition to the correlation between four main components of environmental literacy, correlation analysis was also conducted to see the relationship between self assessments of environmental knowledge and overall grades from the environmental knowledge part of the questionnaire.

4.2.1.1 Assumptions for Zero Order Correlation

Normality and linearity are two main assumptions for zero order correlation and were checked before the analysis.

4.2.1.1.1 Normality

Normal distribution is defined by Fraenkel and Walen (1996: p.586) as “a theoretical “bell-shaped” distribution having a wide application to both descriptive and inferential statistics.” In Order to test normality Q-Q plots and histograms were analyzed and observed that normality assumption was not violated.

4.2.1.1.2 Linearity and Homoscedasticity

Linearity refers to the presence of a straight-line relationship between each pair of variables. Homoscedasticity refers to scores for variable X should be similar at all variable Y. Scatter plots were used for each pair of variables and no violation was observed for this assumption. These assumptions were checked by scatter plots and no violation was observed.

4.2.1.2 Results of zero order correlation

The results of zero order correlation analysis among four component of environmental literacy indicated significant positive correlations for all pairs with different magnitudes.

As it is shown in Table 4.11 below, knowledge component of environmental literacy showed significant positive correlations with attitude, use, and concern components.

The correlation between knowledge and attitude components showed a weak positive relation with $r=.296$ and $p<.01$. The coefficient of determination (r^2) value is calculated as 0.0876 which means knowledge of the participants helps to explain 8 % of their variance in their views about environmental attitude.

Similarly, the relationship between environmental knowledge and use components with $r=.295$ and $p<.01$ indicated a weak relation. The coefficient of determination for this relation is found to be 0.0870 that means knowledge of the participants helps to explain about 8 % of their variance in their views about environmental use.

The lowest correlation was observed for knowledge and concern components ($r=0.223$ and $p<.01$). There is a very weak relationship and knowledge explains just less than 5 % ($r^2=.0497$) of the variance in their concern view.

Relatively stronger relationships were observed between environmental attitude

component with use, and concern dimensions. A positive low correlation was observed with attitude and concern dimensions ($r=0.446$ and $p<.01$, $r^2 =.1989$). This means attitude dimension explains 19% of the variance in participants' concern mean.

The highest r value (0.675) for the zero order correlation of this study was obtained from the relationship of attitude and use dimensions which means one can explain 45 % of the variance in participants' views on environmental use ($r^2 =0.4556$) by the help of attitudes of the same participant group.

Moreover, positive, moderate and significant correlation was found between use and concern dimensions ($r=0.518$ and $p<.01$). The coefficient of determination ($r^2 =.2683$) indicates that environmental use of participants explains 26 % of the variance on their environmental concern.

Table 4.11 Zero order correlations between participants 'environmental knowledge, attitude, uses, and concern

	Knowledge	Attitude	Uses	Concern
Knowledge	1	.296**	.295**	.223**
Attitude		1	.675**	.446**
Uses			1	.518**

** . Correlation is significant at the 0.01 level (2-tailed).

As a result of the correlation analysis, all components of environmental literacy are found to be positively correlated with each others ranging from very little to moderate relations.

4.2.2 Some predictors of environmental literacy

The gender effect on the components of environmental literacy was tested by One way MANOVA

4.2.2.1 Assumptions for Multivariate Analysis of Variance (MANOVA)

4.2.2.1.1 Sample Size

There are more cases in each cell than the number of dependent variables. Therefore the sample size (n=1182) is suitable to conduct for seven analysis.

4.2.2.1.2 Normality and Outliers

Univariate and multivariate normality analysis should be conducted for MANOVA. For the present study, skewness, kurtosis, and histograms were examined to check univariate normalities and normal distribution was observed. Moreover, to check the multivariate normality, Mahalanobis distance was calculated. For this study the distance was found to be 78.126. When this distance was compared from the critical value given Chi-square table (Hinkle, Wiersma, and Jurs, 1988) for the variables, it was seen that Mahalanobis value is higher than the critical value, it was considered as an outlier.

4.2.2.1.3 Linearity

Scatter plots for each pair of dependent variables were used to check this assumption and no violation of the linearity assumption was observed.

4.2.2.1.4 Multicollinearity and Singularity

Multicollinearity and singularity indicates independent variables are redundant with one another. In order to check this assumption, correlations were checked among the dependent variables. None of the correlation coefficient exceeded the value of 0.8, hence it can be concluded that dependent variables are moderately correlated and the assumption was not violated.

4.2.2.1.5 Homogeneity of Variance-Covariance Matrices

The result of the Box's M Test of Equality of Covariance Matrices showed that all significant values were larger than 0.001 so this assumption was not violated for all MANOVA analyses.

After the assumptions for MANOVA were checked, the analyses were conducted.

4.2.2.2 Results of Multivariate Analysis of Variance

In this section effect of gender, experience, education level, residence, environmental knowledge source, perception of the importance of environmental education, having environment related course on environmental literacy analyzed by MANOVA,

4.2.2.2.1 Effect of Gender

One way MANOVA was conducted to test the gender effect on the components of environmental literacy. Results indicated that there is a statistically significant multivariate effect of gender with respect to environmental literacy variable (Wilks' $L = 0.959$, $F = (4, 869) = 9.302$, $p = 0.000$ $p < .01$).

The multivariate η^2 value of 0.041 showed that 4.1 % of multivariate variance of the dependent variables, environmental literacy, was associated with gender. As a result

it can be said that there is a statistically significant difference between males and females in terms of their environmental literacy levels.

As it was shown in Table 4.12, a follow up analysis of pair-wise comparisons of means revealed a significant difference in the mean score of male and female teachers for environmental knowledge ($p\ 0.019 < .05$) and concern ($p\ 0.000 < .01$) components. The multivariate η^2 value of 0.006 indicated that 0.6 % of multivariate variance of knowledge can be explained by gender. For environmental concern component, η^2 value 0.034, implied that 3.4 percent of the environmental concern can be explained by gender.

Table 4.12 Pairwise comparisons of means.

	Components of Environmental Literacy	df	F	Sig.(p)	Partial Eta Squared (η^2)
Gender	Knowledge	1	5.553	0.019*	0.006
	Attitude	1	.519	0.471	0.001
	Use	1	2.786	0.095	0.003
	Concern	1	30.718	0.000**	0.034

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

To test the gender effect on environmental literacy, the mean responses of the environmental literacy variables by gender were compared. The mean of the responses as displayed Table 4.13 indicated lower mean for environmental knowledge level for female teachers. On the other hand, all other means, including environmental attitude, use, and concern dimensions, indicated higher mean values for female teachers.

Table 4.13 Mean values of environmental literacy components by gender

	Male		Female	
	Mean	Standard Deviation	Mean	Standard Deviation
Knowledge	8.542	0.061	8.381	0.057
Attitude	3.903	0.021	3.933	0.020
Use	4.179	0.020	4.232	0.019
Concern	4.403	0.026	4.579	0.024

The findings revealed that female science and technology teachers have higher concern levels regarding to their male counterparts but environmental knowledge levels of males are higher than those of females.

4.2.2.2.2 Effect of Experience

Experience is another factor tested by using one way MANOVA. Results indicated that there is a statistically significant multivariate effect of experience with respect to environmental literacy variable (Wilks' $L = 0.954$, $F = (20, 869) = 2.206$, $p = 0.002$, $p < .01$).

The multivariate partial eta squared value of 0.012 showed that 1.2 % of multivariate variance of the dependent variables, environmental literacy, was associated with experience of participants. As a result it can be said that there is a statistically significant difference among experience levels of participants in terms of their environmental literacy levels.

As it was shown in Table 4.14, a follow up analysis of pair-wise comparisons of means revealed a significant difference in the mean score of teachers with different experience levels for environmental knowledge ($p = 0.014 < .05$) and use ($p = 0.001 < .01$) components. The multivariate η^2 value of 0.015 indicated that 1.5 % of multivariate

variance of knowledge can be explained by experience. For environmental concern component, η^2 value 0.022, implied that 2.2 percent of the environmental concern can be explained by experience.

To test the experience effect on environmental literacy, the mean responses of the environmental literacy variables by experience were compared. The mean value of the responses as displayed Table 4.15 indicated that teachers having experience less than one year have the lowest knowledge mean from the questionnaire. On the other hand, teachers' knowledge level increases during their first ten year of teaching. After 10 years of experience, teachers' mean value for the knowledge component of the items decreased relative to their previous years.

A very similar pattern was observed for use component. Teachers with experience less than 1 year had the lowest mean value for the items of this component. Their mean increased during first ten years of their teaching after then decreased continuously.

Table 4.14 Pairwise comparison of means

Experience	df	F	Sig.(p)	Partial Eta Squared η^2
Knowledge	5	2.875	.014*	.015
Attitude	5	1.549	.172	.008
Use	5	4.079	.001**	.022
Concern	5	1.126	.345	.006

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

Table 4.15 Mean values of EL Components by Experience

	Less than 1 year		Between 1-5 years		Between 6-10 years		Between 11-15 years		Between 16-20 years		More than 21 years	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Knowledge	7.647	.325	8.330	.096	8.679	.105	8.581	.092	8.543	.102	8.590	.100
Attitude	3.809	.105	3.966	.031	3.960	.034	3.889	.030	3.959	.033	3.887	.032
Use	3.944	.100	4.219	.030	4.268	.033	4.189	.029	4.309	.032	4.179	.031
Concern	4.412	.137	4.456	.041	4.502	.045	4.488	.039	4.544	.043	4.576	.042

4.2.2.2.3 Effect of Education Level

The effect of education level of participants on environmental literacy was tested by using Multivariate Analysis of Variance and as it was seen from the Table 4.16, it was observed that there was no statistically significant effect of education level on participants environmental literacy (Wilks' Lambda = 0.987, $F = (12, 2434) = 1.037$, $p = 0.411$, $p > 0.05$).

Table 4.16 Multivariate test on effect of education level

Education Level	Value	F	df	Sig.	Partial Eta Squared
Wilks' Lambda	.987	1.037	12.000	.411	.004

4.2.2.2.4 Effect of Residence

The effect of residential difference of participants on environmental literacy was tested by using Multivariate Analysis of Variance and as it was seen from the Table 4.17, there was no statistically significant effect of residential difference on environmental literacy (Wilks' Lambda = 0.978, $F = (16, 2814) = 1.273$, $p = 0.205$, $p > 0.05$).

Table 4.17 Multivariate test on effect of residence

Residence	Value	F	df	Sig.	Partial Eta Squared
Wilks' Lambda	.978	1.273	16.000	.205	.005

4.2.2.2.5 Effect of Environmental Knowledge Source

The effect of environmental knowledge source of participants on environmental literacy was tested by using Multivariate Analysis of Variance and as it was seen

from the Table 4.18 that there was no statistically significant effect of environmental knowledge source on environmental literacy (Wilks' Lambda = 0.977, $F = (20, 2949) = 1.039$, $p = 0.410$, $p > 0.05$).

