

MODELLING PRE-SERVICE SCIENCE TEACHERS' ENVIRONMENTALLY
FRIENDLY BEHAVIOURS IN RELATION TO
PSYCHOLOGICAL AND COGNITIVE VARIABLES

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ABSTRACT

MODELLING PRE-SERVICE SCIENCE TEACHERS' ENVIRONMENTALLY FRIENDLY BEHAVIOURS IN RELATION TO PSYCHOLOGICAL AND COGNITIVE VARIABLES

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The aim of the present study is in twofold: (1) to explore pre-service science teacher's knowledge of environmental issues, attitudinal motives (ecocentric and anthropocentric), internal locus of control, spatial optimism and temporal pessimism, and environmentally friendly behaviours and (2) to investigate the significant determinants of their environmentally friendly behaviours.

Data collected from 1497 junior and senior pre-service science teachers through knowledge of environmental issues scale, environmental attitude (ecocentric and anthropocentric) scale, environmental action internal control index, environmental future scale, and behaviour inventory of environmental action: a one-year history

Results indicated that Turkish pre-service science teachers who participated to the current study had inadequate level of knowledge about environmental issues. They found to endorse ecocentric attitudes, and express a high degree of internal locus of

control as well as spatial optimism and temporal pessimism. They also found to exhibit moderate level of environmentally friendly behaviour.

In order to examine the significant predictors of environmentally friendly behaviours, path analysis was conducted. Results revealed that attitudinal motives, internal locus of control, spatial optimism and temporal pessimism directly predict pre-service science teachers' environmentally friendly behaviours whereas knowledge of environmental issues indirectly. However, knowledge of environmental issues was found to indirectly affect pro-environmental behaviours of Turkish pre-service science teachers.

Keywords: Environmentally Friendly Behaviours, Attitudinal Motives, Spatial Optimism and Temporal Pessimism, Locus of Control, Knowledge of Environmental Issues.

ÖZ

FEN BİLGİSİ ÖĞRETMEN ADAYLARININ ÇEVRE DOSTU DAVRANIŞLARININ PSİKOLOJİK VE BİLİŞSEL DEĞİŞKENLER KULLANILARAK MODELLENMESİ

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Bu çalışmanın amacı fen bilgisi öğretmen adaylarının çevre sorunları hakkındaki bilgi düzeylerinin, çevreye yönelik tutumlarının (insan merkezli ve çevre merkezli), içsel kontrol odaklarının, mekânsal iyimserlik ve zamansal kötümserlik algılarının ve çevre dostu davranışlarının araştırılması ve bu davranışların yordayıcılarının ortaya çıkarılmasıdır.

Çalışmanın verileri çevre sorunları bilgi ölçeği, çevreye yönelik tutum ölçeği, çevre eylemi içsel kontrol endeksi, çevre geleceği ölçeği ve çevre eylem davranış envanteri kullanılarak 1497 fen bilgisi öğretmen adayından toplanmıştır.

Betimsel analiz sonuçlarına göre, çalışmaya katılan fen bilgisi öğretmen adaylarının çevre sorunları hakkındaki bilgilerinin yeterli düzeyde olmadığı saptanmıştır.

Öğretmen adayları genellikle çevre merkezli değer yönelimlerine sahip olduğu çevre problemlerine karşı içsel kontrol odaklarının yüksek olduğu belirlenmiştir. Bunun yanı sıra mekânsal iyimserlik ve zamansal kötümserlik algılarının da olduğu tespit edilmiştir. Ayrıca, öğretmen adaylarının orta düzeyde çevre dostu davranış sergiledikleri bulunmuştur.

Fen bilimleri öğretmen adaylarının çevre dostu davranışlarının istatistiksel olarak anlamlı yordayıcılarını belirlemek amacı ile yol analiz yöntemi kullanılmıştır. Çalışma sonucunda, öğretmen adaylarının çevreye yönelik tutumlarının, içsel kontrol odaklarının, mekânsal iyimserlik ve zamansal kötümserlik ön yargılarının çevre dostu davranışları direkt olarak etkilediği ortaya çıkmıştır. Bununla birlikte, çevre sorunları hakkındaki bilgi düzeyinin, çevre dostu davranışı dolaylı olarak etkilediği bulunmuştur.

Anahtar Kelimeler: Çevre Dostu Davranış, Çevreye Yönelik Tutum, Mekânsal iyimserlik ve Zamansal Kötümserlik, İçsel Kontrol Odağı, Çevre Sorunları Hakkında Bilgi.

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To my Pumpkin

TABLE OF CONTENTS

PLAGIARISM	iii
ABSTRACT	iv
OZ.....	vi
ACKNOWLEDGMENTS.....	viii
DEDICATION	ix
TABLE OF CONTENTS	x
LIST OF TABLES	xiii
TABLE OF FIGURES	xv
CHAPTER	
1. INTRODUCTION.....	1
1.1. Research Questions.....	9
1.2. Significance of the study	9
1.3. Definition of Important Terms.....	11
2. LITERATURE REVIEW.....	13
2.1. Historical Roots of Environmental Education.....	14
2.2. Conceptual Framework of Environmental Education	19
2.3. The Role of Environmental Education in Teacher Education.....	20
2.4. Conceptual Framework of Environmentally Friendly Behaviour	22
2.5. Models Identifying Environmental Friendly Behaviour	23
2.6. Studies on Environmentally Friendly Behaviour and Associated Variables...33	
2.6.1. Studies on EFB and Associated Variables in Turkish Context.....	48
2.7. Predictors of Environmentally Friendly Behaviours	60
2.7.1. Cognitive Factors	60
2.7.2. Psychological Factors.....	62
2.7.2.1. Attitude.....	63
2.7.2.1. Internal Locus of Control	65
2.7.2.1. Optimism and Pessimism.....	67

3. METHOD.....	70
3.1. Design of the Study	70
3.2. Population and Sample	71
3.3. Variables	75
3.4. Data Collection Instruments	75
3.5. Validity and Reliability Issues of the Instruments	79
3.5.1. Content Validity of the Instruments.....	79
3.5.2. Construct Validity of the Instruments.....	79
3.5.3. Convergent Validity of the Instruments.....	88
3.5.4. Discriminant Validity of the Instruments.....	90
3.5.4. Nomological Validity of the Instruments.....	91
3.6. Analysis of Data	91
3.7. Threats to Internal Validity	94
3.8. Threats to External Validity	95
4. RESULTS	96
4.1. Preliminary Analysis	96
4.2. Descriptive Statistics	100
4.2.1. Environmentally Friendly Behaviour Profiles of Pre-Service Science Teachers.....	101
4.2.2. Environmental Attitude Profile of Pre-service Science Teachers.....	110
4.2.3. Spatial Optimism and Temporal Pessimism Profile of Pre-service Science Teachers.....	118
4.2.1. Internal Locus of Control Profile of Pre-service Science Teachers.....	127
4.2.1. Environmental Knowledge Profile of Pre-service Science Teachers	131
4.3. Path Analysis Results	135
4.3.1. Assumptions of Path Analysis	135
4.3.2. Results of Path Analysis	140
4.3.2.1. Initial Models	141
4.3.2.2. Model Fit Indices and Modification Index.....	142

4.3.2.3. Results of Direct, Indirect, and Total Effects of Revised Models....	144
4.4. Summary of Results	158
5. DISCUSSION, CONCLUSION and IMPLICATIONS	162
5.1. Conclusion and Discussion of the Results.....	162
5.2. Implications of the Study.....	178
5.3. Limitations and Recommendation for Further Research.....	180
REFERENCES.....	183
APPENDICES.....	198
A.THE QUESTIONNAIRE USED IN THE STUDY	198
B.EXTENDED TURKISH SUMMARY	206
C. CURRICULUM VITAE	226
D. TEZ FOTOKOPİSİ İZİN FORMU	227

LIST OF TABLES

TABLES

Table 3.1 The list of selected provinces in each statistical region	72
Table 3.2 Region and province statistics across gender.....	73
Table 3.3 Profile of pre-service science teachers.....	74
Table 3.4 Explanatory factor analysis pattern (and structure) for two-factor model.	82
Table 3.5 Goodness-of-fit indices of the model for BIEA.....	84
Table 3.6 Latent variables, observed variables, β , λ_x , R^2 , and δ of BIEA	85
Table 3.7 Goodness-of-fit indices of the model for EAICI and EAS	87
Table 3.8 Latent variables, observed variables, β , λ_x , R^2 , and δ of EAICI	87
Table 3.9 Latent variables, observed variables, β , λ_x , R^2 , and δ of EAS	88
Table 3.10 Item correlations, reliability coefficients, composite reliability, average variance explained values of BIEA and EAS	89
Table 3.11 Discriminant validity statistics.....	90
Table 4.1 Missing data statistics of each variable in the model.....	97
Table 4.2 Residual statistics for outliers	98
Table 4.3 Univariate normality statistics	99
Table 4.4 Multivariate normality statistics.....	100
Table 4.5 Mean scores, standard deviation, minimum and maximum values of variables in the model.... ..	101
Table 4.6 Means and standard deviations of light and dark green actions with respect to gender and hometown.....	102
Table 4.7 Frequency distributions of participant responses to light green action statements and corresponding item means and standard deviations.....	107
Table 4.8 Frequency distributions of participant responses to dark green action statements and corresponding item means and standard deviations.....	109
Table 4.9 Means and standard deviations of ecocentric and anthropocentric attitude with respect to gender and hometown.....	111
Table 4.10 Item descriptive summary for the ecocentric items of the EAS	115

Table 4.11 Item descriptive summary for the anthropocentric items of the EAS	117
Table 4.12 Means scores and standard deviations of current and expected environmental conditions regarding local, national, and global	118
Table 4.13 Item descriptive summary of local, national and global environmental issues in terms of their current and expected situations	126
Table 4.14 Mean scores and standard deviations of internal locus of control with respect to gender and hometown	127
Table 4.15 Item descriptive summary for the dimensions of the LOC	131
Table 4.16 Mean scores and standard deviations of knowledge of environmental issues with respect to gender and hometown	132
Table 4.17 Item descriptive summary for environmental knowledge statements	135
Table 4.18 Pearson product-moment correlations of variables in the model.....	139
Table 4.19 Selected model fit criteria and acceptable fit interpretation.....	142
Table 4.20 Fit indices of the proposed (initial) models.....	143
Table 4.21 Fit indices of the revised models.....	144
Table 4.22 Direct, indirect and total path coefficients for model-1	151
Table 4.23 Direct, indirect and total path coefficients for model-2	151
Table 4.24 Direct, indirect and total path coefficients for model-3	156
Table 4.25 Direct, indirect and total path coefficients for model-4	156

LIST OF FIGURES

FIGURES

Figure 1.1 Proposed model for environmentally friendly behaviours and its associated variables	7
Figure 2.1 Early linear model of knowledge-attitude-behaviour	24
Figure 2.2 The model of responsible environmental behaviour	25
Figure 2.3 Behavioural flow chart: major and minor variables involved in environmental citizenship behaviour	28
Figure 2.4 Theory of reasoned action	30
Figure 2.5 Planned behaviour theory	32
Figure 3.1 The overview of the study	71
Figure 3.2 Scree plot of exploratory factor analysis	81
Figure 4.1 Mean scores of light and dark green actions across gender.....	103
Figure 4.2 Mean scores of light and dark green actions across hometown.....	104
Figure 4.3 Mean scores of light and dark green actions across regions.....	105
Figure 4.4 Mean scores of ecocentric and anthropocentric attitude across gender..	112
Figure 4.5 Mean scores of ecocentric and anthropocentric attitude across hometown.....	113
Figure 4.6 Mean scores of ecocentric and anthropocentric attitude across regions.	114
Figure 4.7 Mean scores of today and future spatial optimism levels across gender.....	119
Figure 4.8 Mean scores of today and future spatial optimism levels across hometown.....	120
Figure 4.9 Mean scores of today and future spatial optimism levels across regions	121
Figure 4.10 Mean scores of local and global temporal pessimism across gender ...	123
Figure 4.11 Mean scores of temporal pessimism across hometown.....	124
Figure 4.12 Mean scores of temporal pessimism across regions	125
Figure 4.13 Mean scores of internal locus of control across gender.....	128

Figure 4.14 Mean scores of internal locus of control across hometown.....	129
Figure 4.15 Mean scores of internal locus of control across regions.....	130
Figure 4.16 Mean scores of environmental knowledge across gender	132
Figure 4.17 Mean scores of environmental knowledge across hometown	133
Figure 4.18 Mean scores of environmental knowledge across regions.....	134
Figure 4.19 Histogram of residuals	138
Figure 4.20 Normal P-P plot of residuals.....	138
Figure 4.21 Scatter plot of predicted value and residual.....	140
Figure 4.22 Proposed main model of environmentally friendly behaviour	141
Figure 4.23 Standardized path coefficients for model-1	145
Figure 4.24 Standardized path coefficients for model-2	149
Figure 4.25 Standardized path coefficients for model-3	153
Figure 4.26 Standardized path coefficients for model-4	157
Figure 4.27 Environmentally friendly behaviours model of pre-service science teachers.....	159

CHAPTER 1

INTRODUCTION

Stockholm Conference is the first United Nations conference emphasize on human activities related to the environment. The conference concluded that international collaboration is highly necessarily for reducing the effects of human on the environment because most of the environmental problems are global (United Nations, 1972). In fact, one the earliest studies, Maloney and Ward (1973, pp. 583-584) drew attention to the role of human being in environmental damage by stating:

The solution to such problems does not lie on traditional technological approaches but rather in the alteration of human behaviour..... We must “go to the people” in an attempt to understand these behaviours. We must determine what the population “knows” regarding ecology, the environment, and pollution; how they feel about it; what commitments they are willing to make; and what commitments they do make. These are the necessary antecedent steps that must be made before an attempt can be made to modify critically relevant behaviour.