Table 4.18: Multivariate test on effect of environmental knowledge source

Env. Knowledge source	Value	F	df	Sig.	Partial Eta Squared
Wilks' Lambda	.977	1.039	20.00	.410	.006

4.2.2.2.6 Effect of Perception of the Importance of Environmental Education

Another factor, importance perception of environmental education was also tested by using MANOVA. Results indicated that there is a statistically significant multivariate effect of importance perception of environmental education with respect to environmental literacy variable (Wilks' $L = 0.976$, $F = (4, 929) = 5.702$, $p = 0.000$, $p < .01$).

The multivariate partial eta squared value of 0.024 showed that 2.4 % of multivariate variance of the dependent variables, environmental literacy, was associated with importance perception of environmental education of participants. As a result, it can be said that there is a statistically significant difference among importance perception of environmental education of participants in terms of their environmental literacy levels.

Table 4.19 Pairwise comparison of means

Experience	df	F	Sig.(p)	Partial Eta Squared (η^2)
Knowledge	1	.242	.623	.000
Attitude	1	12.788	.000**	.014
Use	1	15.660	.000**	.017
Concern	1	8.169	.004*	.009

* Correlation is significant at the 0.05 level

** Correlation is significant at the 0.01 level

As it was shown in Table 4.19, a follow up analysis of pair-wise comparisons of means revealed a significant difference in the mean score of teachers with different importance perception of environmental education for environmental attitude ($p < 0.000 < .01$), use ($p < 0.000 < .01$), and concern ($p < 0.004 < .05$), components. The multivariate η^2 value of 0.014 indicated that 1.4 % of multivariate variance of attitude can be explained by importance perception of environmental education. The multivariate η^2 value of 0.017 indicated that 1.7 % of multivariate variance of use component can be explained by importance perception of environmental education. For environmental concern component, η^2 value 0.009, implied that only 0.9 % of the environmental concern can be explained by this factor.

To test the effect of this factor on environmental literacy, the mean responses of the environmental literacy variables by importance perception of environmental education of participants were compared. As it can be seen from the Table 4.20 teachers' response are concentrated on first two choices. The mean value of the responses displayed that teachers believe the importance of environment and the necessity of giving its education have higher grades for all components of environmental literacy.

A very similar pattern was observed for use component. Teachers with experience less than 1 year had the lowest mean value for the items of this component. Their mean increased during first ten years of their teaching after then decreased continuously.

Table 4.20 Means of EL Components by importance of environmental education

Perception of importance of environmental education	The environment issue is very important and its education must be given		The environment issue is very important but it is not essential to give its education	
	Mean	SD	Mean	SD
Knowledge	8.5260	1.34652	8.3333	1.37069
Attitude	3.9341	.42990	3.4861	.52804
Use	4.2310	.41376	3.7544	.47200
Concern	4.5154	.55981	4.0463	.89450

4.4.4.4.7 Effect of Having Environment Related Course

The effect of having environment related course on environmental literacy was tested by using Multivariate Analysis of Variance and as it was seen from the Table 4.21 that there was no statistically significant effect of having environment related course on environmental literacy (Wilks' Lambda = 0.996, $F = (4, 917) = .809$, $p = 0.519$, $p > 0.05$).

Table 4.21 Multivariate test on effect of having environment related course

Having environment related course	Value	F	df	Sig.	Partial Eta Squared
Wilks' Lambda	.996	.809	4.000	.519	.004

4.2.3 Effects of Some Background Characteristics on Environmental Literacy

Canonical analysis was performed to investigate the effects of defined predictors (environmental Interest, importance of environmental problems, self assessment on environmental knowledge, outdoor activity choices, age, and income) on environmental literacy of the participants.

4.2.3.1 Assumptions for Canonical correlation

4.2.3.1.1. Sample Size

In this study, the total number of variables for both MANOVA and Canonical analysis is 13 and 1182 participants enrolled to the study. Since canonical correlation requires about 15 cases per variable, the sample size ($n=1182$) of the current study is suitable to conduct for these analysis.

4.2.3.1.2. Normality and Outliers

Univariate and multivariate normality analysis should be conducted for MANOVA. For the present study, skewness, kurtosis, and histograms were examined to check univariate normalities and normal distribution was observed. Moreover, to check the multivariate normality, Mahalanobis distance was calculated. For this study the distance was found to be 78.126. When this distance was compared from the critical value given Chi-square table (Hinkle, Wiersma, and Jurs, 1988) for the variables, it was seen that Mahalanobis value is higher than the critical value, it was considered as an outlier.

4.2.3.1.3. Linearity and Homoscedasticity

Scatter plots were used to check this assumption, and no violation of the linearity and homoscedasticity assumptions were observed.

4.2.3.1.4. Multicollinearity and Singularity

This assumption was checked for each variable set. None of the correlation was found to be higher than 0.80 so the assumption was not violated.

4.2.3.2 Results of Canonical correlation

Canonical correlation analysis was used to examine the relationship between some of the background characteristics of teachers and set of environmental literacy variables.

The results of the first canonical analysis showed that the first canonical correlation was 0.248 (with 6.1 % overlapping variance) indicating significant relationships between the two sets of variables [Wilks Lambda (L)=0.920 $\chi_{(28)}^2 = 69.71$. P<0.01]. Because only the first canonical correlation is significant the other canonical correlations were ignored and not interpreted.

According to the results, the teachers' perception of interest, perception of importance of environmental problems, self assessment on environmental knowledge, and outdoor activity choices were highly correlated to the first canonical variate. The first canonical variate was positively associated with all background variables yet negatively correlated to income variable. Knowledge component of environmental literacy was found to be positively correlated to the first canonical variate as other three dimensions were found to be negatively correlated.

Table 4.22 Canonical correlations and coefficients, variance, and redundancies of participants' environmental background and environmental literacy components

Environmental background	First canonical variate	
	Correlation	Coefficient
Environmental interest (s1)	.612	.396
Environmental importance (s2)	.594	.529
Self assessment of env.knowledge (s3)	.481	.198
Outdoor activities (s57-s65)	.561	.415
Income	-.312	-.290
Age	.097	.252
Percent of variance	.230	
Redundancy	.014	
Environmental literacy components		
Knowledge	.090	.107
Attitude	-.635	-.392
Use	-.597	-.246
Concern	-.840	-.708
Percent of variance	.368	
Redundancy	.023	
Canonical correlation	0.248	

The first pair of canonical variates indicates that the teachers' perception of interest, perception of importance of environmental education, self assessment on environmental knowledge and outdoor activity choices were associated with knowledge, attitude, use and concern. In other words teachers who are interested in environmental issues, who give importance to environmental problems, who thinks they have good knowledge about environmental issues, who attend outdoor activities in relation to environmental issues have better knowledge about environmental issues.

The reported percent of variance values indicate that the first canonical variate pair accounts for 23 % of the variance of students' characteristic variables and 37 % of the variance from the environmental literacy components of the questionnaire.

The redundancy values in table reveal that proportion of variance of "teacher background characteristics" explained by canonical variate of "environmental literacy components" is .014. This means that canonical variate of "environmental literacy components" explains 1.4 % of the variance in "teacher background characteristics". On the other hand proportion of variance of "environmental literacy components" explained by canonical variate of "teacher background characteristics" is .023. This means that canonical variate of "teacher background characteristics" accounts for 2.3% of the variance in "environmental literacy components".

4.3 Summary of Results

4.3.1 Summary of the Results for Descriptive Analyses

Descriptive analyses were used for defining participants' characteristics, environmental literacy levels for environmental knowledge, attitude, uses, and concern components. Those analyses were also used for determining the environmental literacy levels of participants for 12 subregions.

According to the result, 1182 science and technology teachers enrolled to this study and 49 % of them are female and 43 % are male. More than half of the participants (62 %) had professional experience over 10 years and 58 % of them are below age 40. Their primary environmental knowledge sources are found to be internet (37.6), radio and TV programs (35 %), and magazines and newspapers (15.7 %). More than half of the participants have a license degree from an education faculty. Respondents also reported that they had an environment related course during their university education (51.8 %). Besides that their monthly family income were asked and it was found that their income is between 2000-5000 (63 %), and below 2000 (30.5 %). The questionnaire includes a question on the childhood residence of the respondents.

According to the answers, more than half of the respondents spent their childhood in big cities. The teachers stated their popular environmental activities as outside waking (94.7 %), watching documentaries on environment (95.7 %), reading books/magazines etc. on environment (95.5 %), and visiting environment related websites (90.6 %).

About 97 percent of the participants believe that the environment issue is a very important problem and thus the environmental education must be given but they reported the following inadequacies related with environmental education; do not having enough information on effective methods of environmental education (34.6 %), and not having necessary materials (13.6 %). Moreover, teachers reported the activities they use for teaching environment related issues. The most popular activity preferred by science and technology teachers is reported as extracurricular environmental projects (including research projects) with a 74.1 %. It is followed by environmental trips (65 %), contest (45.%) , and museum visits (37.7 %).

Science and technology teachers assessed themselves in terms of their environmental knowledge. Fifteen percent of them assessed their environmental knowledge with grade A; majority assessed their knowledge with grade B, and only 10 % assessed themselves with average environmental knowledge. Shortly, all of the participants evaluated their environmental knowledge level as more than adequate.

On the other hand, analysis of the grades obtained from the knowledge component of ELQ resulted with a different picture. Almost 21 % of the respondents were found to be inadequate in terms of their environmental knowledge while 79 % were found to be adequate. The average mean for environmental knowledge component found as 8.40 with a standard deviation of 1.51.

Results indicated that most of the science and technology teachers enrolled to this study displayed a positive attitude toward environment. Their mean score for the 12 environmental attitude items was calculated as 3.79 with a standard deviation of 0.69. Many respondents agreed on such statements that humans must live in harmony with nature (92.4 %); mankind is severely abusing the environment (89 %); a steady-

state economy have to be developed to maintain a healthy economy (87 %); and growth is not a limitless process (84.4 %).

Furthermore, environmental uses of the participants were evaluated with 19 items. According average mean for the items 4.12 with a standard deviation of 0.64. This high mean indicates positive responsibility of teachers toward environment. Participants agreed on several items like; all plants and animals play an important role in the environment (95.1 %); laws regarding water quality should be stricter (94.9 %); it is important that everyone be aware of environmental problems (93.8 %); government should pass laws to make recycling mandatory (93.7 %); special areas should be set aside for endangered species (93.4 %); technological changes often do as much harm to the environment as they do good for the environment (92 %); I feel personally responsible for helping to solve environmental problems (91.8 %); people should be held responsible for any damages they cause to the environment (90.9 %); lifestyle changes (i.e., consumption) will help solve environmental problems (90.5 %) etc.

Science and technology teachers of this study found very concerned on environmental issues; the results indicated a very high concern level with a mean of 4.40 with a 0.82 standard deviation . Observed concern levels for each item are listed as; hazardous wastes (94.7 %), industrial pollution (94.6 %), gobal warming (94.6 %), ozone depletion (93.8 %), poor drinking water quality (90.% %), automobile emissions (88.6 %), indoor air pollution (86.5 %), and noise pollution (78.5 %).