This statement can be considered as an early hint emphasizing the role of environmental psychology and environmental education (EE) on the solution of environmental problems. Considering the growing attention to environmental problems since 60s, environmental education has come out as a possible solution for better environment and protection of natural resources. Accordingly, the essential aim of the environmental education is proposed as to educate individuals who adopted environmentally friendly behaviours (EFB) (Hines, Hungerford, & Tomera, 1986-87; Hungerford & Volk, 1990). In this context, well-developed environmental education programs have aimed to raise environmentally sensitive individuals (Jurin & Fortner, 2002). So, does environmental education reach its targets? The answer of this issue based on National Environmental Education Training Foundation (NEEFT)

is “yes” (Coyle, 2005). According to NEEFT, before the sprawling of the environmental education, people used to see the environment as a resource to be exhausted for the use and benefit of the people and worry about the environment very little. In this regard, people’s awareness may be increase in parallel with the help of environmental education. In spite of increased awareness and sensitivity developed toward environment, human behaviour is still assumed to be one of the most major contributors to the environmental issues (Gardner & Stern, 2002) studies have shown that the friendly behaviours toward environment could not be established yet (Kollmuss & Agyeman, 2002; Lee, 2008).

Accordingly, several models have been proposed in attempt to determine factors influencing individuals’ general behaviours (e.g. Ajzen & Fishbein, 1980; Ajzen, 1991) as well as specific environmental behaviours (e.g. Ramsey & Rickson, 1977; Hines et al., 1986/87; Hungerford & Volk, 1990). In their early attempt, Ramsey and Rickson (1977) suggested a linear relationship among knowledge, attitude, and behaviour in their model. They claimed that knowledge will help to amend environmental behaviour and thus enhance environmentally friendly behaviour. Ajzen and Fishbein (1977), on the other hand, stated that there was found no correspondence between the elements of attitudinal and behavioural entries. Moreover, the research revealed discrepancy between attitude and behaviour and since then, this gap has been tried to be explained by the researcher. One of the reasons of this gap is caused from attitude-behaviour measurement (Rajecki, 1982). Ajzen and Fishbein mentioned the measurement discrepancy issue in the Theory of Reasoned Action (Fishbein & Ajzen, 1975) and the Theory of Planned Behaviour (Ajzen & Fishbein, 1980). This theory is concerned with three relationships: intentions to a given behaviour; a weighted combination of attitudes and subjective norms to intentions; outcome-behavioural and normative beliefs to attitudes and subjective norms. In other words, there are four basic notions which are belief, attitude, intention and behaviour. According to the theory, behaviour is assumed as a function of intention and the attitudes affect the behaviour. In other words, individuals who state that they are willing to realize the environmental actions, play

an important role in the resolution of these problems. The theory gives importance to the beliefs or value systems of the individuals for the potential behavioural change (Ajzen & Fishbein, 1977). According to the model, the individual should be motivated to behaviour without any punishment and reward because theory claimed that behaviour takes its shape in regard to the logical evaluations of the individuals (Bamberg & Möser, 2007). Another influential theory is Ajzen's Theory of Planned Behaviour (Ajzen, 1985; 1991). It is an extended version of the Theory of Reasoned Action and is based on the thesis that person's intention to do a particular behaviour is a fundamental factor. There are three conceptually independent predictors of behavioural intention; attitude toward the behaviour, subjective norm and perceived behavioural control. It is widely accepted that the more favourable the attitude and subjective norm is better the perceived behavioural control and accordingly is expected for a person to have stronger intention to engage in a given behaviour (Ajzen, 1985). According to the Theory of Planned Behaviour, it is also possible to benefit from the perceived behavioural control along with behavioural intention in terms of predicting behavioural achievement (Ajzen, 1991). Contrary to Theory of Reasoned Action, Theory of Planned Behaviour is also engaged with perceived behavioural control (Ajzen, 1991). When compared with the other, the theory of reasoned action is more applicable especially when under volitional control. However, when the volitional control is not taken into account, the theory of planned behaviour becomes superior especially in terms of predicting the target behaviour (Madden, Ellen, & Ajzen, 1992).

Particularly considering environmental behaviour, Hines et al. (1986/87) proposed "Model of Responsible Environmental Behaviour" on the basis of Ajzen and Fishbein's theory of planned behaviour. They conducted a comprehensive meta-analysis in the light of 128 studies and in the model four major categories of the variables were evident to be influential predictors of environmental behaviour. Cognitive variables namely, knowledge of environmental problems/issues, action strategies, and action skills; demographic variables such as age, gender, income, and education were observed to be correlated with EFB. Considering psycho-social

variables, attitude, locus of control, and personal responsibility were found to be the predictor of behaviour. Furthermore, in the scope of Hines and colleagues' study, experimental studies were also analysed to investigate the EFB through classroom and behavioural intervention strategies. Results of the study indicated that increased intention to take action towards environmental problem/issue fostered EFB. Intention variable was a combination of cognitive, psycho-social, and demographic variables. However sophisticated the framework seems than Ajzen and Fishbein's (1980), it is not enough to explain environmental responsible behaviour. Too many other factors have influence over environmental behaviour. Hines' et al. (1986/87) named these factors as the situational factors, including economic constrains, social pressures, and opportunities to choose different actions.

Along with Hines et al. (1986/87), many other researchers made great contributions with their research to the literature related to the behaviour (Sia, Hungerford, & Tomera, 1985/86; Sivek & Hungerford, 1989/90; Marchinkowski, 1988). Hungerford and Volk (1990) revealed the possible existence of three categories (entry-level variables, ownership variables, and empowerment variables) contributed to behaviour. Entry-level variables covered prerequisite variables such as environmental sensitivity, androgyny, knowledge of ecology and attitudes toward pollution/ technology/ economics. These variables are thought to increase the decision making process of people. Ownership variables are related to personal factors of environmental issues namely, in-depth knowledge (understanding) of issues and personal investment. Empowerment variables include knowledge of environmental action strategies, locus of control and intention to act. Human beings having high level of empowerment variables feel themselves that they are able to make changes and help to resolve the environmental problems and issues. As psychological and social variables influences on developing EFB, social-psychological research also investigated behaviour and its associated variables.

Previously mentioned models and theories revealed that cognitive variables such as knowledge of environmental problems/issues, knowledge of action strategies, and

skill using action strategies positively were related to environmentally friendly behaviours. These studies also indicated that some psychological variables such as attitudinal motives and locus of control have effect on environmental behaviour. In this regard, beside variables frequently used in previous studies, new variables should need to be investigated if they have an impact on friendly behaviour toward environment. For example, O'Brien's (2007) included optimism and pessimism level as a psychological variable, revealed a pessimistic worldview regarding global environmental issues that the overall quality of the environment would decline a lot in the past ten years. O'Brien (2007) claimed that if individuals maintained a pessimistic perception toward global environmental problems, they might not be willing to make effort for improving the situation. Similarly, McKinley (2008) stated that if an individual convinces him/herself that his/her future life will worsen; he/she may be unwilling to work in order to improve future life. Moreover, Gifford et al. (2009) reported that people have more optimism toward local environmental problems when compared to global problems indicating they have spatial optimism. They suggested that optimistic perception toward environmental problems inhibit pro-environmental behaviour because people underestimate the local problems due to their optimism. In parallel, according to Hatfield and Job (2001) if individuals do not worry about their future and be optimistic, they will not be willing to take precautions. Individuals' pessimism and optimism as a psychological variable also found to be related to locus of control and attitude which are the significant predictors of EFB. McElwee and Brittain (2009) in their study showed that individual's optimism have a negative correlation with New Ecological Paradigm (NEP) Scale indicating that optimistic people adopt negative attitude toward environment asserting that students' pessimism might be linked to their locus of control level (Carifio & Rhodes, 2002). They founded that pessimist individuals tended to exhibit high external locus of control. Therefore, researchers suggested that it might be expected that individuals with a pessimistic perception tended to exhibit less environmentally friendly behaviours.

To conclude, although the magnitude of the relationships differs depending the nature of the studies, it seems that there have been reached a consensus that environmental knowledge, attitude, and internal locus of control are significant predictors of environmentally friendly behaviour. On the other hand, optimism and pessimism are considered as a new constructs. Since using variables from previous research to develop a model is not useful, based on the literature it is thought that we have omitted a discussion on our perceptions about optimism and pessimism of our today and future or local area and World. We might be really enthusiastic about to change our behaviour or adopt positive attitudes; yet, we possibly will not do so. There can be made two explanations for this; first is that we have no faith in the positive effect that our behaviours will bring, in other words, we don't have enough optimism to motivate us (O'Brien, 2007). On the other hand, we have too much optimism that we end up in a highly unrealistic situation with no worries at all and correspondingly, no reason to exhibit environmentally friendly behaviours Hatfield & Job, 2001).

In this regard, the present study proposed a conceptual model explaining the probable predictors of the environmentally friendly behaviours by using knowledge of environmental issues, attitudinal motives, internal locus of control, spatial optimism and temporal pessimism. Figure 1.1 is given a structural model illustrating the assumed relationships between these constructs, based on the theoretical and empirical evidences gathered from the results of the previous studies. According to the model, it was proposed that individual's knowledge of environmental issues would contribute to their attitudinal motives, internal locus of control, and environmentally friendly behaviours. In addition, knowledge of environmental issues would have indirect effects on environmentally friendly behaviours through its effect on attitudinal motives and internal locus of control. In particular, it was proposed that individual's attitudinal motives and internal locus of control would be linked to their environmentally friendly behaviours. Attitudinal motives and internal locus of control would have also direct effect on spatial optimism and temporal pessimism. Moreover, attitudinal motives and internal locus of control would contribute to

environmentally friendly behaviour through spatial optimism and temporal pessimism. Finally, spatial optimism and temporal pessimism would have direct effect on environmentally friendly behaviours.

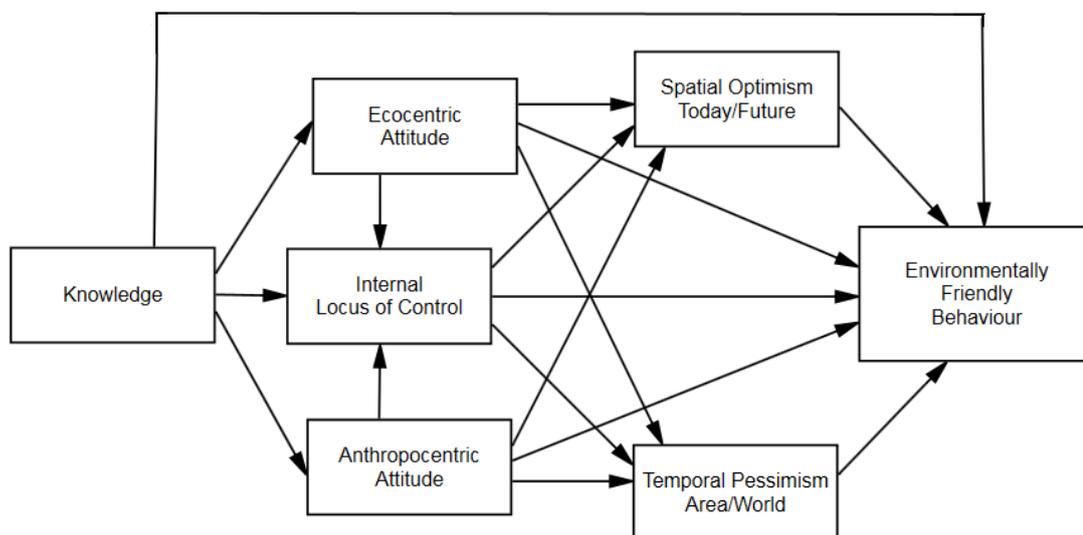


Figure 1.1 Proposed model for environmentally friendly behaviours and its associated variables.

Thus, this study will examine the complex nature of pre-service science teachers' environmentally friendly behaviours in a developing country – Turkey by means of measuring knowledge of environmental issues, attitudinal motives, internal locus of control, spatial optimism (today and future) and temporal pessimism (local and global). In this regard, a model is expected to enable us to understand better the environmentally friendly behaviours of Turkish pre-service science teachers. As is seen from the model, spatial optimism variable has two components which are today and future. Similarly, temporal pessimism also has two components named as local and global. So the main model tested both the current spatial optimism and future spatial optimism by putting them successively into the model. The same process was made for temporal pessimism, too. Local temporal pessimism and global temporal pessimism were tested by putting into the model separately. Thus; within this study, 4 different models could be tested depending on just one main model.