These four components of environmental literacy were also evaluated at regional levels for all of the 12 subregions. Except attitude dimension, West of Marmara subregion placed at top three in terms of mean values. Similarly, Northeast Anatolia subregion located at the first five means for all components. Mean of Middle East Anatolia subregion is also placed among the first five means for all components except concern component. On the other hand, teachers from İstanbul, Middle

Anatolia, and Mediterranean subregions placed among the lowest five mean scores for all of the environmental literacy components.

4.3.2 Summary of the Results for Inferential Analyses

Inferential analyses were conducted through three different parts. The first part of the analyses was focused on the relationships among the four components of environmental literacy. It was handled by zero order correlation analysis. As a result it was found that all of the environmental literacy components have significant positive relationships at several levels.

The highest correlation was found between environmental attitude and use components with $r = 0.675$. This moderately high correlation is followed by the correlation of environmental use and concern components with $r = 0.518$. On the other hand the lowest correlation observed among the environmental literacy components was the environmental knowledge and concern ($r = 0.223$).

The effect of gender, experience, education level, residence, environmental knowledge source, importance perception of environmental education, and having environment related course on environmental literacy component were tested by MANOVA. Analysis indicated that there are no statistically significant effects of education level, residence, environmental knowledge source, and having environment related course on environmental literacy.

Results also revealed that there is a significant difference in the mean score of male and female teachers for environmental knowledge ($p 0.019 < .05$) and concern ($p 0.000 < .01$) dimensions. The effect of gender on environmental knowledge is very small but. Gender can explain only 0.6 % of knowledge. On the other hand, 3.4 % of environmental concern can be explained by gender.

Experience is another factor affecting environmental literacy of participants. There is a statistically significant multivariate effect of experience with respect to

environmental literacy variable (Wilks' $L = 0.954$, $F = (20, 869) = 2.206$, $p = 0.002$ $p < .01$). The multivariate partial eta squared value of 0.012 showed that 1.2 % of multivariate variance of the dependent variables, environmental literacy, was associated with experience of participants.

Moreover, the effect of importance perception of participants on environmental education with respect to environmental literacy variable (Wilks' $L = 0.976$, $F = (4, 929) = 5.702$, $p = 0.000$ $p < .01$) is found to be statistically significant. Partial eta squared value of indicated that 2.4 % of multivariate variance of the environmental literacy, was associated with importance perception of environmental education of participants.

The third analysis was conducted to analyze the effects of some background characteristics on environmental literacy by conducting Canonical correlation.

The teachers' perception of interest, perception of importance, perception of knowledge and participation to environmental social activities were associated with knowledge, attitude, use and concern. In other words teachers who are interested in environmental issues, who give importance to environmental problems, who thinks they have good knowledge about environmental issues, who attend social activities in relation to environmental issues have better knowledge about environmental issues, more positive attitude towards environmental issues, more positive view on environmental uses and concern environmental problems.

According to the results, canonical variate of "environmental literacy components" explains 1.4 % of the variance in "teacher background characteristics". On the other hand canonical variate of "teacher background characteristics" accounts for 2.3% of the variance in "environmental literacy components".

CHAPTER 5

DISCUSSION, CONCLUSIONS, AND IMPLICATIONS

The results of this research are discussed in this Chapter under four main sections named as; environmental literacy of science and technology teachers, relationships among environmental literacy components (environmental knowledge, attitude, use, and concern), and characteristics affecting of environmental literacy. Moreover, this chapter also covers the conclusions of the results, implications of the study, and recommendations for further studies.

5.1 Discussion of the Results

The data obtained from the study displays the demographic structure of Turkish science and technology teachers. Results indicated that most of the participants are female 48.6%, and more than half of them (58.1%) are below 40 years old. The percentage of the teachers with more than 10-year experience is above 60 and more than half (60 %) of them has a lycence degree from an education faculy. Almost 52 % reported that they do not have any envirenment related course during their education. Since participants are from state schools, they reported their monthly family income as between 2000-5000TL (for 63.0 % of the participants) and below 2000 TL (for 30.5 % of the participants). As a conclusion it can be said that science and technology teachers in Turkey are mostly female, relatively young and moderately experienced with low or middle level family income.

After drawing this general picture of the teachers, the environmental literacy levels of those participants is going to be discussed at the following section.

5.1.1 Environmental Literacy of Science and Technology Teachers At Country Level

Teachers were asked to evaluate themselves on three main issues; interest on environmental problems, perception of importance of environmental problems, and their knowledge on environmental issues. Participants stated their views on their interest for environmental problems as 67.7% “fairly” concerned; almost 22% “a great deal” concerned, and less than 10% “somewhat” concerned. On the other hand, about 82% of the respondents indicated environmental problems as one of the 2 or 3 most important problems that people currently face. Furthermore, almost two third of them defined their environmental knowledge level as “a fair amount.”

In this study, environmental literacy is evaluated by taking four main environmental literacy components into consideration; knowledge, attitude, use, and concern. The same or similar environmental literacy categorizations were used by many researchers all around the world. For instance, Tuncer et al. (2009) investigated the environmental literacy levels of pre-service teachers at one of the largest public universities in Turkey. Environmental knowledge, attitude, uses, and concern components were evaluated in detail. Ökeşli (2008) used the same components to investigate the environmental literacy of 6th, 7th and 8th grade, 848 primary school students in four public schools of Bodrum, Turkey. Similarly, environmental literacy of 681 sixth grade students at a private school investigated by İstanbullu (2008) using the same environmental literacy components. Environmental knowledge, attitude, sensitivity, and concern levels of 437 eight grade public school students were investigated by Varışlı (2009). Negev, Sagy, Garb, Salzberg, and Tal (2008) investigated the environmental knowledge, attitude, and behavior of 6th and 12th grade students from Israel. Moreover, Pe'er, Goldman and Yavetz (2007) conducted a study with 765 first year teacher-training students from three large collages in Israel and evaluated their environmental environmental behavior attitude and knowledge. Another study conducted by Hsu(1997). He studied with 1312 secondary teachers in Taiwan and investigated their environmental knowledge, attitude, sensitivity, locus of control, and environmentally responsible behavior.

There are many more examples using similar categorization for environmental literacy.

As a result of the study, teachers participated to this research mostly possess acceptable level of environmental knowledge, showed high degree of positive attitudes toward environment, have high degree of responsibility toward environment, and high degree of concern about environmental problems.

The categorization used to assess environmental knowledge grades is based on the method used by Kaplowitz and Levine (2005). According to this categorization, 23.1 % of the participants answered 10 or 11 questions correctly and had grade “A”. 29.4 % of the participants, on the other hand, gave 9 correct answers and got grade “B”. Moreover 24.4 % gave 8 correct answers and had “C”. Teachers with 7 correct answers are 14.5 % of the total participants and graded as “D”. Finally, 8.7 % had F grade with less than 6 correct answers.

By using the same categorization method with Kaplowitz and Levine (2005), 77 % of the participants are found to have adequate levels of environmental literacy but 23 % of the respondents do not have adequate environmental knowledge. This result is seems to be very interesting when it is compared with the participants’ self evaluation on their environmental knowledge levels. All of the science and technology teachers evaluated themselves as having adequate environmental knowledge as 75 % of the science and technology teachers got “B”, 10 % got “C” and 15 % got “A”. When these two results compared, it is clear that science and technology teachers enrolled to this study are not very realistic about their environmental knowledge level. They thought that they have enough knowledge but indeed they do not. This result is also proved by correlation analysis between the participants’ self evaluation on their environmental knowledge levels and their grades from knowledge part of the questionnaire. Results indicated that there is a slightly positive correlation ($r = .060$, $p < .05$) between teachers’ self environmental

knowledge perception and their grades from the environmental knowledge test of the current study.

This result indicating 77 % of the teachers have acceptable levels of environmental knowledge. When the related literature is analyzed, several similar and different results are observed. For instance, results of the present study were found to be consistent with the result of the study of Kaplowitz and Levine (2005). They studied on the level of environmental knowledge of Michigan State University (MSU) students relative to the results of biannual national study of the environmental knowledge of the general population of the United States. According to the results, majority of MSU students (66%) had a passing grade from the environmental knowledge test. Furthermore, Aydemir (2007) conducted a study with 183 teachers from 91 selected elementary schools throughout Ankara, and found that majority of the teachers in the study had average knowledge about environmental concepts and only small number of teachers had adequate knowledge level about environmental concepts. There are many studies indicating middle or low levels of environmental knowledge. One of them was conducted by Buhan (2006). Buhan worked with 300 preschool teachers from Istanbul. Results revealed that teachers are lacking in sufficient knowledge. Additionally, Tuncer et al. (2009) found that only 48.7 % of pre-service teachers at one of the largest public universities in Turkey possess adequate level of environmental knowledge. Pe'er, Goldman and Yavetz (2007) conducted a study with a heterogeneous group of 765 first year teacher-training students from three large colleges in Israel. Results showed that beginning students had low ecological and environmental knowledge. Even their basic knowledge of subjects with which high school graduates should be familiar was limited, although their scores on those questions were higher than were their scores on the advanced questions.

The difference from the results obtained from literature may be caused by several factors. First of all, there are few comprehensive environmental knowledge studies covering many different aspects of environmental issues in Turkey. Additionally, most of the previous studies conducted with preservice teachers. The results of this

study were also indicated the increasing environmental literacy level during teachers' first ten years of experience so it can be reasonable that the higher environmental knowledge levels possessed by inservice teachers than the preservice teachers have. Moreover, this is the first nationwide sampling of a study investigating environmental knowledge levels of science and technology teachers in Turkey. These differences may be the reasons for the high percentage (77%) of teachers with adequate levels of environmental knowledge which is above the average percentages found by the previous researches. If the knowledge grade analyses in dept, the percentage of the teachers with high environmental literacy (23.1 %) is found to be low and the percentage (23.2%) who could not obtain the passing grade is going to be found as alarming for the science and technology teachers who are the key elements of environmental education.

The teachers enrolled to the present study had their higher correct response percentages from the items on the cause of pollution of streams, rivers and oceans (96 %); definition of biodiversity (96 %); the most common reason for animal extinction (87 %); the protective feature of ozone layer (86 %); the name of primary governmental authority responsible for the environmental protection of Turkey (83.3 %); solid waste storage (83 %); renewable energy sources (79.5 %); hazardous household wastes (70.1 %). The correct answer percentages are at the lowest level for the items on electricity generation in Turkey (64 %); the most common method for disposing nuclear waste (62 %); and the major source of carbonmonoxide (31.7 %).