Considering the fact that the main goal of environmental education is to change behaviour, it would be crucial to understand the abovementioned determinants of environmental behaviour, which is an important issue to develop an effective environmental education. As the environmental education holds an important place in formal education, the reasons of the inadequacies in developing friendly behaviour toward environment could be fixed by enhancing formal education. In harmony with all the other reforms around the world, the education reform in Turkey supported the environmental conservation. For instance, environmental subjects including sustainable development, conservation behaviour, climate change, recycling, water pollution, deforestation, ozone layer depletion, global warming, renewable and non-renewable energy sources, and biodiversity are included in the existing curricula with the aim of raising individuals with good environmental knowledge and thus exhibiting environmentally friendly behaviours (MoNE, 2013). However, the integration of environmental subjects into curricula only is not enough. At this point, teachers, who are the educators of our future generations and one of the important factors of formal education, should be considered responsible for shaping and affecting students' interest in environmental issues (UNESCO, 1977). Tbilisi Intergovernmental Conference held in 1977 was the first international meeting that highlighted teachers' role in environmental education. It was suggested that teachers played a key role for they had the capability the shape a new generation who incorporated and practiced an effective environmental education curriculum. In order to achieve effective environmental education and raise environmentally literate citizens, teachers should have some competencies such as adequate knowledge, attitudes and skills regarding to environment (Gayford, 2002; UNESCO, 1987). However, it is evident that teachers have not possessed all those features at adequate level (e.g. Boubonari, Markos, & Kevrekidis, 2013; Goldman, Yavetz, & Pe'er, 2006; Pe'er, Goldman, & Yavetz, 2007; Tuncer, Tekkaya, Sungur, Cakiroglu, Ertepinar, & Kaplowitz, 2009). It is not possible for teachers who do not have environmentally friendly behaviours to help students to develop environmentally friendly behaviours. For this reason, many research have turned their attention to

explore individuals', in this case the teacher candidates, environmental behaviours and to the factors that are possibly associated their environmental behaviours.

1.1 Research Questions

- i. What are pre-service science teachers' environmentally friendly behaviours, attitudinal motives, knowledge of environmental issues, internal locus of control, spatial optimism (today and future), and temporal pessimism (local and global) in terms of gender, hometown, and geographical regions?
- ii. What is the nature of the relations among Turkish pre-service science teachers' environmentally friendly behaviours, knowledge of environmental issues, attitudinal motives, internal locus of control and their spatial optimism and temporal pessimism?

1.2 Significance of the Study

It is true that human have been exhausting the natural resources for improving the quality of life. However, this process has become a threatening factor to the environment we live in and also to us. Tung, Huang, and Kawate (2002) stated that most of the environmental problems that we face today are because of the lifestyles of humans. Therefore, life styles of human beings' seem to be major issue causing environmental problems. In this context, researchers studying on education, psychology and sociology have attempted to identify the factors affecting individual's behaviour towards the environment recently (Bamberg & Möser, 2007; Hines et al., 1986/87). However the number of the studies on the optimistic or pessimistic perspectives of individuals is really scarce. Instead, they generally focus on the variables such as knowledge, attitudes and internal locus of control since their effects are regarded as the most evident ones on the environmentally friendly behaviours. In that sense, the current study aimed to expand our knowledge regarding environmental education by proposing a model including the variables such as optimistic and pessimistic variables unlike other studies.

Considering the significant role of teachers in shaping society for environmentally friendly citizens, pre-service science teachers are crucial agencies as the teachers of the future. In that sense, pre-service science teachers were determined as the subjects of the present study because the most important element of an effective environmental education was shown as teachers (Plevyak, Bendixen-Noe, Henderson, Roth & Wilke, 2001). Teacher candidates with environmentally friendly behaviours are expected to handle environmental problems in different ways in their class, develop and use their own teaching materials, make their students adopt positive attitudes, awareness, and responsible behaviour toward environment. Therefore, as teachers are accepted as the key factors for environmental education (Loughland, Reid, & Petocz, 2002), identifying factors supporting or preventing their environmental behaviours is important.

The current study has a potential to contribute to the development of teacher education programs regarding environmental education. Besides the importance of factors influencing teachers' behaviours related to environmental decisions, it is also important to provide pre-service teachers with proper environmental education to influence their environmental behaviour change. However, when examining teacher education programs in Turkey, it is obvious that the environmental education do not get enough attention among other courses regarding amount of time and qualification. Accordingly, examining the predictors of pre-service teachers' environmentally friendly behaviours will enhance the content of environmental education programs although the ultimate goal of this study is not to develop an environmental education program. Although, increasing number of studies, models, and theories have attempted to demonstrate the factors encouraging environmental action, it is apparent that there is a gap between the intended outcomes and practice of environmental education (Volk, 1984). Considering Turkey as a developing country, it can be said that Turkey does not have a well-established environmental education policy (Tuncer, Ertepinar, Tekkaya, & Sungur, 2005). Therefore, it is believed that the outcomes of the current study will contribute to the development of more qualified environmental education programmes.

1.3 Definition of Important Terms

Knowledge of Environmental Issues:

Environmental knowledge means to be knowledgeable over the issues including environmental problems and issues. In other words, to have environmental knowledge means to have the ability to understand and evaluate the effects of the people over the environment (Gambro & Switzky, 1992). In the present study, junior and senior pre-service science teachers' knowledge level regarding environmental issues was assessed by twelve questions in multiple choice formats with five alternatives.

Environmental Attitudes: Attitude refers to a set of values and feelings of concern for the environment and motivation for actively participating in environment improvement and protection (UNESCO, 1978). According to Thompson & Barton (1994) individuals with ecocentric attitude appreciate the nature just because it is the nature and hold the opinion that it deserves protection because of its intrinsic value. On the other hand, individuals with anthropocentric attitude protect the environment because of its possible and long term consequences over the human life (Schultz & Zelezny, 1999). Junior and senior pre-service science teachers' attitudes toward environment were measured with Environmental Attitude Scale with 21 Likert type items with a 5 point response scale the instrument.

Internal Locus of Control: According to Rotter (1966) Internal Locus of Control (ILOC) refers to an individual's perception that events or outcomes of situation are the results of his/her own action. Considering environmental issues, ILOC refers to individual's perceived ability to influence the resolution of a discrete environmental problem or issues (Hsu, 1997). Junior and senior pre-service science teachers' internal locus of control toward environment was measured with Environmental Action Internal Control Index using 11 Likert-type items.

Spatial Optimism: Gifford et al. (2009) stated that people who have spatial optimism tended to view proximal conditions more favourably than distal conditions. If one thinks that environmental problems are better in his/her local area than the World it is named as Current Spatial Optimism. On the other hand, if one thinks that environmental problems will be better in his/her local area than World, it is named as Future Spatial Optimism. Junior and senior pre-service science teachers' current and future spatial optimism toward environment issues was measured with Environmental Future Scale including 15 environmental issues.

Temporal Pessimism: According to Gifford et al. (2009) temporal pessimism is a perception that "things will get worse". If one thinks that environmental problems will get worse in his/her local area it is named as Local Temporal Pessimism. On the other hand, if one thinks that environmental problems will get worse in World it is named as Global Temporal Pessimism. Junior and senior pre-service science teachers' local and global temporal pessimism toward environment issues was measured with Environmental Future Scale including 15 environmental issues.

Environmentally Friendly Behaviour: It refers to the variety of recognized approaches to environmental action available to individuals or groups for use in preventing or resolving environmental problems or issues (Mackinkowski, 1988). These environmental actions are categorized as: persuasion, consumer/economic action, eco-management, legal action, and political action. Junior and senior pre-service science teachers' environmentally friendly behaviours were measured with Behaviour Inventory of Environmental Action using 31 Likert type items.

CHAPTER 2

LITERATURE REVIEW

Today's people have experienced ceaseless economic growth and technological progress. Both of these have two faces: one is the good one with the conveniences that it has brought to our lives; yet, the other is the bad one with serious problems it has caused both in our social lives and environment (UNESCO, 1975). Environmental problems must be cared for they are great dangers for global warming, air and noise pollution, biodiversity loss, water shortages and etc. (Gardner & Stern, 2002; Winter & Koger, 2004; Vlek & Steg, 2007) which means that they are not insoluble in fact and could be overcome with behavioural change (Steg & Vlek, 2009). Citizens with environmentally friendly behaviour are required for the challenge against all those problems abovementioned and these citizens need to be provided the environmental education for developing such manners. In order to get people to attain the environmentally friendly behaviour it is all-important to investigate the determinants of that an action which demands a sustainable future (McKenzie-Mohr, Nemiroff, Beers, & Desmarais, 1995).

This chapter suggests a summary of the research literature related to the aim of this study for a thorough understanding of the pre-service science teachers' environmentally friendly behaviours. First, the landmarks of Environmental Education are mentioned in global sense with the help of conferences, declarations and seminars. Afterwards, conceptual framework of environmental education is mentioned by giving the evolution of the definitions, aims, objectives of Environmental Education from past to present. Then, the role of Environmental Education in teacher education is discussed. Subsequently different viewpoints concerning the environmentally friendly behaviour are allowed with the presentation of the behavioural models. Finally, upon examining the national and international

studies related to environmentally friendly behaviour and its associated variables, the predictors selected in the scope of the current study is discussed.

2.1 Historical Roots of Environmental Education

It is a fact that the environmental education has a very long history and has had various branches for appreciating the environment itself and dealing with the problems in an educational frame such as nature study, outdoor education and conservation education (Daudi & Heimlich, 2002). Nature study prevailing the late 19th and early 20th could be defined as the investigation of and the interaction with the natural world and its entire phenomenon and thus it focuses on the observation and thereafter the admiration of the objects as they exist as well as the processes as they go on (Disinger, 1983). On the other hand, the outdoor education which was often associated to taking students to camping has been exposed to a generalization as gaining the status to include all of the educations given out of doors from its initial conception as a focus only on nature study started during 1920s (Hammerman, Hammerman, & Hammerman, 2001). It is also stated by McCrea (2006) that outdoor education engages in structured education and utilises an outdoor framework for teaching. Yet, the foci of both nature study and outdoor education methods are to provide students with an actual setting, enabling them to centre on the nature in nature itself. For the conservation education there stands out a boom in 1930s in which the National Education Association played a key role with its upholder for this education in public schools throughout the nation. Within the scope of this practice called as the conservation education movement, Wisconsin became the first state to urge a teacher education program of which context consisted of the conservation of natural resources. This movement made a fine contribution to EE with its attention on the link between humans and nature and also the sagacious usage of resources.

Not only the educational attempts but also the art and literature were truly beneficial in calling people's attention to environmental issues. 1960s and the times thereafter witnessed the gradually growing apprehension on the environment. In the year 1962

there released *Silent Spring* by Rachel Carson, a book drawing attention to the destructive effects of pesticides, created a tremendous effect on public and also raised the awareness of how negatively the pollution affected the biogeochemical cycles of nature (Miller, 1990). 1972 was also a year the environmental movement was inflamed once again with the first photograph of the Earth taken by Apollo 17 (NASA 1972) which touched the hearts with its demonstration of our planet as with all its frailty and with the fact that its sources are not infinite.

In the period between 1960s and 1970s, many countries recognize the importance of relationship between human and natural world. In this regard, three international conferences held that can be regarded as the cornerstones of EE namely; Stockholm, Belgrade and Tbilisi. Moreover, the importance of the declaration of 22 April 1970 as the “Earth Day” cannot be underestimated. Presence of environmental degradation was first accepted and agreed in international area in The United Nations Conference on the Human Environment which was held in Stockholm in Sweden, in 1972 (United Nations, 1972). Stockholm Declaration was a sparkle in the development and distribution of EE. The need for environmental education was emphasized in this conference. Recommendation 96 from this conference stated the crucial role of environmental issues worldwide emphasizing extension of the existing curriculum which means to integrate the environmental education as to train people from every occupation or to develop and use new materials and methods in EE (McCrea, 2006). In the year 1975, the International Environment Workshop proposed this suggestion with a general acceptance of the statement of the Charter given in the following:

The goal of environmental education is to develop a world that is aware of, and concerned about, the environment and its associated problems, and which has the knowledge, skills, attitudes, motivations, and commitment to work individually and collectively towards solutions of current problems and the prevention of new ones.

1975 was the year in which the International Environmental Education Programme (IEEP) was established and become a cooperative activity between UNESCO and UNEP (UNESCO, 1975). IEEP was founded for the purpose of access the

information; research and experimentation; integrating environmental dimensions into EE; training of personnel; technical and vocational education; educating and informing the public; general higher education; special training; international and regional cooperation (Sato, 2006).

Two years after Belgrade, in 1977, another intergovernmental conference was held in Tbilisi, Republic of Georgia. The final report of Tbilisi set out goals, objectives, and guiding principles of EE many of which are still valid and useful today was published (UNESCO, 1977). Between the years 1978 and 1980, greater attention is devoted to the conceptual and methodological development of EE. During this period, many studies were performed considering different pedagogical aspects of EE in order to integrate an environmental dimension into the general educational practices. In this sense, The National Leadership Conference on Environmental Education was performed in Washington, D.C in 1978. "From Ought to Action" was published as an outcome of the conference. In this report, great emphasis was placed on in-service teacher education, accessibility and dissemination of materials (Stapp, 1978). IEEP published newspapers, books for the purpose of dissemination of concepts and methodological approaches to attract the attention to the EE practices in and out of the school considering the contents, methods and materials of training activities.

During the late 1980s, sustainability movement was started. World Commission on Environment and Development (WCED) published a report called as "Our Common Future" or "The Bruntland Report" in 1987. The importance of this is that, it was a pioneer for it was the first to touch on environmental sustainability. It targeted governments or the business world and, in general sense, all those people who are powerful and influential in the environment and development policies. It also enabled to examine the major environmental problems and the question of how to solve (Bruntland, 1987). In 1991, "Caring for the Earth: A Strategy for Sustainable Living" was published by Union of Conservation Scientists (IUCN), UNEP, and World Wide Fund for Nature (WWF). Report included 9 principals, 132 detailed

actions, and specific targets regarding for building sustainable societies. These principals and targets proposed a set of information and also served as a guide for governments, NGOs, and individuals (Munro & Holdgate, 1991). Environment and Sustainable was stated as a hot topic of many declarations in 1990s (i.e. The Talloires Declaration in 1990, The Halifax Declaration in 1991, and The Kyoto Declaration in 1993). Twenty years after the first global environment conference, Stockholm, “The Earth Summit” was held in Rio de Janeiro, Brazil in 1992. Principal themes of the conference were environment and sustainable development. By the scope of this conference, the United Nations (UN) tried to lead governments and business in order to rethink the patterns of production (particularly the production of toxic components, such as lead in gasoline, or poisonous waste), alternative energy resources, new reliance on public transportation, and scarcity of water. In this regard, five documents were published: Agenda 21, The Rio Declaration on Environment and Development, The Statement of Forest Principles, The United Nations Framework Convention on Climate Change, The United Nations Convention on Biological Diversity (United Nations, 1992). After that, in the 20th anniversary of the Tbilisi (1977) and 5th anniversary of Rio (1992), 81 countries come together for the purpose of both celebrating these conferences and also reorienting of education to the sustainable development in Thessaloniki, Greece in 1997 (Knapp, 1997). Education for a Sustainable Future: A Transdisciplinary Vision for Concerted Action was prepared as a background paper of this conference. The paper addressed the key role of education on achieving sustainable future. Report also emphasizes the need to reform curricula and educational policies as well as the importance of teachers’ education and training. Most importantly, shifting to suitable lifestyle by changing the attitudes and behaviours of people as both consumers and citizens were also discussed (UNESCO, 1997).

In the new decade, in 2002, UN organized a conference in Johannesburg, South Africa namely “The World Summit for Sustainable Development (WSSD)-Johannesburg Summit” (Sato, 2006). Five major environmental issues were discussed in the conference: water and sanitation, energy, health and environment,

agriculture, and biodiversity and ecosystem management, called “WEHAB” (EETAP, 2002). Conference aimed to indicate the link between human being and their local and global environment, and also links among social, environmental and economic decisions. United Nations General Assembly proclaimed the UN Decade of Education for Sustainable Development (UNDESD) for the period 2005-2014. It was a strategic document that tries to integrate the principals, values and practices of SD into all aspects of education and learning with the aim of addressing the social, economic, and cultural environmental issues that are faced in this century. In this sense, the UNDESD simply aims to enable everyone to take environmental education and so to realize the values and behaviours necessary for the sustainable environment (UNESCO, 2005). More recently, two decades later, “Earth Summit 2012” held in Rio de Janeiro, Brazil between 20-22 June. Political documents from this conference yielded clear and practical measures regarding implementation of sustainable development. Additionally, the conference also highlight on number of thematic areas such as energy, food security, oceans, cities, and decided to convene a Third International Conference on Small Island Developing States (SIDS) held in Apia, Samoa at 1-4 September 2014. It was realized that carrying out a conference with the participation of many countries had also impact on environment. In this regard, participants will make their own contribution to the sustainability of this conference in many ways for example, by using shuttle buses, reducing water and electricity consumption, using locally-grown produce, reducing paper consumption, using local business, climate-neutrality and carbon offsetting.

Eventually, many remarkable international conferences over the three decades have been contributed to the evolution of the mission and vision of the Environmental Education. Outputs of these conferences provide both theoretical backgrounds for the environmental education. In this context, definitions and objectives of environmental education is presented in the following part.

2.2 Conceptual Framework of Environmental Education

To raise awareness about the environmental issues people are aimed to be informed about the environment they live in. Within this frame there suggested to raise environmentally literate persons with the help of education and even though it will start locally, it will eventually help to produce global solutions to the environmental problems in general (Hungerford & Volk, 1990). In the first years of this attempt, the focus was on some different terminologies and the context of the environmental education was also different. Stapp et al. (1969, p.30) was the one presenting the earliest definition of EE.

Environmental education is aimed at producing a citizenry that is knowledgeable concerning the biophysical environment and its associated problems, aware of how to help solve these problems, and motivated to work toward their solution.

Human and Environment Conference held in Stockholm was the initial of the following conferences held to underline the importance of the protection of the environment and announce it as the main goal of human beings: the protection and pass of the environment uncorrupted to the next generations (United Nations, 1972). However this aim was too broad to be specified for the environmental education. More clear definition was reached in Tbilisi (UNESCO, 1978, p. 1):

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

In order to make the definition of environmental education more clear, five main topics were determined (UNESCO, 1978, p.3):

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 feeling 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

To reach the mentioned goals and aims of Environmental Education, perceiving the cosmos as a whole should be an important component of education programs. Therefore, Environmental Education curriculum was needed an interdisciplinary approach. Environmental Education is unique in that it is characterized by interdisciplinary integration of subject areas, problem- and issue-based learning experiences, child centred instruction, and constructivist approaches (NAAEE, 2001).

To sum up it could be said that those various rising remarks in terms of the goals of environmental education has been decreasing since there reached an consensus in Tbilisi Conference which is dearly beneficial for the development of environmental education. Perceiving the World as a huge network of phenomena connected strictly to each other will be helpful for us to put our own experiences into our senses (Schramm, 2002). So, it is possible to say that the Environmental Education's focus is on placing itself on the focus of the curriculum of life. In accordance with this, the role of teacher and teacher training in this process, being one of the most important components of environmental education will be elaborately analysed in the next part.

2.3 The Role of Environmental Education in Teacher Education

Integrating environmental issues into child education from earlier ages depends on the qualities of the teachers and also success in environmental education is primarily affected by the approaches of the teachers. Chawla (1998) emphasize the important role of teachers in environmental education. The results of his study indicated that environmental specialists explain the reason of choosing this profession due to their

role models. Their teachers shaped their decisions while choosing their professions. Thus; it has been primarily recommended to provide training for both pre-service and in-service teachers for the development of environmental education (UNESCO, 1978). For this reason, in many conferences having importance of environmental education, teacher education was emphasized as a priority.

For instance, in The Tbilisi Intergovernmental Conference the role of the teachers in environmental education has been underlined. Diverse learning environments and educational approaches were highlighted as guiding principles (UNESCO, 1975). In a similar way, The IEEP saw the preparation of the teachers as “the priority of priorities” for action to improve the effectiveness of environmental education (UNESCO-UNEP 1988, p. 1). The crucial role of teachers in EE process was summarized by Wilke (1985, p.1) with these words:

The key to successful environmental education is the classroom teacher. If teachers do not have the knowledge, skills and commitment to environmentalize their curriculum, it is unlikely that environmentally literate students will be produced.

In addition, Agenda 21 (1992) emphasize the importance of setting up pre-service and in-service training programmes for all teachers, promoting educational methods and developing innovative teaching methods for educational settings. In these conferences it has been agreed that the teachers are the main dependency in the point of the introduction of environmental education into schools. Even though teachers are a role model for the students with their responsible and sensitive behaviours towards the environment (Hungerford & Volk, 1990), the majority of the teachers do not have adequate knowledge about environmental issues and action strategies (Boubonari et al., 2013; Karatekin, 2013; Pe'er et al., 2007; Tuncer et al., 2009). Teksoz, Şahin, and Ertepinar (2010) supported that pre-service science teachers did not have adequate comprehension and subject matter knowledge about environmental issues. However, they seemed to utilize environmental issues into their applied curriculum. At this point, Kaplowitz and Levine (2005) indicated that giving a rise up to the degree of environmental knowledge of the next generation

teachers may be useful. Not only knowledge but also other components of EE such as awareness, attitudes, values, action skills, commitment, and participation should also enhance in pre-service and in-service education programmes.

Therefore, it can be said that teachers undertake a key role for environment education but they couldn't provide a deep understanding of environmental issues and behaviours. Individuals, in this study case the pre-service science teachers, have effected from many factors in the process of building a whole system for environmentally friendly behaviour. In this respect, these factors affecting environmentally friendly behaviour have to be examined as an important step to achieve the desired behaviour. Thus, in the next sections, conceptual framework of the environmentally friendly behaviour will be presented.

2.4 Conceptual Framework of Environmentally Friendly Behaviour (EFB)

In behaviour based environment education approach, developing environmentally friendly behaviours are the ultimate aim of the environment education (Culen, 2001; Hines, et al., 1986/1987). The researchers, who try to understand the nature of the environmentally friendly behaviours, determine the factors affecting these behaviours and then generally they develop educational efforts based on the manipulation of these factors. Therefore, prerequisite for developing EFB is deep understanding of the friendly behaviour toward environment and its determinants. In this regard, Hungerford and Volk (1990, p.9) identify environmentally responsible citizens as the ones who have:

- i. an awareness and sensitivity to the total environment and its allied problems and/or issues,*
- ii. a basic understanding of the environment and its allied problems and/or issues,*
- iii. feeling of concern for the environment and motivation for actively participating in environmental improvement and protection,*
- iv. skills for identifying and solving environmental problems and/or issues,*
- v. active involvement at all levels in working toward resolution of environmental problems and/or issues.*

To understand the behaviour more detailed, EFB has been categorized into different components. In 1973, early attempt for classification was made by Maloney and Ward. They categorized environmental action such as recycling, writing to legislators, community involvement, altered purchase behaviour or boycotting, and subscribing to ecological publications. After that, Hungerford and Peyton in 1976 came up with more accepted categories as; persuasion, consumerism, political action, legal action, eco-management, and interaction (as cited in Hsu, 1977). Small changes were made on the definition of these categories. Most recently, researches commonly use five categories in order to define target behaviours of EFB (Marchinkowski & Rehring, 1995, p.12).

Eco-management: It is also called as physical action. It refers to those environmental actions in which people work directly with the natural world to help prevent or resolve environmental issues.

Consumer/Economic Action: It refers to those environmental actions in which people use monetary support or financial pressure to help prevent or resolve environmental issues.

Persuasion: It refers to those environmental actions in which individuals or groups appeal to others help prevent or resolve environmental issues.

Political action: It refers to those environmental actions in which people use political means to help prevent or resolve environmental issues.

Legal action: It refers to those environmental actions in which people use to support or enforce existing laws which are designed to help prevent or resolve environmental issues.

After identifying the dimension of environmentally friendly behaviour deeply, models of EFB will be discussed in the following part.

2.5 Models Identifying Environmental Friendly Behaviour

Related literature revealed that a great deal of research regarding environmentally friendly behaviours came up with many variables affecting EFB and endeavoured to find similar patterns of these variables. By targeting common factors such as generalised cognitive and affective variables, various behaviours may be identified simultaneously in models, with its beneficial environmental effects.

The oldest and the simplest model of EFB based on a linear relationship of environmental knowledge leading to environmental awareness-attitudes and ultimately lead to EFB. According to Ramsey and Rickson (1977), responsible environmental behaviour resulted from appropriate and adequate environmental knowledge and awareness/attitude. Hungerford and Volk (1990) show this linear relationship in their study as in Figure 2.1.

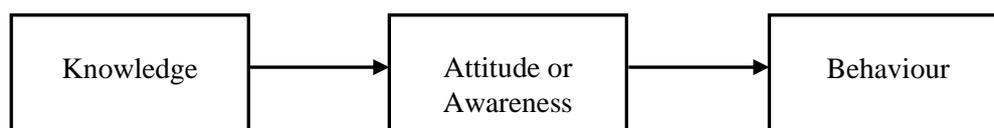


Figure 2.1 Early linear model of knowledge-attitude-behaviour (adapted from Hungerford and Volk 1990, p. 258)

Such linear models were recognized insufficient in portraying human actions from the early 1970s. The sequential studies after this model have shown that there is no such strong connection between knowledge and behaviour as it is thought (Alp, Ertepinar, Tekkaya, & Yilmaz, 2008; Hungerford & Volk, 1990; Kollmus & Agyeman, 2002). In other words, only increased knowledge is not the guarantee of environmentally friendly behaviours. According to the Norm Theory developed by Schwartz (1977), the awareness and knowledge about environmental problems are the important cognitive prior conditions for the development of moral norms that affects environmentally friendly behaviours. Due to the complexity of human behaviour, these model are still not enough to “bridge the gap” between knowledge and behaviour (Kollmuss & Agyeman, 2002).

Hines et al. (1986/87) conducted a meta-analysis for the purpose of determining the factors of EFB and proposed more applicable model (see Figure 2.2). Four major categories of the variables, in the model, were evident to be influential predictors of environmental behaviour. Cognitive, psycho-social, and demographic variables generated the model in the light of 128 studies. Cognitive variables namely, knowledge of environmental problems/issues, action strategies, and action skills;

demographic variables such as age, gender, income, education were observed to be correlated with EFB. Considering psycho-social variables, attitude, locus of control, personal responsibility, and economic orientation found to be the predictor of behaviour.