Tuncer et al. (2009) investigated the environmental literacy levels of preservice teachers and obtained similar results with the current study. The most correct answers obtained from the items on definition of biodiversity (90.4 %), and surface pollution (88.3 %). The correct answer percentage is the lowest for the item on major source of carbonmonoxide (33.6 %). The other items with low correct answer percentages are method for storing nuclear waste (40.9 %), household hazardous waste (52.9 %), and solid waste storage (54.2 %). Similarly, the study of Spiropoulou, Antonakaki, Kontaxaki, and Bouras (2007) worked with 188 Greek in-

service primary school teachers in Primary Education and found some misunderstandings or misconceptions on the term “sustainability” and “renewable resources of energy.” Teachers confused renewable resources of energy with the non renewable ones. Teksöz, Şahin, and Ertepinar (2010) investigated the environmental literacy of 60 students enrolled in five-year chemistry teacher education program. Similar results were obtained with the present study. The environmental knowledge item that answered correctly by the participants concerned the definition of biodiversity (90%). The knowledge item answered incorrectly by all the participants concerned industrial discharges as one of the major sources for surface water pollution. A hundred percent of the participants answered this item as discharge of municipal solid wastes. Only 26.3 % of the participants, on the other hand, stated the motor vehicles as the major contributor of carbon monoxide; more than 70 % of respondents incorrectly identified factories and business as the major source of carbon monoxide.

When it is thought about the potential effects of teachers on their students, some results obtained from the answers to the questionnaire of the science and technology teachers enrolled to the study are very disturbing. One of them is on the main way of electricity generation in Turkey. About one third of the participants chose “burning oil, coal, and wood” alternative. About 10 % of the respondents chose “do not know” alternative for the most common way for disposing nuclear waste. 12 % indicated “iron ore” as renewable energy source. Although TEMA is a nongovernmental organization, about 10 % stated this organization as the name of primary governmental authority responsible for environmental protection of Turkey. The main reason for these disappointing results can be explained by the main environmental information sources of participants. In the present study, the main information sources were reported as internet, radio and TV programs. These resources have the possibility to limit the environmental information proposed to the audiences. Environmental issues are not very popular among Turkish media and generally focused on to the environmental disastrous without giving the scientific details and underlying truths to the public. The air pollution caused by low quality coal has been a popular subject among the news for years. Nuclear power plants, on

the other hand, were very well-known subjects among Turkish citizens during 1980s and 1990s due to the Chernobyl Disaster. After societal memory covered by the sand of time, the establishment of nuclear power plants started to be discussed but these discussions always stayed at a “good” or “bad” point for most of the media agents but not the details of scientific evidences. The science-technology-society-environment approach is a relatively new concept for Turkish society so the restricted way of presenting the news on environmental issues to Turkish society can be understandable. Respondents’ selection of the wrong alternative “TEMA” is another evidence of the effect of environmental information sources. This NGO is a very well-known organization and it implemented many different country wide awareness campaigns. Very often, those campaigns and the founder of TEMA, which is a popular environmental activist in Turkey, find themselves a place in Turkish media. Under the light of these results, source of environmental information should be reevaluated and new strategies should be developed to use them properly.

At the end of the current study, the second component of environmental literacy, environmental attitude, is found to be very positive. Like many other studies (Jinliang, Yunyan, Ya, Xiang, Xiafei, and Yuanmei, 2004; Chunteng, 2004; Pe’er et al., 2007; Petegem, Blicck, and Boeve-De Pauw, 2007; Tuncer et al., 2006; Tuncer et al., 2009) respondents of the current study expressed positive environmental attitudes with an average mean of 3.79. Participants mostly (92.4 %) agreed on the idea that humans must live in harmony with nature. Although the percentage of the respondents believing that “the Earth is like a spaceship with only limited room and resources” is quite high (78 %), only 36.1 % of the teachers were agree on the item “We are approaching the limit of the number of people the earth can support” and 13.3 % were unsure about the statement.

The third component of environmental literacy is defined as “use” which measures science and technology teachers’ intention to take part in pro-environmental behaviour. The mean value calculated for environmental uses component of the ELQ is 4.12 with a standard deviation of 0.64. Most of the science and technology teachers were agree on the items related to plants and animals’ role in the

environment (95.1 %); necessity of the laws regarding water quality to be stricter (94.9 %); importance of the environmental awareness (93.8 %); and the necessity of laws to make recycling mandatory (93.7 %). Tuncer et al. (2009); obtained similar findings from their studies indicating high levels of intention to take part in pro-environmental behavior. On the other hand, Buhan (2006) worked with 300 preschool teachers from İstanbul and found that teachers are lacking in sufficient behavior concerning environmental awareness and protection. Another study dealing with environmental behavior was conducted by Goldman, Yavetz, and Peer (2006). They studied on the level of environmental behavior of new students in 3 major teacher-training colleges in Israel. Findings indicated that graduates of the educational system who chose to prepare themselves to be teachers were characterized by a low level of environmental literacy, as reflected in their environmental behavior. Candidate teachers demonstrated limited performance of behaviors that require a high level of commitment, and hence, reflect a high level of environmental literacy.

Although this study found high level of intention to take part in pro-environmental behaviour, many other studies conducted on environmental behaviors showed low levels of environmental behavior. The reason for this difference may be the results of different focus of the studies like “intention to act” and “act”.

In short, it can be inferred as a result that, science and technology teachers of this study are intended to use natural resources in a responsible, protective manner and they believe in the importance of individual responsibilities as well as the governmental precautions.

The concern level of the participants is found to be very high. Their concern level for each environmental problem can be listed as hazardous wastes (94.7 %), industrial pollution (94.6 %), global warming (94.6 %), ozone depletion (93.8 %), poor drinking water quality (90.0 %), automobile emissions (88.6 %), indoor air pollution (86.5 %), and noise pollution (78.5 %). The mean value for the environmental

concern for the science and technology teachers was calculated as 4.40 with a 0.82 standard deviation. Tuncer et al. (2009) found slightly different results from their study conducted with preservice teachers. Their average mean was found to be 3.97. Preservice teachers in Tuncer et al.'s study, poor drinking water quality, indoor air pollution, and ozone depletion. The priority difference between two studies can be explained by two main reasons. Tuncer et al. (2009) collected their data in 2006, Ankara. In 2005 a serious water shortage problem was experienced by the residents of Ankara. Moreover, smoking has not been banned in closed areas at that time but the related law, restricting indoor smoking, put into practice in 2010. Moreover, everyday, citizens of the world are facing more and more environmental problems so increasing concern for environmental problems can be understandable in this manner.

5.1.2 Environmental Literacy at Regional Level

These four components of environmental literacy were also evaluated at regional levels for all of the 12 subregions. The regional differences were analyzed in terms of the mean values of the components of environmental literacy of the science and technology teachers. Descriptive studies indicated some differences among regions.

West of Marmara (Tekirdağ, Balıkesir, Çanakkale) subregion placed among the first three in terms of mean values for environmental knowledge, use, and concern dimensions. Similarly, Northeast Anatolia subregion (Erzincan, Kars, Ağrı) located at the first five means for all components. Middle East Anatolia subregion (Elazığ, Van, Muş) is also placed among the first five means for all components except concern component. On the other hand, teachers from İstanbul, Middle Anatolia (Kayseri, Niğde, Yozgat), and Mediterranean subregions (Adana, Hatay, Kahramanmaraş) placed among the lowest five mean scores for all of the environmental literacy components.

West of Marmara (Tekirdağ, Balıkesir, Çanakkale), East of Marmara (Kocaeli, Bolu, Düzce) and Northeast Anatolia (Erzincan, Kars, Ağrı) subregions indicated the highest knowledge levels among the other regions. On the other hand, İstanbul, West Black Sea (Zonguldak, Çorum, Tokat), and Middle Anatolia (Kayseri, Niğde, Yozgat) subregions obtained the lowest mean scores from environmental knowledge questionnaire.

On the other hand East Black Sea (Rize, Giresun, Gümüşhane), West Black Sea (Zonguldak, Çorum, Tokat), and Northeast Anatolia (Erzincan, Kars, Ağrı) subregions showed highest positive attitude toward environment but İstanbul, Mediterranean (Adana, Hatay, Kahramanmaraş), and Middle Anatolia (Kayseri, Niğde, Yozgat) showed the lowest positive attitude toward environment.

Teachers from East Black Sea (Rize, Giresun, Gümüşhane), Northeast Anatolia (Erzincan, Kars, Ağrı), and West of Marmara (Tekirdağ, Balıkesir, Çanakkale) showed higher intention to act proenvironmental behaviors than the others. On the other hand, teachers from Aegean (İzmir, Aydın, Afyon), Middle Anatolia (Kayseri, Niğde, Yozgat), and Mediterranean (Adana, Hatay, Kahramanmaraş) subregions obtained the lowest mean values from this component of environmental literacy.

Mean values for environmental concern component were the highest for West of Marmara (Tekirdağ, Balıkesir, Çanakkale), West Black Sea (Zonguldak, Çorum, Tokat), and East of Marmara (Kocaeli, Bolu, Düzce) subregions, and lowest for Southeast Anatolia (Gaziantep, Şanlıurfa, Şırnak). Middle Anatolia (Kayseri, Niğde, Yozgat), and Mediterranean (Adana, Hatay, Kahramanmaraş) subregions.

West of Marmara subregion has taken attention with its high mean scores for environmental knowledge, use, and concern components. Teachers from Tekirdağ, Balıkesir, and Çanakkale got the higher values than the teachers from the other subregions. These three provinces are partially industrialized regions but at the same time, especially Balıkesir and Çanakkale are the provinces in which environmental

activists perform their studies to protect Ida Mountains from the effects of gold mining. Several awareness campaigns which were put into practice in these regions may have an effect on teachers' environmental literacy.

Teachers from West Black Sea subregion indicated little environmental knowledge but high level of positive attitude and concern about environmental issues. Similar to the West of Marmara subregion, people from West Black Sea region faced with a serious threat against their local environment; establishments of many hydro electric power plants. A social movement had been started to prevent the construction of new hydroelectric power plants. This movement may help to explain the high positive attitudes and high level of concern for environmental issues.

By looking through the highest mean values of the subregions on environmental literacy components, it can be concluded that teachers from more industrialized regions, facing more environmental problems, reaching less natural resources are tended to have higher scores from the environmental literacy tests.

It is possible to find several research studies indicating the effect of regional differences on environmental literacy. One of them was conducted by Teksöz, Tekkaya and Erbaş (2009). They analyzed a nationwide data obtained from the Programme for International Student Assessment (PISA) 2006 for students from 7th, 8th, 10th, and 11th grades. Result showed that there is a significant effect of geographical regional difference on students' responsibility towards natural resources and environment. Mean values showed that students in the Eastern Anatolia and South-eastern Anatolia Regions seem more optimistic than all other regions but they have lower awareness and concern toward environmental issues. Another study indicating the effect of regional differences was conducted by Taşkın (2004). Results revealed that although the mean scores of students do not differ to a statistically significant extent depending on the geographical regions, interviews showed the effect of regions on participants.