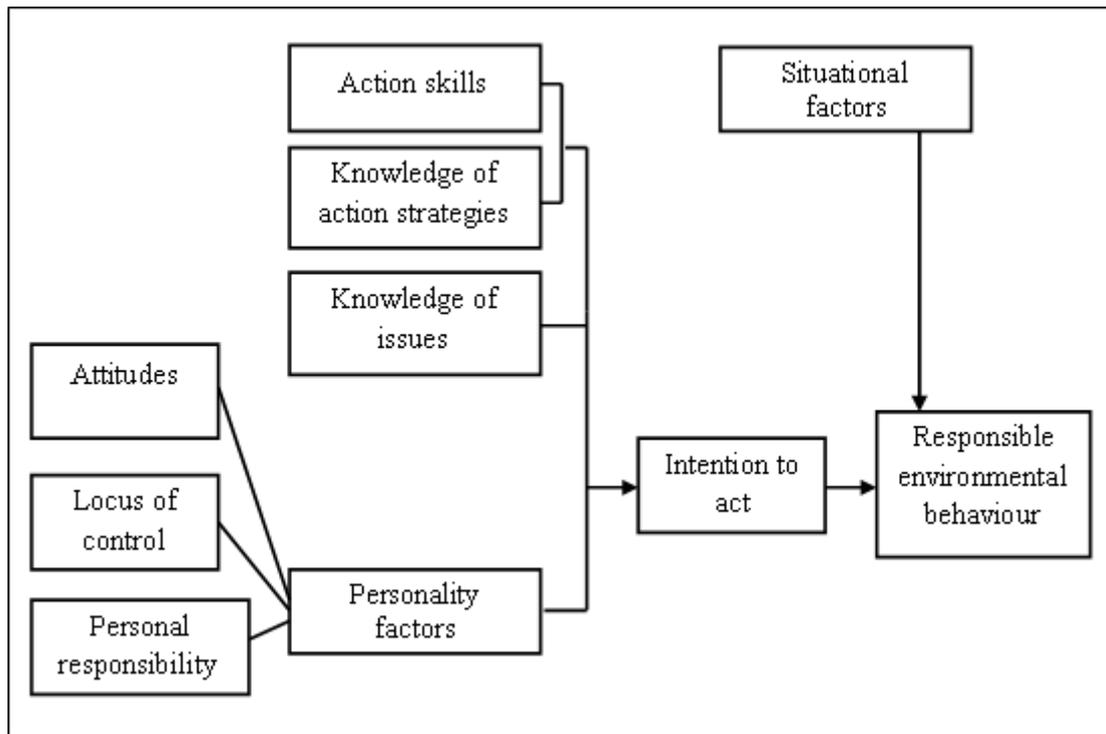


Figure 2.2 The model of responsible environmental behaviours (Hines et al., 1986/87, p. 7).

In this study, the *cognitive variables* are treated as the features including the environmental knowledge or the issue of the environment itself to some extent. The knowledge of issues touch that a person has to be acquaintance with the environmental problems and what causes them. On the other hand, knowledge of action strategies referred that a person has to be aware of what kind of a behaviour she/he has to exhibit in order to decrease her/his negative effects upon the environment. 17 studies which interested in cognitive variables were analyzed in the scope of Hines's study. The correlation results indicated that there is a positive relationship between knowledge of environmental issues/knowledge of how to take

action on those issues and actual measures of behaviour ($r=.37$, $SD=.20$) and also self-reported behaviour ($r=.29$, $SD=.19$) indicating that person who have an idea how to take action toward environmental issues tended to exhibit more either actual environmentally behaviour or self-reported behaviour.

Psycho-social variables referred to the characteristic features of an individual such as her/his perceptions of her/himself and the others around. As one of the psycho-social variable, *locus of control* means the perception of an individual in the sense that whether she/he could give rise to a change on the environment with her/his actions. People who carry a strong internal locus of control have the belief that they could change something with their actions; however, people who have an external locus of control feel that their actions would not be important and that only those who have much more power than they do, as they suppose, could bring change into existence. The relation between LOC and behaviour was found out as $.36$ ($SD=.12$) referring that who perceive that his/her behaviours have effects of the solution process of environmental problems are likely to develop more responsible behaviour toward environment. *Attitude* as another psychological behaviour is meant the general attitude towards the environment as well as it is meant more specific ones such as the attitudes towards energy crisis, unleaded gasoline, or attitude toward environmental action. People who adopt positive attitudes toward environmental action ($r=.38$, $SD=.14$) found to develop more environmental behaviour than who adopt positive attitude toward environment ($r=.34$, $SD=.24$). A slightly high stronger relationship between attitude and actual environmental behaviour was observed ($r=.43$, $SD=.29$) than was observed between attitude and self-reported behaviour ($r=.33$, $SD=.21$). When it comes to the *personal responsibility*, it indicates the individual's own perceptions of her/his duty and musts. If they have high personal responsibility then they will possibly be busy with developing environmentally friendly behaviours ($r=.33$, $SD=.12$). *Economic orientation* depicted the economic awareness and financial worries of an individual in terms of the economical outcomes of certain responsible behaviours and environmental actions. Weak correlation between economic orientation and behaviour ($r=.16$, $SD=.12$) was revealed via meta-analysis

of six studies Afterwards *verbal commitment (the intention to act)* found to be the most strongest construct on environmental behaviour. Results revealed that the communicated willingness of people to take place in environmental actions have considerable role on their individual willingness to adopt a responsible environmentally behaviour ($r=.49$, $SD=.13$). Moreover this quantity was also examined with the experimental studies. Purposes of these studies were encouraging EFB through classroom practices. Results indicated that increased intention to take action towards environmental problem/issue leads behaviour. These experimental studies also revealed that intention variable was a combination of cognitive, psycho-social, and demographic variables as presented in the model.

Demographic variables included *gender, income, age, and education* associated with the responsible environmental behaviour. The strongest relationship was observed between responsible behaviour and education level ($r=.18$, $SD=.12$) indicating that well educated people engage in slightly more responsible behaviour. On the other hand no significant relationship was observed between responsible behaviour and gender. Considering age, ten studies were examined and average correlation founded as $-.151$ ($SD=.20$) referring young people were slightly more likely to develop behaviour than older individuals. Lastly, association between income and behaviour indicated a weak relationship ($r=.16$, $SD=.08$) which showed that individuals with higher incomes develop slightly more responsible behaviour compared with lower income individuals.

Situational factors cover variables related to economic difficulties, social pressure, advantages and disadvantages of the actions etc. Model suggested that these variables can support or prevent responsible behaviour depending on the situation and personal characteristics.

In another study, Hungerford and Volk (1990) developed their own model based upon previously proposed models. Entry-level variables, ownership variables, and

empowerment variables were determined as the supporting variables of the behaviour. Their model of behavioural flow chart is displayed in Figure 2.3.

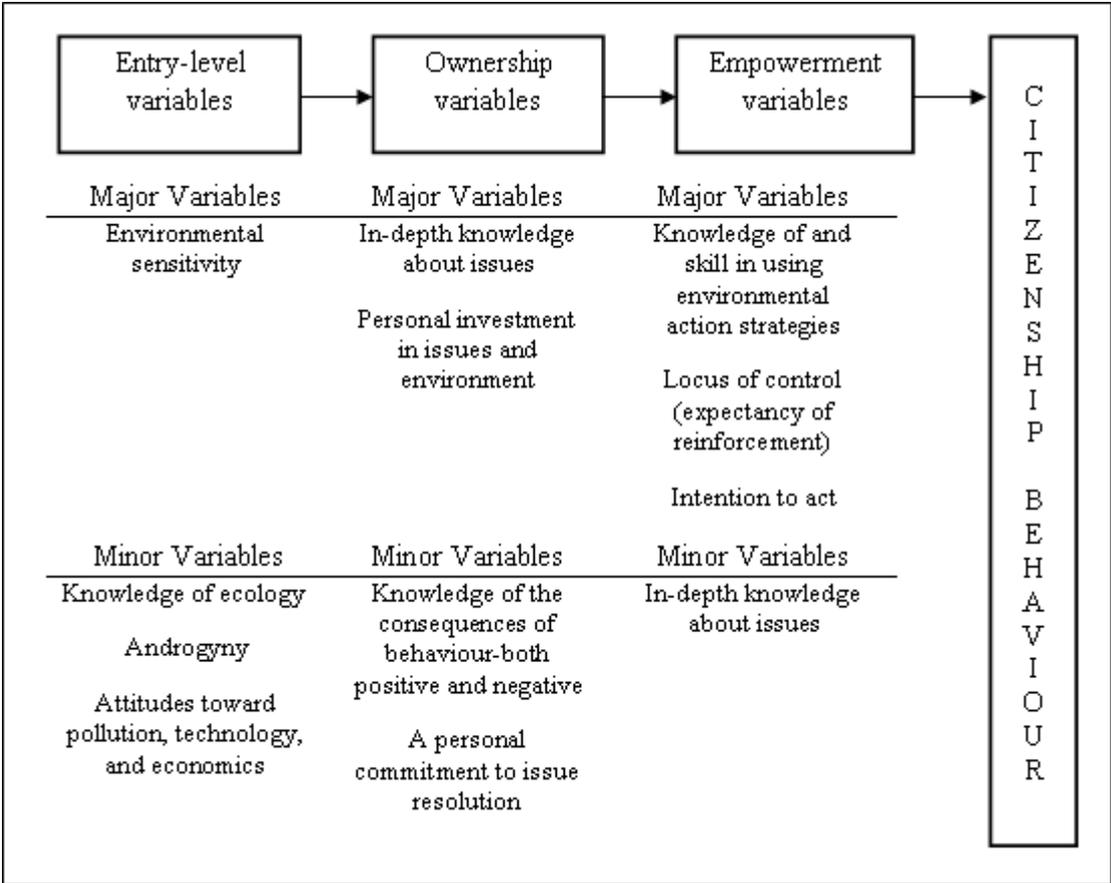


Figure 2.3 Behavioural flow chart: major and minor variables involved in environmental citizenship behaviour (adapted from Hungerford and Volk 1990, p. 260)

Entry level variables are the ones required primarily for they have the ability to improve the decision making mechanism of an individual. These variables were determined as environmental sensitivity, androgyny, knowledge of ecology and attitudes toward pollution/technology/economics. These variables are thought to be increase the decision making process of people. *Environmental sensitivity* referred to a sympathetic point of view towards the environment and *Androgyny* represents people are inclined to disobey the traditional roles of sexes. As an illustration, an

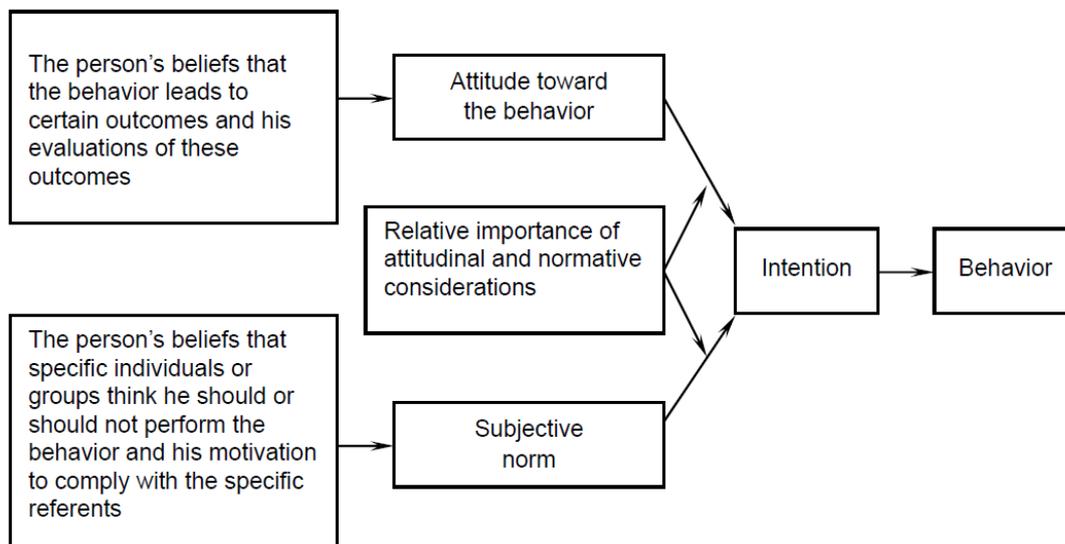
androgynous female may be a very anti-sympathetic individual and she may be more resistant to bad conditions which are accepted as traditional male characteristic. An androgynous man on the other hand can give more emotional rations known as a female nature. Therefore, model suggested environmental sensitivity as a considerable variable in this model whereas androgyny was not a strong predictor of environmental sensitivity. The role of *knowledge* and *attitude* as an entry variable seemed to be somewhat controversial. The knowledge of ecology sets forth a concept in terms of decision making yet, it has not been found to have enough power to develop a behaviour of its own. Although many of the studies supported the contribution of attitude toward pollution/technology/economics on behaviour, there is a debate on the magnitude of this contribution.

Ownership variables related to personal factors of environmental issues namely, *in-depth knowledge (understanding) of issues* and *personal investment* nested. If individual gains in-depth understanding of environmental issues in terms of both ecological and human perspective, she/he may feel the responsibility of friendly behaviour toward environment. After a while responsibility can evolve to personal need. Namely, if one has deep understanding of effects of non-recyclable materials on nature and human life, she/he may start to read the text on the products and give attention to buy recyclable ones. In this regard, individual develop special interest in recyclable products which stated as personal investment. Either deep knowledge of issues or personal investment positively associated with behaviour.

Empowerment variables included *knowledge of environmental action strategies* and *perceive skill to use these actions*, *locus of control* and *intention to act*. Although perceived skill in using environmental action and knowledge of environmental action strategies are seen as overlapping variables, the extent to their effects on behaviour differs. Skill in using environmental action is parallel with the self-confidence of individual. Having the power of using action strategies observed to the one of the best predictor of responsible behaviour. On the other hand, relationship between behaviour and knowledge of environmental action strategies is not certain. In spite of

the relevance between locus of control and perceived skill in using action strategies, LOC do not predicts behaviour as well as perceived skill. Intention to act was seemed to closely related to LOC and perceive skill toward action. If one intends to take action, the chance of that action occurring are increased. In overall, human beings having high level of empowerment variables feel themselves that they are able to make changes and help to resolve the environmental problems and issues.

Hines et al. (1986/87), Hungerford and Volk (1990) proposed environmentally friendly behaviour models in educational perspective. Area of psychology was also interested in relevant behaviour. Fishbein and Ajzen (1975) asserted the Theory of Reasoned Action (see Figure 2.4) by setting their conceptual framework on attitude. Under the scope of theory three relationships were investigated, namely outcome-behavioural and normative beliefs to attitudes and subjective norms, attitudes and subjective norms to intentions, and intention to a given behaviour. In other words, there are four basic notions which are belief, attitude, intention and behaviour.



Note: Arrows indicate the direction of influence.

Figure 2.4 Theory of reasoned action (adapted from Ajzen & Madden, 1986, p. 454)

The Reasoned Action Theory suggests that the behaviours of an individual are impelled by the behavioural intentions of that person when the behavioural intentions serve as a function of her/his attitude towards the behaviour itself and individual norms. What is meant by the term '*the attitude towards behaviour*' is the process of decision of an individual whether to exhibit or not exhibit a behaviour which is determined by her/his anticipations about the consequences of that behaviour or how much he/she desires those consequences. *Subjective norms* stated as another factor affecting behaviour. Subjective norm is defined as "an individual's perception of whether people important to the individual think the behaviour should be performed. The contribution of the opinion of any given referent is weighted by the motivation that an individual has to comply with the wishes of that referent".

There are some limitations in the model of Theory of Reasoned Action such as the existence of a critical risk of mistaking the attitudes and norms. Attitude may often substitute for norms and vice versa. Secondly it contains an assumption that when someone is intended to do something then there could be nothing to stop him/her. However, what is eluded here is that the factors such as ability, time, and environmental limits were proposed as inhibitors that influence unconscious habits including freedom to act. Given that, The Theory of Planned Behaviour (TPB) aimed to understand and solve this limitation. In other words, TPB was proposed to explain behaviours which people have limited volitional control. For this purpose, perceive behavioural control integrated to the model (see Figure 2.5).

According to Planned Behaviour Model, *perceived behavioural control* depended on past experiences of the individual. Ease and difficulty of performing the behaviour or good or bad experiences with intended behaviour can affect the behaviour. In other words, TPB interested in situations that people have a high degree of volitional control against intended behaviours (Ajzen, 2002).

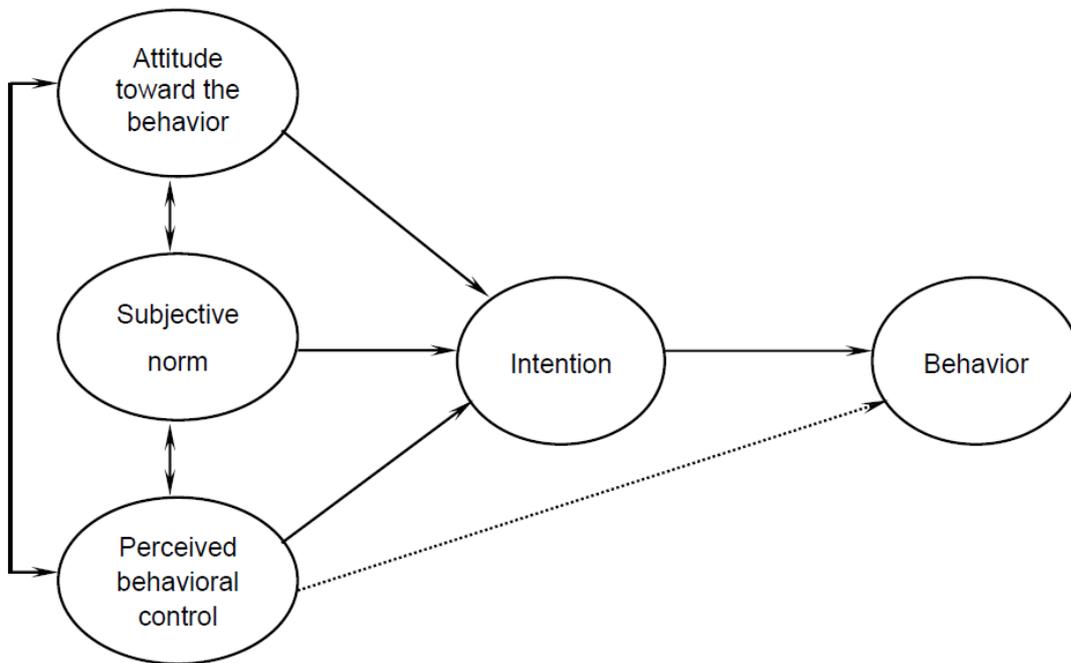


Figure 2.5 Planned behaviour theory (adapted from Ajzen & Madden, 1986, p. 458)

For example, one can try to save money from energy consumption by using public transportation instead of using his car even though he loves go his work with his car. This person is in the conscience that he has to use public transportation however he cannot carry out this behaviour. With this example it is illustrated that personal deficiencies or external obstacles could prevent exhibiting intended behaviours. Thus, these factors should consider while interpreting the model in specific behaviour.

This part briefly presented the proposed models on environmentally behaviours. These models suggested that the determinants of environmental behaviour are highly associated with psychological, cognitive and demographic factors. And thus, efforts to change individual behaviour start from identifying relevant variables to these behaviours. In this regard, studies related to environmentally friendly behaviour and selected cognitive, psychological, and demographic variables associated this behaviour will be discussed in the next part.

2.6 Studies on Environmentally Friendly Behaviour and Associated Variables

Considering research in the related literature, there is often the assumption that enhancing environmental related variables will lead an increase in environmentally friendly behaviours. However, before reaching such an assumption, nature of these variables, sample characteristics, research designs need to be examined more thoroughly and deeply in a cautious way. For this purpose, comprehensive studies selected from abroad and Turkey were presented below. Firstly, studies investigating determinants of general environmental behaviour were provided. Then, studies related to specific behaviour toward environment (i.e. littering behaviour, recycle behaviour) were included.

Marcinkowski (2001) reviewed three dissertation studies related to environmentally friendly behaviour conducted by Sia (1985), Marcinkowski (1988), and Sivek (1989) who are thought to be pioneers of environmental behaviour studies. These dissertations used same eight predictors of behaviour and these were the first attempts to examine a broader set of predictor variables and a broader measure of responsible environmental behaviour. Environmental sensitivity, perceived individual locus of control, perceived group locus of control, belief about/attitude towards pollution, belief about/attitude towards technology, psychological sex role, perceived knowledge of environmental action strategies, perceived skill in using environmental action strategies were used to predict participants' environmental responsible behaviours in terms of eco-management, consumer action, persuasion, legal action, and political action components. In the study of Sia (1985), 171 people were conveniently selected from the members of two environmental organizations. Regression analysis revealed that more than half (52.15%) of the variance in REB were accounted for selected eight variables. It is also observed that five of the eight selected variables found to be as statistically significant of REB which were perceived knowledge of environmental action strategies, perceived skill in using environmental action strategies, environmental sensitivity, belief about/attitude towards technology, and psychological sex role. Also he found that his first three

variables were consisted of only the statistically significant predictors which also accounted for the great majority (49.24 %) of the variance. In his study, Sivek (1989) was accompanied by 281 participants of three environmental organizations which were randomly selected. Eight variables explained 29.61% variance in environmental behaviour which was considerably lower than Sia's study. Perceived skill in using action strategies and level of environmental sensitivity accounted for 27.07% variance in behaviour. Regardless of sample differences of Sia' and Sivek's study, the top two predictors of REB were perceived skill in using action strategies and level of environmental sensitivity. Marcinkowski (1988) studied with 119 participants who were members of environmental organizations as well. As the results of stepwise regression analysis suggested, almost half of the variance (47.9%) in REB was explained by the eight selected variables. It is observed that two of his eight selected variables acted as predictors of REB and they were perceived knowledge of environmental action strategies and group locus of control. Throughout these three studies five variables stood out for significantly correlating with REB scores and also serving as predictors: individual and group locus of control, knowledge of/skill in using action strategies and environmental sensitivity. Other variables including attitudes towards technology and economics correlated with REB scores and served as predictors; yet, less consistently and at a lower degree. Engaged in these studies, all researchers suggested that all variables can and should be addressed in formal and non-formal settings.

Using almost same variables with previous researches, Hsu and Roth (1999) investigated the predictors of Taiwanese secondary teachers' general behaviours toward environment with environmental sensitivity (ES), environmental attitude (EA), environmental responsibility (ER), locus of control (LOC), intention to act (IA), perceived knowledge of environmental action strategies (KNOW), perceived skill in using environmental action strategies (SKILL), perceived knowledge of ecology and environmental science (KECO), perceived knowledge of environmental problems and issues (KISSU) of secondary teachers. Responsible environmental behaviour (REB) was measured by 30 items regarding eco-management, consumer-

economic action, persuasion, political action, and legal action dimensions. The ES was examined through questions about the feelings and life experiences of the participants (4 items); the EA was assessed via environmental attitudes toward technology, economics, and environmental protection in Taiwan (5 items). The ER subscale included 2 items, the LOC subscale included 2 items, and lastly the IA subscale included 5 items. Environmental knowledge consisted of totally 15 items to measure participants' KNOW, SKILL, KECO, and KISSU. 236 secondary teachers answered totally 63 statements in the scale. Firstly, correlation analysis was utilized to investigate the relation between behaviour and its associated variables. It was found that there was a moderate and positive relation between each pair of all associated variables and behaviour. More detailed, highest correlation coefficient was detected between responsible environmental behaviour and intention to act ($r=.46, p<.05$), REB and perceived knowledge of environmental action strategies ($r=.46, p<.05$). Lowest correlation was observed between behaviour and environmental attitude ($r=.21, p<.05$). Nine variables explained almost 34% of the variance in REB. Regression results revealed that perceived knowledge of environmental action strategies and perceived skill in using environmental action strategies variables were the most powerful predictors of REB in this study. It was stated that perceived knowledge of action, intention to act, and perceived skill in using action were the significant predictors of the study, and that these three variables accounted for 32.36% of the variance in REB. Moreover, it was observed that his three other most powerful predictor variables were perceived knowledge of environmental problems and issues, environmental sensitivity and locus of control. Researchers suggested that it is necessary to revise the content of EE in Taiwan depending on the findings of this study. And, variables found to be powerful predictors of REB should be integrated into the content of EE programs.

More recently, Fielding and Head (2012) examined the pro-environmental intentions, pro-environmental behaviours and environmentally harmful behaviours of 18-24 years ($n=2192$) and 12-17 years old ($n=1529$) young Australians. They also investigated the locus of control, knowledge, responsibility attributions,

environmental concern, and barriers to pro-environmental behaviours of the participants. Environmental concern was assessed with two items about concern levels of climate change and environment protection. Nine questions were used to measure perceived environmental knowledge of environmental issues. Some environmentally friendly actions (i.e. buy fewer new things, eat fewer meat meals, buy organic local food, recycling things) were rated by participants in order to measure the pro-environmental intentions and pro-environmental behaviours they had. Environmentally harmful behaviours of the participants were determined through the question that how often they do harmful things (i.e. throw things away that could be recycled, use too much paper, litter, and use more water than I should). Barriers to pro-environmental behaviour were presented and participants were asked to choose three most important of them. Results in terms of demographic variables indicated that female participants provided higher pro-environmental intentions and pro-environmental behaviour than males. Moreover, older respondents (18–24 years) were reported to have more pro-environmental intention and behaviour than young ones (12-17 years). Predictors of pro-environmental intentions, pro-environmental behaviour, and environmentally harmful behaviour were examined by series of hierarchical multiple regression analyses. Considering 12-17 years old participants, 25% of the pro-environmental intention was explained by the concern ($\beta=.29$), knowledge ($\beta=.12$), community responsibility ($\beta=.14$), and LOC ($\beta=.16$) significantly. 29% of the pro-environmental behaviour was explained by the concern ($\beta=.23$), knowledge ($\beta=.26$), community responsibility ($\beta=.14$), and LOC ($\beta=.13$) significantly. These results revealed that young people concerning about the environment, having knowledge of environmental issues, perceiving environmental responsibility, feeling the power of his/her actions on the solution of environmental problems tended to intent and perform mentioned pro-environmental behaviours than the young who did not have these features. As seen from these results, pro-environmental intentions and pro-environmental behaviour were perceived as almost same variables. In other words it is not wrong to say that when a person has intention to act, and then to a great extend he/she performs that act. Research also made a great

contribution to the comprehension of what the facilitators and barriers of the young's environmental actions are. For 12-17 years-olds the most prominent reason in performing actions harmful for the environment was the laziness and then the belief in the lack of any alternatives of such behaviours. Over a third of the participants gave reasons such as not understanding what was harmful and what was not for the environment or not having enough time and the belief that they could not make any change. When it comes to 18-24 years-olds, again the main reason given for their harmful actions was that they thought there was no alternative. 40% of the participants also explained themselves as giving more importance on saving money and not having enough time. Moreover, laziness was put forward again by a third of the participants. Determining the barriers in this study also led us to determine some possible solutions too such as; informing young people about pro-environmental actions easy to do and showing them that they could also save money with pro-environmental actions.