Results of the current study revealed that the area of residence has an effect on environmental literacy of science and technology teachers in Turkey. This result can be used to develop regional strategies to have teachers with higher levels of environmental literacy.

5.1.3 Relationships among environmental literacy components

As a result of the correlation analysis, all components of environmental literacy are found to be positively correlated with each other ranging from very little to moderate relations.

The correlation between knowledge and attitude components showed a weak positive relation with ($r=.296$) so knowledge of the participants helps to explain 8 % of their variance in their views about environmental attitude. Similar to this result, Makki et al. (2003) found a small correlation between environmental knowledge and attitude of Lebanese secondary school students. On the other hand, Tuncer et al. (2009) and DeChano (2006) could not find any correlation between knowledge and attitude dimensions of the environmental literacy.

Similar to the knowledge-attitude relation, the relationship between environmental knowledge and use components with $r=.295$ indicated a statistically significant positive relation but the relation is weak. The knowledge of the participants helps to explain about about 8 % of their variance in their views about environmental use. Tuncer et al. (2009) showed small correlation between pre-service teachers' environmental knowledge and use but Yavetz, et al. (2010) studied with students at the end of their studies, in three academic colleges of education observed no relationship between environmental behavior and knowledge. At the end of their studies, Negev, et al. (2008) obtained similar results with Yavetz, et al. (2010) and could not see any significant correlation between environmental knowledge and behavior of 6th and 12th-grade students.

The lowest correlation observed from the current study is from knowledge and concern components ($r=0.223$). There is a very weak relationship. Environmental knowledge of a participant explains just less than 5 % of the variance in their concern view.

Relatively stronger relationships were observed between environmental attitude component with concern dimensions ($r=0.446$). This means attitude dimension explains 19% of the variance in participants' concern mean. Tuncer et al. (2009), on the other hand, found a smaller correlation between the respondents' environmental attitude and concern with $r = .20$.

The highest r value (0.675) for the zero order correlation of this study was obtained from the relationship of attitude and use dimensions which means one can explain 45 % of the variance in participants' views on environmental use ($r^2 = 0.4556$) by the help of attitudes of the same participant group. Similarly, Ökeşli (2008) found a strong correlation between 'attitude and use' components of environmental literacy. Yavetz et al. (2010) also obtained the highest correlation of their study between attitudes and behavior of the students.

Moreover, positive, moderate and significant correlation was found between use and concern dimensions ($r=0.518$ and $p<.01$). The coefficient of determination ($r^2 = .2683$) indicates that environmental use of participants explains 26 % of the variance on their environmental concern. The relationships among the components of the environmental literacy have been analyzed by Ökeşli (2008) and the strongest correlation found between 'use and concern' variables among the components of EL.

The strongest correlations were found between attitude-use and use-concern components of EL. These results indicate that teachers with high level of positive environmental attitude and high concern level have a strong possibility to express more responsibility toward environment.

Furthermore, the weak correlation of environmental knowledge component with the environmental attitude, use and concern components indicated that environmental knowledge does not change much things on environmental problems by itself. Environmental knowledge can be labeled as “the necessary but not enough” agent of environmental education.

5.1.4 Characteristics affecting the environmental literacy

Depending on the related literature, 13 factors were investigated as the potential predictors of environmental literacy and some found to have an effect on environmental literacy of science and technology teachers.

5.1.4.1 Gender

Results of the study showed that gender can explain 4.1 % of the environmental literacy variable. When the means are compared, female teachers are seen as with lower environmental knowledge mean scores than their male counterparts. On the other hand, all other means, including environmental attitude, use, and concern dimensions, indicated higher mean values for female teachers. 0.6 % of multivariate variance of knowledge and 3.4 percent of the environmental concern can be explained by gender effect.

In line with the other studies, the current research found that female teachers have more positive attitudes, higher responsibility and sensitivity toward environment. The environmental knowledge levels of female teachers, on the other hand, determined as lower than the male teachers' environmental knowledge level. Although there are some studies (eg. Akbaş, 2007; Kyridis, Mavrikaki, Tsakiridou, Daikopoulous, and Zigouri, 2005) indicating no or little effect of gender on environmental literacy components, most of the reseraches dealing with the effect of gender on environmental literacy, obtained positive results. Tuncer et al., 2009; Varışlı, 2009; İstanbullu, 2008; Alp, Ertepinar, Tekkaya, and Yılmaz, 2006; Yılmaz and Andersen, 2004; Tikka et al., 2000; and Owens, 2000 are some examples of such studies that

found similar results with the current study.

At that point “why” question arises; why females have higher environmental literacy levels for attitude, use and concern components? Many theories used to explain gender difference in environmental area. One of them is named as “socialization theory”. As stated by Zelezny, Chun, and Aldrich (2000), this theory states that behavior is predicted by the process of socialization, whereby individuals are shaped by gender expectations within the context of cultural norms. On the other hand, another theory named as “social structure theory” states that gender differences are caused by division of labor and power. As Petersen and Hyde (2010) reported, division of labor gives the breadwinner role to males and homemaker role to females. The theory also indicates the power effect on gender differences. Although this gender disparity in power is true for most areas of the world, the magnitude of the power differential varies (Petersen and Hyde, 2010)

This difference between males and females can be explained by combining both of those theories. Cultural norms push females into certain social roles and feelings despite their desires. Together with their given homemaker role of females with their lower power levels in the society, environmental literacy levels of female science and technology teachers are higher especially for three EL components; attitude, use, and concern.

5.1.4.3 Experience

Results indicated that 1.2 % of environmental literacy is associated with experience of participants. The teachers having experience less than one year have the lowest knowledge level. Teachers’ knowledge level increases during their first ten year of teaching then decreases. A very similar pattern was observed for use component. Teachers with experience less than 1 year had the lowest mean value for the items of this component. Their mean increased during first ten years of their teaching after then decreased continuously. 1.5 % of environmental knowledge can be explained by experience while 2.2 % of the environmental concern can be explained by

experience.

Related literature supports the effect of experience on environmental literacy. For example, Owens (2000) worked on the EL of urban middle school teachers and found that years of teaching experience played a strong role in environmental sensitivity, awareness and values, and environmental behaviors, but displayed no significant role in environmental knowledge and total EL. Similarly, Aydemir (2007) showed the effect of experience on environmental literacy. Aydemir (2007) worked with 183 elementary school teachers of Ankara and found that the main predictor of teachers' knowledge were teaching experience, class hours taught in a week and being a part of an environment project. Moreover, Petegem, Blicck, and Boeve-De Pauw (2007) studied with preservice teachers. They observed that the non-science teachers, with little environmental education experience, did not feel responsible, because they understood EE to be a task for science teachers. When researcher evaluated the results after 5 year of implementation, science teachers as well as non-science teachers lost their feelings of uncertainty and felt more involved in EE.

Although several studies indicated the importance of experience, the underlying reasons for this effect of experience needs to be defined clearly by further studies and must be used to develop new strategies for the improvement of environmental literacy of beginning teachers.

5.1.4.3 Education Level

After the necessary analyses were conducted, it was seen that education level has no effect on environmental literacy of science and technology teachers. This result should be taken into consideration that increasing education level does not mean an increase in environmental literacy of science and technology teachers. Since all the answer choices of the question was about the higher education, this no effect can be explained by the absence of environmental education at higher levels of education and indicates the need for revising higher education programs in an interdisciplinary manner.

5.1.4.4 Residence

Results of the current research revealed no effect of the childhood residence on environmental literacy. There are some studies indicating the effects of childhood residence like the study conducted by Goldman et al.,(2006). They investigated the level of environmental behavior of new students in teacher-training collages of Israel and found that students from urban environments were less active than students who spent their childhood in a rural environment. Yılmaz and Andersen (2004), on the other hand, found that students living in urban areas, displayed more positive attitudes toward environmental issues. In addition to these studies, Teksöz et al. (2009), indicated the effect of geographical regions in which 15 years old Turkish students live. All these results indicating controversial effects of residence but interestingly current study showed no effect of childhood residence on EL.

5.1.4.5 Environmental Knowledge Source

Although there are some studies indicating the effect of environmental knowledge source on environmental literacy, current study revealed no effect of the environmental knowledge source on environmental literacy. Mert's (2006) study is one of them indicating the effect of knowledge source. Environmental knowledge and attitude of 1341 high school students were investigated by Mert (2006) and she found that watching ecological documentaries and having sources for environmental issues in their libraries make a difference on their environmental knowledge level and attitudes toward environment. Varışlı (2009), on the other hand, indicated similar result with the current study. She found no statistically significant effect of source of information about environment on students' environmental literacy.

5.1.4.6 Perception of the Importance of Environmental Education

A statistically significant multivariate effect of importance perception of environmental education with respect to environmental literacy variable was observed from the study. According to the results, about 2.4 % of environmental

literacy was associated with importance perception of environmental education of participants. Moreover 1.4 % of multivariate variance of attitude can be explained by importance perception of environmental education. Additionally, 1.7 % of multivariate variance of use component can be explained by importance perception of environmental education. For environmental concern component, only 0.9 % of the environmental concern can be explained by this factor.

This result can be explained by the mutual effect of environmental literacy and importance perception of environmental education but it needs further investigation to understand cause-effect relation.

5.1.4.7 Having Environment Related Course

Although there are studies indicating the effect of having an environmental course on environmental literacy, current study revealed no effect of having an environmental course on EL. Owens (2000) worked urban middle school teachers and obtained different results. He showed that taking preservice and inservice environmental courses have a positive impact on environmental behavior, environmental sensitivity, awareness and values but has no effect on environmental knowledge. Moreover, Aydın's (2008) study revealed that "guidance perception" and "academic efficacy perception" of the undergraduate preservice primary school teachers who have taken a course in environmental science are relatively higher.

The result of this study indicating no effect of having environmental related course may be caused by the inadequate explanation given by the related item. Teachers were asked whether they had an environmental related course during their university education or not but any explanation was given for that course. This ambiguity may broaden the alternatives for respondents and they may have chosen incorrect alternative regarding their own education history. An alternative explanation may be the inadequacy of the courses given at universities on environmental issues. For both cases, this result should be seen as a warning and teacher educators should focused on the way that they use to educate their students.

5.1.4.8 Environmental interest

According to the result of canonical correlation analysis, the teachers' perception of interest is highly correlated to the first canonical variate. This result is in line with the related literature, and proved the well known relation between interest and educational outcomes. Ökeşli (2008) obtained similar result with the current study. She showed that students who were interested in environmental issues had better knowledge about environmental issues, more positive attitude towards environmental issues, more positive view on environmental uses and service and concern environmental problems. Pande (2001) worked with the teachers and found that teacher's interest and motivation are the most significant factors on their effectiveness in teaching environmental education. This outcome of the study indicates the necessity of making individuals interested about environmental issues. Educational programs and activities should be planned by taking this necessity into consideration for all levels of education.