Specific environmental behaviour was used in the study of Hwang, Kim, and Jeng (2000). Researchers investigated littering behaviour of 523 visitors of forest in Korea. They proposed a model starting from knowledge as cognitive variable; continuing with attitude, locus of control, and responsibility as affective variables; and ending with intention to act. Knowledge was examined by asking participants their perceived and actual knowledge of general environmental issues. Attitude was assessed by asking general feelings and opinions about forest. Locus of control was measured by asking internal locus of control regarding the result of forest conservation, and perceived personal responsibility was assessed by asking the responsibility level of participants for the forest destruction. Intention to act was measured by participants' conservation activity (bringing back one's own waste). Proposed model was tested via path analysis using LISREL. Model fit indices indicated that model fit the data well. Findings of the path analysis revealed that knowledge as starting point had direct effect on attitude ($\beta=.08$) and on personal responsibility ($\beta=.02$) indicating that having much knowledge about forest resulted with much positive attitude and personal responsibility. On the other hand,

knowledge did not have significant effect on locus of control and intention to act. There was a direct effect of LOC on attitude ($\beta=.39$), on personal responsibility ($\beta=.17$), and on intention to act ($\beta=.25$). These results indicated that what the theory of reasoned action postulated; the locus of control and attitude were supported by the data of the study. Thus; it can be said that the level of internal locus of control of a person could bring forth his/her positive attitude, and also that the positive attitude enhance the intention to act. Considering intention to act as an end point of the model, locus of control had the highest direct effects on intention to act ($\beta=.21$) whereas personal responsibility and attitude had no significant direct effects. So it could be concluded that the main variable for improving the intention to act for responsible environmental behaviour was founded to be the locus of control. Researchers suggested that that if environmental educators will a change or improvement in the level of heir student's intention to act, then they should benefit from programs and materials which could stimulate internal locus of control.

Barr (2003) also proposed a comprehensive model to examine reduce, reuse, and recycle behaviours through environmental values, behavioural intention, situational and psychological variables. 981 randomly selected households in South-west England were asked about current reducing, reusing, and recycling behaviours, behavioural intentions, environmental values, situational factors, and psychological variables. More detailed, local waste knowledge, kerbside bins, knowledge source, gender, environmental knowledge and experience were identified as situational factors. Acceptance of norms to recycle, awareness of norms to recycle, and active concern were determined as psychological variables. Importance of nature versus human priority was specified as environmental values. Collected data were analysed via multiple regression analysis using MINITAB Release 12 statistical package. Regression analysis yielded two models regarding recycling and reduce behaviours respectively. Regarding recycling behaviour, 46% of the variance was explained with selected variables. Recycling behaviour pattern revealed that there was a positive association between kerbside bins and recycling behaviour ($\beta=.28$), acceptance of norms to recycle and willingness to act ($\beta=.24$), awareness of norms to recycle and

recycling behaviour ($\beta=.10$) indicating that individuals tended to exhibit recycling behaviour when efforts were minimized and subjective norms were activated. In addition, local waste knowledge had positive effect on willingness to act ($\beta=.21$) and recycling behaviour ($\beta=.19$) referring individuals likely to be well aware of the need to recycle and will generally do. Model indicated that recycling behaviour was well accepted by South-west English community. In terms of minimization behaviour, 75% of the minimization behaviour was explained by the selected variables. Environmental values also had effect on behaviour. Individuals who tended to give importance to nature seemed to exhibit more recycling behaviour ($\beta=.05$). Two value types (human priority and importance of nature) indicating opposite value orientations, effected both willingness to act and behaviour positively. This finding implied that individuals giving priority to human or nature were willing to act and engage in minimization behaviour. When findings of recycling behaviour were examined, it could be seen that recycling behaviour was normative whereas reduce behaviour was not. In other words, effects of subjective norms and effort minimization (kerbside) made recycling normative due to regular collection of recycling materials and instant awareness of a norm to recycle on the behalf of residents. The findings indicated that waste minimization (reduce) and recycling behaviours had different patterns. Author suggested that there exist three alternative behavioural dimensions (recycling, minimization and reuse) for the waste management behaviour and they have significantly different determinants. Thus they also suggested that waste policy should go beyond the usual campaigns on raising environmental awareness.

Similar to previous research, Lee (2008) also investigated the recycling and consumer behaviours of African American adults. In this regard, the process of transformation of the attitudes into environmental behaviours and information source were examined. The survey was conducted with 292 African American college students from Houston. In the first part, demographic information such as age, gender, major, marital and employment status, and current residential type were included. In the second part, general environmental worldview and attitudes of the

participants were measured through NEP Scale. In the third part, self-reported recycling behaviours (newspapers and magazines; glass bottles and jars; plastic bottles and jugs; cardboard boxes; and e-waste such as televisions, monitors, printers, cell phones, and other household electronics) with five items and conservation behaviours with six items (electricity conservation, water conservation, use of public transportation, decreased use of paper towels, use of high-efficiency laundry detergents, and carpooling) were examined. Results revealed that the mean scores of attitudes were 50.31 ($SD=6.79$) out of 75 indicating a moderate level of environmental attitudes. Regarding recycling behaviour, mean was found as 10.01 ($SD=5.24$) out of 25 and conservation behaviours had a mean of 17.54 ($SD=4.31$) out of 30 indicating inadequate recycling and conservation behaviour. In fact, 77.5% of the students never or rarely recycled, and 76.3% of them never or rarely used public transportation. Considering these results, the educators could focus on transmitting messages on the benefits of environmentally friendly behaviours and could associate those behaviours with such awards that; better physical health and a more quality of life.

In another study, Oluyinka (2011) assessed whether littering attitudes mediated relation between personal attributes and littering behaviour or not. For this purpose, 1360 participants were selected by multistage sampling technique from Ibadan city in Nigeria. Altruism was measured by 7 items and LOC was assessed by 17 items with 5-point Likert type scale from strongly agree (5) to strongly disagree (1). Attitude towards littering was measured by 24 self-reported items. Responsible environmental behaviour was examined through 44 items related to individual's habitual characteristics or conscious actions preventing the daily littering whether intentional or unintentional littering of their surroundings. Questionnaire was a self-report instrument with 4-point Likert type scaling from never (1) to always (4). Sequential analyses including correlation, simple linear multiple regression analysis and mediation test analysis were performed. First of all, correlation analysis was conducted and results revealed that REB was significantly and negatively related to littering attitude ($r=-.53$; $p<.01$), altruistic motivation ($r=-.44$; $p<.01$) and locus of

control ($r=-.50$; $p<.01$) referring an increase in individual's LOC, altruism, and littering attitude caused a decrease in REB. In other words, one's strong desire to control events in his/her life (LOC), actions for the benefits of others (altruism), and tendency against throwing litters (attitude) were found to encourage responsible environmental behaviours (no littering). Then, regression analyses were conducted by entering two personality attributes (LOC and altruism) and then, the littering attitude and REB were respectively added to the analysis as criterion variables. First regression analysis revealed that altruistic motivation and locus of control independently influenced littering attitude. Altruistic motivation and locus of control explained the 39% of the variance in littering attitude indicating that variables which were not included in this study accounted for about 61% of variance in attitude towards littering. These results originated from the effects of social, political, and cultural factors that were not taken into account in this study. Second analysis results indicated that altruistic motivation and locus of control independently effected REB. Altruistic motivation and locus of control accounted for 18% variance in REB pointing that 82% of variance in REB were related to variables not included in this study. Lastly, the mediator test of attitudes toward littering was performed. Result indicated the mediator effect of attitude towards littering on the relation between altruistic motivation and environmental behaviour. In a similar way, the mediator role of attitude on the relationship between LOC and REB was discussed and results confirmed the mediator role of attitude. Researcher suggested that as altruistic motivation and locus of control significantly predict attitude and REB, other studies should give attention to other personality factors.

To conclude, both general behaviours toward environment and specific behaviours (i.e. recycling, littering, and consumer behaviour) were examined with various age groups in many study. As behaviour patterns of individuals change by their age, socio-economic status, background, education etc. better understanding of pre-service teachers' environmentally friendly behaviours could be achieved by examining studies conducted in this specific sample area.

Goldman et al., (2006) conducted a study with 765 pre-service teachers in three major teacher-training colleges in Israel to examine their environmental behaviour levels with respect to background variables. For this purpose, environmental behaviour was measured through two parts. In the first part, 20 environmentally related activities including “resource-conserving actions with personal financial benefit”, “environmentally responsible consumerism”, “nature-related leisure activities”, “recycling efforts”, “citizenship action”, and “environmental activism” were assigned to participants to rate them based on Likert-type scale from 1 (never) to 5 (almost always). In the second part, participants were asked multiple choice questions among which the respondents chose alternative behavioural options for selected activities. Demographic data were obtained by asking students’ background: age, gender, hometown (rural and urban), ethnicity (Jewish, Arab), parents’ level of education, and the disciplinary subject chosen as an academic major. Regarding descriptive pre-service teachers have moderate environmental behaviours. More detailed, participants engage in resource-conserving actions with personal financial benefit and environmentally responsible consumerism more than environmental activism and citizenship behaviour. Considering second part of behaviour, although pre-service teachers’ generally did not engage in consumer behaviour, their perceived awareness toward environmental behaviour was considerably high. For instance, only small amount of them purchased the recycled products but most of them were aware of the importance of REB. In terms of demographic variables and behaviour, pre-service teachers growing up in rural areas tended to exhibit more citizenship action, nature-related leisure activities, and environmental activism compared with pre-service teachers from urban areas. Results also showed that there was a positive relationship between the students’ engagement in recycling behaviour and level of mother’s education. In addition, pre-service teachers from environmentally affiliated fields were likely to exhibit more environmentally responsible consumerism, nature-related leisure activities, and environmental activism than their counterparts educated in non-environmentally affiliated fields. So the authors suggested that the features of teacher-training students should be

benefited in developing training programs of which context should embody all the necessary components for the development of EL competency of students. Thus, they also stated that this would enable to close the gap between students' awareness of REB and their actual participation to REB.

Same researchers also investigated the environmental attitudes, knowledge, and behaviour with the same sample of their previous study (Pe'er et al., 2007). Thus, 765 new students from three teacher-training colleges participated to the study. Ecological and environmental knowledge of the participants were measured by 23 multiple-choice questions constructed as basic (9 questions) and advanced level (14 questions). Fundamental ecological principles and processes, global and local environmental issues, and environmental action strategies were covered in the scale. Environmental attitude was assessed through items related to the importance of incorporating environmental education in the educational system, priorities for national resource management policy, the use of environmental legislation and enforcement as a tool for environmental management, the locus of control, and human–environment interrelationship. Behaviour was measured with the question that how frequently they performed given 20 environment-related activities using a 5-point, Likert-type scale ranging from 1 (never) to 5 (almost always). Collected data were analysed to determine descriptive and correlation statistics of environmental attitudes, knowledge, and behaviour. Considering descriptive results, highest mean score was pertained to fundamental ecological process whereas environmental action strategies got the lowest mean. Mean scores of global and local environmental issues indicated that pre-service science teachers were not aware of environmental problems either in their local area or in the world. Concerning attitude, students got high scores in terms of all dimension. In more detail, the highest score was observed in the dimension related to the importance of environmental education, whereas attitude toward the priority of national resource management policy provided the lowest. In addition, Locus of control which was another affective variable was examined under the attitude scale and produced a high mean. Considering behaviour, moderate environmental behaviour was observed. Overall results indicated that pre-

service teachers did not have enough knowledge background to develop environmental behaviour but they had positive attitude toward environment and environmental education, and they also believed in the power of their actions on environmental problems. Correlation analysis of these three variables revealed there was a positive relationship between all variable pairs. In other words, relationship between behaviour and attitude was founded as the highest ($r = .49$) and relationship between behaviour and knowledge ($r = .23$), and knowledge and attitude ($r = .33$) was lower respectively. These results implied that student teachers had high attitude toward environment but did not tend to develop relevant behaviour. As stated by the authors, the primary challenge of the pre-service teachers is the endeavour of bridging for this gap between attitude and behaviour. They suggested a few solutions to this problem. First, the pre-service programs shouldn't elude the studies highlighting the student's characteristic which are formed by their social, cultural and physical environments. And secondly, those programs should include all the requirements for preparing a future of effective environmental education for educators.

Another study, investigating the relationship among knowledge, attitude, and environmental practice was conducted by Esa (2010). 115 pre-service biology teachers participated to the study in Malaysia. The instrument included two sections. Background variables were stated in the first section and items related to environmental issues were included in the second section. Environmental knowledge, attitude, and behaviour of the pre-service teachers were measured with a total of 45 items. Environmental knowledge was represented by 13 items related to the concepts of environment (i.e. energy sources and definitions of ecology terms) and 14 items about facts about the environment (i.e. sources of pollution, the ozone layer, biodegradable materials and ecology). Attitude was assessed through 17 four-point Likert-type items in terms of responsibility of human towards the environment and the role of individuals, government and technology. Environmental practices (i.e. recycling, consumer behaviour, and other environmental practice) were measured with 17 items on a scale ranging from 1 (never) to 4 (always). Regarding the results

of the study, the knowledge of pre-service teachers was found to be high. More precisely, most of the teachers (98%) were also able name the energy sources as renewable or not and determine the source of ozone depletion (89.5%) and identify the materials which are biodegradable. Similarly, prospective teachers revealed high attitude level with a mean of 17.16 out of 22. In particular, mankind was found blameworthy for the environmental degradation by most of the pre-service science teachers. They also agreed on the claim that the more they developed economically the more they destructed the environment (53.9%). In addition, a considerable amount of participants agreed that the industrially developed states are the biggest source of environmental degradation (73.7%). Moreover, almost all of the teachers agreed on the suggestion that government should aim at preserving the environment, live in harmony with nature, and the majority agreed on that natural resources should be conserved due to the fact that 92.1% of them perceived earth as a spaceship. Considering behaviour, the mean of attending an environmental action was 9.66 out of 17. Small amount of pre-service science teachers indicated that they always contributed to environment (8.8%) whereas most of them did sometimes (76.5%). In addition, a trace amount of the teacher (0.9%) reported that they never performed any environmental actions. These results showed that pre-service teachers had adequate environmental knowledge and positive attitudes toward environment but less environmental practices. In this regard, link between knowledge and attitude ($r=.56$) was observed to be higher than the relationships between knowledge and practice ($r=.26$), and practice and attitude ($r=.26$). Although this study stated that many of the pre-service teachers have good environmental practices and environmental knowledge, their contribution to environmental behaviour is low. They suggested that identifying the psychological, social or physical reasons of this pattern should be investigated.