5.1.4.9 Environmental importance perception

Similar to the results obtained from several studies (Tuncer et al., 2009; Ökeşli, 2008; Ünal, 2008), the current study indicated that the environmental importance perception makes a difference on environmental literacy of the participants. This result indicates the importance to design environmental education programs by taking this point into consideration.

5.1.4.10 Self assessment of environmental knowledge

According to the result of canonical correlation analysis, the teachers' self assessment on environmental knowledge highly correlated to the first canonical variate. Similarly, Hsu (1997) indicated the effect of perceived knowledge of environmental problems on responsible environmental behaviors. Tuncer et al. (2009) obtained similar results by the end of their studies with preservice teachers from Turkey.

5.1.4.11 Outdoor activities

According to the result of the analysis, the teachers' outdoor activity choices are highly correlated to the first canonical variate. According to the present data, the most popular outdoor activity choice of the science and technology teachers of this study is walking (94.7%). They rarely engage in activities like, camping, bird watching and fishing. Whereas, 47.4% of the science and technology teachers watch documentaries once a week, 50.1% participate Non Governmental Organizations' (NGO) activities ones or twice in a year, 25 % read books and magazines ones a week and 27 % visit environment related web sites ones a week.

5.1.4.12 Income

The first canonical variate was negatively associated with income variable. The related literature includes several studies investigating the effect of income on environmental literacy of individuals and most of them indicated a difference on environmental literacy levels caused by income levels. Negev et al. (2008) indicated a significant relation between income and environmental literacy. They found that children in the middle socioeconomic group scored higher than did children in the low or high group socioeconomic characteristics were moderately associated with environmental literacy. Taşkın (2008) found similar result with Negev et al (2008). According to Taşkın's result, middle and lower middle class students have the highest score on the GAP. Yılmaz and Andersen (2004), on the other hand, indicated the students with high family income, displayed more positive attitudes toward environmental issues. Additionally, Uzun and Sağlam (2005) stated the same positive effect of middle economical class on students' environmental awareness.

This difference from the literature may be the result of the narrow range of income levels of the participants. Since all of the respondents are teachers at state schools and have the same salaries, the only difference of their income came from the incomes of other family members.

5.1.4.13 Age

Canonical correlation analysis showed that, the teachers' ages slightly correlated to the first canonical variate. Similarly, Kışoğlu (2009) found a significant effect of age on environmental knowledge component of the environmental literacy of prospective teachers. Moreover Alp, Ertepinar, Tekkaya, and Yılmaz (2006) expressed that age has a significant effect on environmentally responsible behavior of 6th, 8th and 10th grade students.

5.2 Conclusion

As Makki et al. stated (2003) "although today's world faces with many environmental problems, humans continue to engage environmental unfriendly behaviors at the individual, corporate, governmental, and societal levels."

Those increasing environmental problems leads to the increase for the demand on improved environmental education whose aim is educating environmentally literate individuals. According to Morrone, Mancl, and Carr (2001), "those individuals are equipped with more than just knowledge about ecology; a completely literate person combines knowledge with values, which leads to action."

"Environmental education's ultimate aim of changing environmental behavior is a formidable goal that cannot be accomplished easily (Knapp, 2000)." Since teachers' attitudes toward a particular subject has been found to influence performance and retention of learned subject matter (Mosothwane, 1992), they are thought as the key factors of environmental education. If science teachers have misconceptions on current environmental issues, they will possibly perpetuate them in their classrooms (Khalid, 2003; Çakır et al., 2010).

Çakır et al. (2010) indicated the importance of the question "whether or to what extent current science teacher education programmes prepare prospective teachers

for this challenge.”

Because of teachers’ multiplier effect on their students, it is important to determine their current environmental literacy levels in Turkey. There is not any country wide environmental literacy study conducted with Turkish teachers. Erdoğan, Marcinkowski, and Ok (2009) also stated the need for researches in Turkey indicating the relationship between categorical (demographic) variables and environmental literacy components.

In this study, science and technology teachers’ environmental literacy levels, their relationship with each other and some predictors of environmental literacy were investigated. Participants are found to be possessed moderate environmental literacy. All environmental literacy components positively correlated with the others. Moreover, gender, experience, perception of importance of environmental education, importance perception of environment, importance of environmental problems, self evaluation on environmental knowledge, income, age, and environmental activity choices are the factors affecting environmental literacy of the teachers.

More studies can be conducted to determine the environmental literacy of individuals and to find the ways of improving this literacy.

As a conclusion, environmentally literate citizens are indispensable expectations for the future generations and necessary actions should be taken in any field where it is necessary.

5.3 Implications of the study

This countrywide environmental literacy study provide several implications for policy developers, teachers, and teacher educators. According to the results, almost 23 % of the respondents were found to be inadequate in terms of environmental knowledge. Because of this alarming result, teacher education programs should be revised and improved by providing more time for environmental education with a

broaden curriculum. Besides university education, this environmental education also can be given as inservice training by Ministry of National Education.

Results also indicated the internet, radio and TV programs as the most popular environmental knowledge source so these agents should be used more effectively not only for teacher education but also for the education of the society as a whole.

Since the results indicating the correlation between environmental attitude and use, concern components of environmental literacy, they should be taken into consideration to develop more responsible environmental behaviors for science and technology teachers. Program developers should focus on increasing the positive environmental attitudes. Moreover, this study revealed the important correlation between environmental use and concern relationship which should not be ignored during environmental literacy studies.

Moreover several factors were determined affecting environmental literacy of the respondents. Gender, experience, perception of the importance of environmental education, environmental interest, environmental importance, self assessment of environmental knowledge, outdoor activities, and age are those factors found to be affective on environmental literacy. Those factors should be taken into consideration during policy and program development. They should also be considered during the education period.

Results indicated the effect of outdoor activities on environmental literacy levels of teachers. For this reason, teachers should be encouraged to attend environmental related activities during and after their education by attending the studies of social clubs, outdoor activities participating environmental non-governmental organizations etc.

Because the results indicated no effect of having environmental related course to the environmental literacy level, environmental courses should be re-designed and

environmental issues should be incorporated into the several subjects.

An open-ended question was asked to the respondents on their views on any point relating environment. They stated their views on several parts of the environmental issues. Most of them indicated the need for compulsory environmental courses for all levels of education including preschool and university. Participants also stated their need for training materials for environmental education. Science and technology teachers enrolled to the study also pointed the importance of cooperation between schools and local authorities on environmental education. They expect financial and administrative support of local governments on environmental activities such as environment festivals, competitions, field trips etc.

5.4 Recommendations for Further Researches

The study can be repeated with a different sampling procedure or by using another instrument to assess environmental literacy. Such studies are going to provide the chance to compare the results of the present study.

The present study conducted with science and technology teachers. Since environmental education is an interdisciplinary area, the teachers from other fields of study should also possess environmental literacy. Hence, studies must be conducted with teachers of every field to determine their level of environmental literacy.

More qualitative studies can be conducted in the field of environmental education to determine the views of teachers and their suggestions to improve environmental education including new methods, materials etc.

Moreover, the effects of several variables on environmental literacy were tested in the current research but they can be retested by further researches and some other variables like the academic majors of the science and technology teachers can also be included to the next studies.

This study implied the effects of some variables like gender; experience etc. on environmental literacy of the participants, more researches can be conducted to see the underlying reasons for this effect. These results can be used to redesign the environmental education at all levels.

Further studies are also necessary to understand the effect of environmental related course and environmental literacy levels, the missing points of such courses and alternative methods to develop those courses to increase the environmental literacy levels of teachers and students.

The current study has an item asking whether the participants have an environmental related course or not but the details of the course were not investigated. Further researches can cover such a question and help to explain the profile of courses taken on environmental issues.

Although most of the environmental researches are conducted with students and teachers in Turkey, there is also need to assess the environmental literacy level of the whole society to be able to overcome the problematic points on the citizens' environmental literacy.

The only open-ended part of the questionnaire was about the general views of participants but some other open ended questions can be added to get more detailed information.

Since this study was conducted to cover the gap of determining studies for nationwide sampling of teachers in Turkey, it does not give much information about the reasons of the results. The new studies on the reasons can help to develop new strategies for environmental education.

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APPENDIX A

PERMISSION FOR PILOT STUDY

T.C.
ANKARA VALİLİĞİ
Milli Eğitim Müdürlüğü

BÖLÜM : İstatistik Bölümü
SAYI : B.B.08.4.MEM.4.06.00.06-312/27717
KONU : Araştırma İzni
Elvan KAHYAOĞLU


22.03/2010

ORTA DOĞU TEKNİK ÜNİVERSİTESİNE

İlgi : a) MEB Bağı Okul ve Kurumlarda Yapılacak Araştırma ve Araştırma Desteğine
Yönelik İzin ve Uygulama Yönergesi.
b) Üniversitenizin 04/03//2010 tarih ve 420-1429 sayılı yazısı.

Üniversiteniz Ortaöğretim Fen ve Matematik Alanları Eğitimi EABD Doktora öğrencisi Elvan KAHYAOĞLU'nun "Türkiye'deki ilköğretim Fen ve Teknoloji Dersi öğretmenlerinin çevre okur-yazarlığı düzeyleri ve etkileyen faktörler." konulu tez ile ilgili çalışma yapma isteği Müdürlüğümüzce uygun görülmüş ve araştırmanın yapılacağı İlçe Milli Eğitim Müdürlüğüne bilgi verilmiştir.

Mühürlü anketler (7 sayfa) ekte gönderilmiş olup, uygulama yapılacak sayıda çoğaltılması ve çalışmanın bitiminde iki örneğinin (CD/disket) Müdürlüğümüz İstatistik Bölümüne gönderilmesini rica ederim.


Gülçin UYSAL
Müdür a.
Müdür Yardımcısı

EKLER :
Anket (7 sayfa)

İl Milli Eğitim Müdürlüğü-Beşevler
İstatistik Bölümü
Bilgi için: Nermin ÇELENK

Tel : 212 66 40/200---223 75 22
Fax: 223 75 22
istatistik06@meh.gov.tr

APPENDIX B

PERMISSION FROM METU ETHIC COMMITTEE



Orta Doğu Teknik Üniversitesi
Middle East Technical University
Öğrenci İşleri Daire Başkanlığı
Registrar's Office

06531 Ankara, Türkiye
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Fax: +90 (312) 2107960
www.ouib.metu.edu.tr

B.30.2.ODT.72.00.00/420-3251

27/5/2010

MİLLİ EĞİTİM BAKANLIĞINA
(Eğitimi Araştırma ve Geliştirme Daire Başkanlığı)

Üniversitemiz Ortaöğretim Fen ve Matematik Alanları Eğitimi Anabilim Dalı Doktora Programı öğrencisi Elvan Kahyaoglu'nun "Türkiye'deki İlköğretim ve Teknoloji Dersi Öğretmenlerinin Çevre Okur Yazarlığı Düzeyleri ve Etkileyen Faktörler" başlıklı çalışmasına ilişkin olarak ekli listede belirtilen Millî Eğitim Bakanlığına ilköğretim okullarında uygulama yapmak için, öğrencinin isteği doğrultusunda görevlendirilmesi Etik Komite onayı ile uygun görülmüştür. Araştırmanın başlatılabilmesi için Doktora ve Doktora Üstü Araştırma Çalışmalarında, Araştırmacıya Yapılacak Eğitim Araştırmaları Desteğine İlişkin Protokol ekte gönderilmektedir.

Gereğini arz ederim.

Saygılarımla.


Nesrin Ünsal
Öğrenci İşleri Daire Başkanı

Ekler:
1-Protokol

APPENDIX C

PERMISSION FROM EARGED

T.C.
MILLÎ EĞİTİM BAKANLIĞI
Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı

Sayı : B.08.0.EGD.0.07.00.00.311-254/1348
Konu : Araştırma

27/05/2010

ORTA DOĞU TEKNİK ÜNİVERSİTESİ REKTÖRLÜĞÜNE


İlgi : 26.04.2010 tarih ve B.30.2.ODT.72.00.00-400-2670/5585 sayılı yazı

Üniversiteniz Ortaöğretim Fen ve Matematik Alanları Eğitimi Anabilim Dalı Doktora öğrencisi Elvan KAHYAOĞLU'nun "Türkiye'deki İlköğretim Fen ve Teknoloji Dersi Öğretmenlerinin Çevre Okur Yazarlığı Düzeyleri ve Etkileyen Faktörler" konulu araştırma önerisi Bakanlığımızca incelenmiş ve desteklenmesi uygun bulunmuştur.

Ek-1'de gönderilen protokolün imzalanarak Bakanlığımıza gönderilmesi hâlinde, araştırma resmen başlatılmış olacaktır.

Ayrıca, destek verilen araştırmalarla ilgili olarak araştırmacılar tarafından, protokol gereği hazırlanmış olan ve Ek-2'de gönderilen "Destek Araştırmaları Gelişim Raporu" formunun her altı ayda bir doldurularak, Bakanlığımız Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığına gönderilmesi gerekmektedir.

Bilgilerinizi ve gereğini rica ederim.


Dr. Halil Rahman AÇAR
Bakan a.
Daire Başkanı

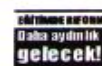
EKLER :

EK 1: Protokol (1 Adet-3 Sayfa)

EK 2: Destek Araştırmaları Gelişim Raporu Örneği (1 Adet-1 Sayfa)



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APPENDIX D

ÇEVRE OKUR YAZARLIĞI ANKETİ İÇİN UYGULAMA YÖNERGESİ

Bu anketin amacı Türkiye'deki devlet ilköğretim okullarında görev yapan Fen ve Teknoloji dersi öğretmenlerinin çevre ile ilgili tutum, bilgi ve ilgilerini değerlendirmektir ve tamamlanması yaklaşık 15-20 dakika alacaktır.

Anketin uygulanması sırasında aşağıdaki hususların göz önünde bulundurulması gerekmektedir;

- ✓ İliniz şehir merkezinde ve taşrada görev yapan öğretmenlerden, resmi yazıda belirtilen sayılarda Fen ve Teknoloji dersi öğretmenin bu anketi tamamlaması beklenmektedir.
- ✓ Anketin tamamlanmasında gönüllülük ilkesine uyulmalı, kimse anketi doldurması için zorlanmamalıdır.
- ✓ Anket sonuçlarının gerçekleri yansıtması için sonuçların gizli kalacağı ve bunun katılımcıları değerlendirme ve not verme çalışması olmadığı bilinmeli, bu tür çağrışımlara yol açacak tutum ve davranışlardan kaçınılmalıdır.

Bu çalışma ile ya da sizin katkılarınız ile ilgili sorularınız için Elvan Kahyaoğlu'nu 0 535 218 63 05 no'lu telefondan arayabilirsiniz.

Yardımlarınız ve katkılarınız için teşekkür ederiz.

APPENDIX E

ENVIRONMENTAL LITERACY QUESTIONNAIRE

FORM ID			
1	3	8	8
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

ÇEVRE OKUR YAZARLIĞI ANKETİ GÖNÜLLÜ KATILIM FORMU

Orta Doğu Teknik Üniversitesi'nde gerçekleştirilen bir doktora çalışmasının parçası olan bu anketin amacı Türkiye'deki devlet ilköğretim okullarında görev yapan Fen ve Teknoloji dersi öğretmenlerinin çevre ile ilgili tutum, bilgi ve ilgilerini değerlendirmektir. Anketin tamamlanması yaklaşık 15-20 dakikanızı alacaktır. Bu çalışmaya katkılarınız gönüllü olmanıza bağlı olup, çalışmanın sonuçlandırılabilmesi açısından çok değerlidir. Bu anketten elde edilecek verilerin değerlendirilmesi aşamasında, anketin son bölümünde yer alan kişisel bilgiler kesinlikle gizli tutulacaktır.

Bu çalışma ile ya da sizin katkılarınız ile ilgili sorularınız için Milli Eğitim Bakanlığı Eğitimi Araştırma ve Geliştirme Dairesi Başkanlığı (Tel: 0 312 230 36 44 / 4122) veya Elvan Kahyaoğlu (e-posta: elvankahyaoğlu@gmail.com) ile iletişim kurabilirsiniz.

Eğer bu çalışmaya gönüllü olarak katkıda bulunmayı kabul ediyorsanız sonraki bölümlerde yer alan soruları yanıtlamaya geçiniz ve **lütfen her soru için bir seçenek işaretleyiniz.**

ÇEVRE OKUR YAZARLIĞI ANKETİ

Bu bölümdeki sorular katılımcıların çevre sorunları konusunda kendilerini değerlendirmeleri amacıyla hazırlanmıştır. Lütfen her soru için verilen seçeneklerden birini işaretleyiniz.

- Çevre sorunları ile ne kadar ilgilisiniz?**
1 Çok fazla 2 Yeteri kadar 3 Biraz 4 Pek az 5 Hiç
- Aşağıdakilerden hangisi sizin görüşünüze en yakındır?**
1 Çevre, günümüzde insanların karşı karşıya olduğu en önemli iki ya da üç problemden biridir.
2 Çevre önemli bir problemdir, ama daha önemli başka problemler de vardır.
3 Çevre önemli bir problem değildir.
4 Çevre bir problem değildir.
- Çevre konuları ve problemleri ile ilgili, genel olarak, ne kadar bilginiz olduğunu düşünüyorsunuz?**
1 Çok 2 Yeteri kadar 3 Biraz 4 Hiç 5 Fikrim yok
- 4. - 14. Sorular katılımcıların çevre konusundaki bilgilerini ölçmeyi amaçlamaktadır. Lütfen düşüncelerinizi her tümce için verilen seçeneklerden birini işaretleyerek belirtiniz.**
- Çok çeşitli bitki ve hayvan türleri vardır ve bunlar çok farklı ortamlarda yaşamaktadır. Bu düşünceyi tanımlamak için kullanılan sözcük hangisidir?**
1 Çeşitlilik 2 Biyolojik çeşitlilik 3 Sosyo-ekonomik 4 Evrim 5 Bilmiyorum
- Türkiye'de karbon monoksit hava kirliliği yaratan önemli bir kirlenendir. Aşağıdakilerden hangisi en önemli karbon monoksit kaynağıdır?**
1 Fabrikalar ve işyerleri 2 İnsanların nefes alıp vermesi 3 Motorlu araçlar
4 Ağaçlar 5 Bilmiyorum
- Türkiye'de elektrik üretimi büyük ölçüde nasıl gerçekleştirilmektedir?**
1 Petrol, kömür ve odun yakılarak 2 Nükleer santraller ile 3 Güneş enerjisi ile
4 Hidro elektrik santralleri ile 5 Bilmiyorum
- Türkiye'deki akarsu ve deniz kirliliğinin en temel nedeni nedir?**
1 Arıtılmamış evsel, sanayi ve tarımsal atık sular 2 Bahçe ve caddelerden akan sular
4 Kumsal ve plajlardan atılan çöpler 5 Şehir çöplerinin boşaltılması
3 Bilmiyorum
- Aşağıdakilerden hangisi yenilenebilir bir kaynaktır?**
1 Petrol 2 Demir Madeni 3 Ağaçlar 4 Kömür 5 Bilmiyorum
- Ozon, atmosferin üst katmanlarında koruyucu bir tabaka oluşturur. Ozon bizi aşağıdakilerden hangisinden korur?**
1 Asit yağmurları 2 Küresel ısınma 3 Sıcaklıktaki ani değişimler
4 Zararlı, kansere neden olan güneş ışığı 5 Bilmiyorum
- Türkiye'de çöplerin büyük bir kısmı nereye atılır?**
1 Denizler 2 Yakma tesisleri 3 Geri dönüşüm merkezleri
4 Çöp depolama alanları 5 Bilmiyorum

DEVAMI İÇİN ARKA SAYFAYI ÇEVİRİNİZ. →

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

① Çevre ve Orman Bakanlığı ② TEMA ③ Tabiatı Koruma Vakfı
④ Türkiye Çevre Eğitim Vakfı ⑤ Bilmiyorum

12. Aşağıdaki evsel atıklardan hangisi zararlı atık olarak adlandırılabilir?

① Plastik ambalajlar ② Cam ③ Piller ④ Yemek artıkları ⑤ Bilmiyorum

13. Hayvan türlerinin nesillerinin tükenmesinin en yaygın sebebi nedir?

① Pestisitler hayvanların ölmesine yol açmaktadır. ② Yaşam alanları insanlar tarafından yok edilmektedir.
③ Avcılık çok artmıştır. ④ İklim değişiklikleri hayvanları etkilemektedir.
⑤ Bilmiyorum.

14. Bilim adamları nükleer atıkların depolanması ile ilgili çalışmalarında henüz sonuca ulaşamamışlardır. Şu anda dünyada yaygın olan nükleer atık depolama yöntemi nedir?

① Nükleer yakıt olarak kullanılmaktadır ② Başka ülkelere satılmaktadır
③ Çöp depolama alanlarında depo edilmektedir ④ Depolanmakta ve kontrol altında tutulmaktadır
⑤ Bilmiyorum

Aşağıdaki tümceler katılımcıların insan ve çevre ilişkisini nasıl algıladıklarını anlamak amacıyla hazırlanmıştır. Lütfen düşüncelerinizi her tümce için verilen seçeneklerden birini işaretleyerek belirtiniz.

Kesinlikle Katılmıyorum - Katılmıyorum - Kararsızım - Katılıyorum - Kesinlikle Katılıyorum

1 2 3 4 5

15. Dünya nüfusu barındırabileceği insan sayısına ulaşıyor. ① ② ③ ④ ⑤

16. Doğanın dengesi çok hassas ve kolaylıkla bozulabilir. ① ② ③ ④ ⑤

17. İnsanoğlu doğal çevreyi kendi ihtiyacına göre değiştirebilme hakkına sahiptir. ① ② ③ ④ ⑤

18. İnsanoğlunun temel amacı doğaya hükmetmektir. ① ② ③ ④ ⑤

19. İnsanoğlu doğayı kullandığı zaman genellikle felakete sonuçlanıyor. ① ② ③ ④ ⑤

20. Bitkiler ve hayvanlar insanların yararı için vardır. ① ② ③ ④ ⑤

21. Sağlıklı bir ekonomi için endüstriyel gelişmenin kontrol edildiği ekonomik sistem gereklidir. ① ② ③ ④ ⑤

22. İnsanoğlu yaşamını sürdürebilmesi için doğa ile uyum içinde yaşamalıdır. ① ② ③ ④ ⑤

23. Dünya bir uzay gemisi gibi sınırlı alan ve kaynaklara sahiptir. ① ② ③ ④ ⑤

24. İnsanoğlunun doğaya uymasına gerek yoktur çünkü insanoğlu doğayı kendi ihtiyacına göre düzenleyebilir. ① ② ③ ④ ⑤

25. Dünya kaynaklarının limiti vardır. ① ② ③ ④ ⑤

26. İnsanoğlu ciddi bir şekilde doğayı tahrip ediyor. ① ② ③ ④ ⑤

Bu bölümdeki sorular uygulamaya yöneliktir. Lütfen aşağıda verilen her tümce için verilen seçeneklerden sizin için en uygun olanını işaretleyiniz.

Kesinlikle Katılmıyorum - Katılmıyorum - Kararsızım - Katılıyorum - Kesinlikle Katılıyorum

1 2 3 4 5

27. Soyu tükenmekte olan türler için özel alanlar ayrılmalıdır. ① ② ③ ④ ⑤

28. Su kalitesi ile ilgili yasalar daha etkili sonuçlar almaya yönelik olmalıdır. ① ② ③ ④ ⑤

29. İnsanların et ihtiyaçlarının karşılandığı vahşi hayvanlar korunması gereken en önemli türlerdir. ① ② ③ ④ ⑤

30. Zehirli yılanlar ve böcekler insanlar için tehdit oluşturduklarından öldürülmelidirler. ① ② ③ ④ ⑤

31. Yasalar toprak sahiplerinin sulak alanlarını tarımsal ve endüstriyel amaçlar için kullanmalarına izin vermemelidir. ① ② ③ ④ ⑤

32. Herkesin çevre sorunlarının farkında olması çok önemlidir. ① ② ③ ④ ⑤

33. Şahıslar sahip oldukları arazileri istedikleri şekilde kullanmakta serbest olmalıdır. ① ② ③ ④ ⑤

34. Çevre sorunlarının çözümlenmesinde kişisel sorumlulukların olduğunu düşünüyorum. ① ② ③ ④ ⑤

35. Hükümet, vahşi hayatın korunması amacı ile özel mülkiyet alanlarının kullanımını denetlemelidir. ① ② ③ ④ ⑤

36. İnsanlar çevreye verdikleri her türlü zarardan sorumlu tutulmalıdır. ① ② ③ ④ ⑤

37. Bitki ve hayvanların tümü doğada önemli bir role sahiptir. ① ② ③ ④ ⑤

38. Teknolojik değişimlerin çevre için yararları olduğu kadar zararları da vardır. ① ② ③ ④ ⑤

39. Geri dönüşümün zorunlu olması yönünde yasalar hazırlanmalı ve uygulanmalıdır. ① ② ③ ④ ⑤

40. Hava kirliliği ile ilgili yasalar yeteri kadar serttir. ① ② ③ ④ ⑤

41. Çevre problemlerinin çözümünde bilim ve teknoloji çok önemlidir. ① ② ③ ④ ⑤

42. Çevre problemlerinin çözümünde kültürel farklılıklar çok önemlidir. ① ② ③ ④ ⑤

43. İnsanların değer yargılarının değişmesi çevre problemlerinin çözümünde rol oynayacaktır. ① ② ③ ④ ⑤

44. Halkın katılımı çevre problemlerinin çözümünde önemli bir yer tutar. ① ② ③ ④ ⑤

45. Yaşam alışkanlıklarındaki değişimler (tüketim gibi) çevre problemlerinin çözümünde önemli rol oynayacaktır. ① ② ③ ④ ⑤

Bu bölümdeki sorular aşağıda verilen çevre problemleri için genel olarak ne kadar endişeli olduğunuzu ölçmek amacıyla hazırlanmıştır.

Lütfen her madde için verilen seçeneklerden sizin için uygun olanını işaretleyiniz.

Endişelenmiyorum - Az Endişeleniyorum - Fikrim Yok - Biraz Endişeleniyorum - Çok Endişeleniyorum
1 2 3 4 5

46. Duman kirliliği.	1	2	3	4	5
47. Ses kirliliği.	1	2	3	4	5
48. Otomobil emisyonları.	1	2	3	4	5
49. Endüstriyel kirlilik.	1	2	3	4	5
50. Zararlı atıklar.	1	2	3	4	5
51. Kalitesiz içme suyu.	1	2	3	4	5
52. Kapalı alanlarda oluşan hava kirliliği.	1	2	3	4	5
53. Ozon tabakasının delinmesi	1	2	3	4	5
54. Küresel ısınma.	1	2	3	4	5

KİŞİSEL BİLGİLER

Yukarıdaki ankete verdiğiniz yanıtları daha kapsamlı değerlendirebilmek için size bir kaç kişisel soru sormak istiyoruz. Bu bölümde vereceğiniz yanıtların gizli tutulacağını lütfen unutmayınız.

55. Kaç yıldır öğretmenlik yapıyorsunuz?

- ① 1 yıldan az ② 1-5 yıl arası ③ 6-10 yıl arası
④ 11-15 yıl arası ⑤ 16-20 yıl arası ⑥ 21 yıldan fazla

56. Eğitim düzeyiniz aşağıdakilerden hangisi ile ifade edilebilir?

- ① Ön lisans ② Lisans/ Eğitim Fakültesi
③ Lisans / Eğitim Fakültesi Dışındaki Bir Fakülte ④ Yüksek Lisans
⑤ Doktora

Aşağıdaki etkinlikleri ne sıklıkta yaparsınız?

Haftada Bir - Ayda Bir - Yılda Bir veya İki Defa - Hiç Yapmam
1 2 3 4

57. Kamp	1	2	3	4
58. Açık havada yürüyüş	1	2	3	4
59. Kuş gözleme	1	2	3	4
60. Balık tutma	1	2	3	4
61. Avcılık	1	2	3	4
62. Çevre ile ilgili belgeselleri izleme	1	2	3	4
63. Çevre ile ilgili kitap/dergi vs okuma	1	2	3	4
64. Çevre ile ilgili internet sitelerini ziyaret etme	1	2	3	4
65. Çevre konusunda çalışan sivil toplum kuruluşlarının faaliyetlerine (konferans, panel, piknik vb) katılma	1	2	3	4

66. Çocukluğunuzu (18 yaşına kadar) geçirdiğiniz bölge aşağıdakilerden hangisi ile tanımlanabilir?

- ① Kırsal alan, çiftlik ② Kırsal alan, çiftlik değil (nüfusu < 2,500 kişi)
③ Küçük kasaba (nüfusu 2,501 ile 25,000 kişi arasında) ④ Kentsel alan (nüfusu 25,001 ile 100,000 kişi arasında)
⑤ Büyük şehir (nüfusu 100,000 kişiden fazla)

67. Çevre konuları ile ilgili bilgiye ulaşırken en sık kullandığınız araç hangisidir?

- ① İnternet ② Radyo ve Televizyon programları ③ Dergi, gazete
④ Sosyal çevre, arkadaşlar ⑤ Çevreyle İlgili Sivil Toplum Örgütlerinin Çalışmaları ⑥ Diğer

68. Çevre eğitimi konusundaki düşünceniz nedir?

- ① Çevre konusu çok önemlidir ve eğitimi mutlaka verilmelidir
② Çevre konusu çok önemlidir ama eğitiminin verilmesi şart değildir
③ Çevre eğitiminin verilmesi gereksizdir
④ Kararsızım

FORM ID

1	3	8	8
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

69. Çevre eğitimi ile ilgili eksikliğini duyduğunuz konular nelerdir

- 1 Eksikliğini duyduğum bir konu bulunmamaktadır
 2 Çevre eğitimi konusunda yeterli bilgiye sahip değilim
 3 Etkili çevre eğitimi yöntemleri konusunda yeterli bilgiye sahip değilim
 4 Çevre eğitimi için gerekli materyallere ulaşamıyorum
 5 Diğer

70. Cinsiyetiniz nedir?

- 1 Erkek
 2 Kadın

71. Hangi yılda doğdunuz?

1	9		
0	0	0	0
1	1	1	1
2	2	2	2
3	3	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

72. Ailenizin toplam aylık geliri hangisine yakındır?

- 1 2000 liradan az
 2 2000-5000 lira arası
 3 5000-15.000 lira arası
 4 15.000 liradan fazla

73. Üniversite eğitiminiz sırasında çevre konusunda her hangi bir ders aldınız mı?

- 1 Evet 2 Hayır

Öğrencilerinizin çevre ile ilgili konuları öğrenmeleri için aşağıdaki etkinliklere başvuruyor musunuz ?

Evet - Hayır
1 2

74. Müze ziyaretleri	<input type="radio"/> 1 <input type="radio"/> 2
75. Çevre gezileri	<input type="radio"/> 1 <input type="radio"/> 2
76. Ders dışı çevre projeleri (araştırma projeleri dahil)	<input type="radio"/> 1 <input type="radio"/> 2
77. Yarışmalar	<input type="radio"/> 1 <input type="radio"/> 2
78. Diğer	<input type="radio"/> 1 <input type="radio"/> 2

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

Katkılarınız için teşekkür ederiz.

CURRICULUM VITAE

PERSONAL INFORMATION

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EDUCATION

Degree	Institution	Year of Graduation
MS	Middle East Technical University, Secondary Science and Maths. Educ. Dept.	2004
BS	Middle East Technical University, Secondary Science and Maths. Educ. Dept.	2001

WORK EXPERIENCE

Year	Place	Enrollment
2006-Present	Ministry of National Education, Projects Coordination Center	Project Expert
2004-2006	29 Ekim Primary School, Ankara	Teacher
2001-2004	Kazan Primary School, Ankara	Teacher

FOREIGN LANGUAGES

English

PUBLICATIONS

-Yalvaç, B., Tekkaya, C., Çakıroğlu, J., Kahyaoğlu, E. (2007). Turkish Preservice Science Teachers' Views on Science, Technology and Society issues. *International Journal of Science Education*, Vol. 29, Iss. 3, p. 331 – 348.

-Kahyaoğlu, E., Çakıroğlu, J., Tekkaya, C., Yalvaç, B. (2007). Turkish Preservice Science Teachers' Views on Science, Technology, and Society Issues. Paper presented at *Annual Meeting of the National Association for Research in Science Teaching, NARST*, April, 7-10, Vancouver, 2004, p. 1-13