Likewise, Boubonari et al. (2013) knowledge, attitudes, and self-reported behaviours of investigated Greek pre-service primary teachers' in terms of marine pollution. 445 pre-service primary teachers were randomly selected. As there was no specific knowledge, attitude, and behaviour measurement tool related to marine pollution,

researchers developed a new instrument by modifying NEP Scale. Knowledge subscale was developed including 14 items. Participants rated the statements using a 5-point Likert-type, ranging from -1 (sure incorrect) to 1 (sure correct). The attitude scale included 13 items regarding willingness to pay, locus of control, and attitudes toward the marine environment using reflections of the NEP scale. Behaviour scale consisted of 12 items concerning individual and collective actions toward marine pollution. Descriptive results showed that prospective teachers had moderate level of knowledge about marine pollution and conservation issue. More specifically, although participants were familiar with marine life, questions related to pesticides issue produced the highest mean score whereas litter on fish, seabirds, and sea-mammals did the lowest. Although Greek education program included subjects related to marine life, Greek pre-service teachers had moderate knowledge and still have misconceptions about marine pollution. It is suggested that to make the program more beneficial for students, teachers should enrich their instruction with additional knowledge, i.e., about marine pollution issues. Contrary to knowledge, pre-service teachers produced high attitude scores revealing the positive attitudes towards the preserving of marine environment exposing an ecocentric view. The lowest mean score was observed in willingness to pay referring that student teachers were not likely to make economic sacrifice to protect the marine. Considering locus of control, the pre-service teachers were found to have a stronger belief to make positive contributions to the preservation of marine environment through their actions. Regarding behaviour, students exhibited higher participation to individual action such as reading articles or/and watching TV programs related to marine issue, recycling paper but exhibited lower participation to collective action such as collecting things from beach, attending in a community meeting. Moreover, it was also investigated that knowledge, attitude, and behaviour of the pre-service science teachers differentiated in terms of their hometown (coastal, non-coastal). Results indicated that student teachers' living in either coastal or non-coastal did not yield any difference in terms of knowledge, willingness to pay, locus of control, individual. Only their collective action differentiated in terms of their hometown

which was probably because of their life experiences; especially the ones gained during childhood period in the coastal, motivating them to take part in collective actions. When correlation results were analysed, an increase was observed in knowledge related to positive attitudes toward environment ($r=.24, p<.01$), and higher locus of control level ($r=.30, p<.01$). On the other hand, individual action was weakly associated with knowledge ($r=.18, p<.01$), and collective action was not associated with knowledge. Concerning relationship between attitude and behaviour, relatively higher association behaviour dimensions and individual action were observed when compared with collective actions. In more detail, individual action was positively related to willingness to act ($r=.30, p<.01$), LOC ($r=.27, p<.01$), and attitude toward environment ($r=.23, p<.01$) and collective action related to willingness to act ($r=.20, p<.01$), LOC ($r=.12, p<.05$), and attitude toward environment ($r=.11, p<.05$) positively and relatively lower. These results revealed that although the pre-service teachers' had positive attitudes toward the marine environment, high internal locus of control and they were willingness to act, they do not readily translate into responsible action for the protection of the marine environment.

In an experimental study, Karpudewan, Ismail, and Roth (2012) tried to environmentalize pre-service teachers' science teaching methods course with the purpose of developing relevant behaviour and attitude toward environment. Total of 263 (227 females and 36 males) pre-service teachers enrolling science teaching method course, were participated to the study. Two classes were assigned as experimental group and the participants of both attended to 10 chemistry experiments/activities integrated with green principals. On the other hand, two other classes conducted the same experiments/activities in a traditional manner as the control group. To measure the attitudes of pre-service teachers, 15 items related to limits of growth, anti-anthropocentrism, the fragility of nature's balance, possibility of an eco-crisis, rejection of exemptionalism, and nature balance were used. For the purpose of assessing pro environmental behaviours students teachers were answered about questions related to 8 self-reported items (i.e. turn off the lights when not in

use, turn on air conditioners, use public transport, try reducing water consumption, or use polystyrenes). After collecting the data, independent t-tests were conducted to identify the differences between experimental and control groups. It was found that there was a statistically significant differences between the experimental ($M=3.13$, $SD=0.29$) and control ($M=2.68$, $SD=0.42$) groups in terms of environmental attitudes ($t_{(261)}=11.02$, $p<0.01$). Serious one-sample t-tests were performed to reveal the differences in behaviours. Statistically significant differences between the pre-test and post-test were observed with all items of behaviour scale. All results supported that engaging in green chemistry experiments increased student teachers' attitudes and behaviour toward environment. It was also suggested that if pre-service teachers green the curriculum and use green experiment/activities in their professional lives; this will lead to an increase in environmental attitudes and behaviour of the all nation.

In summary, literature revealed that correlation and regression analysis were utilized in almost all studies with the purpose of determining the best predictors of environmental related behaviours. Result of these studies revealed that individual tends to have positive attitude toward environment. On the other hand, results indicated an inadequate understanding of environmental issues and low friendly behaviour. In the following part, studies investigating Turkish citizen's environmentally friendly behaviours and its associated variables were presented.

2.6.1 Studies on Environmentally Friendly Behaviour and Associated Variables in Turkish Context

Studies conducted in Turkey were also intended to examine pre service teachers' and also elementary and high school students' environmentally friendly behaviours and associated variables.

Erten (2005) investigated pre-school prospective teachers' environmental knowledge, attitudes and behaviours. A total of 352 students participated to the study. Questionnaire was consisted of 20 items for environmental attitude, 20 items

for environmental behaviour, and 20 multiple choice questions for knowledge. Knowledge, attitude and behaviour items were corresponding to each other. Therefore, the researcher had chance to determine the consistence and inconsistency in the answers of pre-service teachers to detect the gap among selected variables. Results indicated that pre-service teachers revealed great amount of inconsistency regarding knowledge and behaviour responses. As an illustration, 91.5% of the pre-service science teachers were aware of the benefits of using returnable cans but 75.5% of them preferred drinks in metal cans. Similarly, inconsistent responses were observed regarding attitude and behaviour items. As an example, 83.2% of the participants stated that they felt sorry when they saw used paper and other trash together. However, only 16% of them recycled used paper. Beside inconsistent results, parallel responses were also observed in the study. 90.3% of the pre-service science teachers had fears on being unable to find drinking water. 94.6% of these turned off the fountains after using. According to the researcher, these consistent and inconsistent responses might be because of economic factors and risk perceptions of environmental issues. As the results put forward, in the frame of environmental behaviour, it was not sufficient for individuals to only have attitudes toward environmental consciousness or to have knowledge on the environment. The studies revealed that it would take time for positive attitudes to turn into behaviours. Thus; it is required to include environmental courses to the education programs of pre-service teachers and the yields of those courses in terms of developing pro-environmental behaviours should be observed.

Similarly, Sadık and Sarı (2010) investigated student teachers' environmental knowledge, attitudes and behaviours toward environment in terms of gender, enrolling environmental related course, being membership of any NGO. Environmental Knowledge Test (EKT) and Environmental Attitude Inventory (EAI) including Environmental Behaviour sub-scale and Environmental Opinion sub-scale were administered a total of 542 (321 female and 217 male) pre-service teachers. Descriptive results indicated that pre-service teachers produced the highest mean score regarding environmental knowledge out of 25 questions ($M=17.08$, $SD=2.44$).

On the other hand, they got moderate mean scores regarding subscales of environmental attitude. Namely, the mean of Environmental Behaviour sub-scale was 37.63 out of 65 ($SD=7.99$) and the mean of Environmental Opinion sub-scale was 29.55 out of 70 ($SD=4.42$). The overall results of this study indicated that pre-service teachers were found to be successful in terms of general environmental knowledge. On the other hand, their environmental opinion and behaviours were not at the intended level. Considering gender differences, female student teachers got significantly higher mean scores than males regarding environmental behaviour and opinion subscales of attitude. Most of the pre-service teachers stated that they did not take any of the elective environment courses. However, no meaningful differences were found on EKT and EAI in terms of attending an environmental course or not. Only a small amount of student teachers were members of an environmental organization. No significant differences were observed on EKT and EAI scores in terms of having membership of an environmental organization or not. Authors pointed out that the number of pre-service teachers enrolling in environmental course and having a membership of any environmental NGO were very limited. In addition, this limited number was pertained mostly to female student teachers. As is obvious, some regulations are especially necessary for attracting male students to environmental activities. It would be useful to give courses on environment throughout the whole faculty years by integrating it into the other courses instead of giving only for a semester.

Another study investigating pre-service teachers' environmental awareness and attitudes regarding gender, academic major, grade level, geographical region, and socioeconomic status was conducted by Ozden (2008). For this purpose, the researcher developed an instrument focusing on attitude and awareness levels of the student teachers. Awareness of pre-service teachers about environmental issues was measured by two dimensions. Awareness of environmental problems (AEI) dimension related to environmental problems and their effects in life was presented by 8 items. Secondly, awareness of individual responsibility (AIR) aimed to assess the extent to student teachers responsibility about environmental issues with 7 items.

Pre-service teachers' attitudes were assessed by another two dimension named as; general attitudes towards environmental solution (GAES) and general attitudes towards environmental problems (GAEP) by 15 items. Totally 30 statements were extended to 830 pre-service teachers (321 females and 217 males) from Adiyaman University. Results indicated that female student teachers produced statistically significant higher scores on all dimension of environmental attitude than males. Considering socio-economic status, it is observed that pre-service teachers who have high income exhibited more positive attitude towards environmental issues than average ones. These outcomes might due to the fact that teachers of wealthy students have more opportunities in terms of technology so they will possibly be more aware of the environmental issues. Regarding fathers and mothers educational level, significant differences between father-mother education level and environmental attitudes were found. From the point of grade levels of the participants, it was observed that the senior students were more inclined to exhibit positive attitudes towards the environmental issues than the freshmen. The cause of this difference might be because of the classes on environment they had participated or hadn't yet. Pre-service teachers' attitudes also differentiated in terms of their major area. Results indicated that elementary teaching students tended to exhibit more favourable attitudes when compared to mathematics and social teaching pre-service teachers. These findings might derive from the higher rate of the lectures they were given about the environment and nature within their curriculum throughout their education than those of other departments'. Results also showed significant differences in student teachers' environmental issues in terms of residential and geographical region. Pre-service teachers living in big cities in Marmara region were more likely to exhibit the highest positive attitudes towards environmental issues than those living in villages or cities and in other geographical regions. It was also observed that the intensity of environmental issues had a positive effect upon the student teachers which might be because of the rurality of the region and thus the lower rates of environmental problems unlike those like Marmara. Under the light of these studies, it was suggested by the researchers that in the studies of environmental awareness

and attitudes it is highly important to apply different sources as to use a wide range of subjects such as student teachers from all regions of Turkey so that the different characteristics of regions could be observed and taken into consideration while drawing different plans for each which is truly necessary.

Tuncer et al. (2009) studied with 648 student teachers (427 females and 249 males) to examine the environmental literacy levels of the participants. Totally 45 closed ended questions regarding environmental knowledge (11 items), attitude (7 items), uses (19 items), and concern (8 items) were extended to the participants. Results indicated that 49% of the pre-service teachers got passing grade from knowledge questions indicating insufficient level of environmental knowledge. However, prospective teachers had positive attitude toward environment referring 'eco-centric worldview'. For instance, a great majority of the participants (94%) agreed that plants and animals have as much right as humans to live. In addition, the results revealed the awareness of pre-service science teachers on the significance of the relation between humans and the environment. For instance, a great majority agreed on the suggestion that persons giving harm to the environment should be held responsible for this action. However, the results exhibited that the pre-service teachers were actually not 'very concerned' about many of the environmental problems. In terms of correlation analysis, despite positive and low relationship between environmental use and environmental knowledge ($r=.17$, $p=.01$), no correlation was observed between attitude and behaviour. Findings of the study recommended that more environmental attitude and adequate knowledge might result in more concerned pre-service teachers. They also reported that female pre-service science teachers had more positive attitudes and responsibilities toward environment compared with males. It was stated that the aim of analysing the level of pre-service teachers' knowledge from different strata was to provide a stronger base for the requirement of environmental education and then to increase the environmental literacy.

To achieve the same purpose of the previous study, Teksoz et al. (2010) examined pre-service chemistry teachers' environmental literacy levels. Additionally, they also investigated student teachers' perceptions toward environmental education. In this regard, 60 pre-service teachers were administered EE Perception Survey and Environmental Literacy Test consisted of knowledge, attitude, uses, and concern dimensions about the environment. EE Perception Survey was developed by the researchers, including 8 open-ended questions, to identify the participants' perceptions on EE. According to the results self-evaluation of items, most of the chemistry pre-service teachers thought that "if things continue on their present course, we will soon experience a major ecological catastrophe" and "when humans interfere with nature it often produces disastrous consequences" referring that they tended to have a pessimistic perception about the future of environmental problems. Parallel with their pessimistic perception, almost all pre-service teachers were found to have high concern level regarding poor drinking water quality, ozone depletion, global warming and water pollution. So the deduction could be made as that these students had more concern for the environmental problems. However, environmental knowledge test indicated that only 25% of student teachers produced a passing grade. In spite of inadequate knowledge level over the half of the pre-service teachers showed high awareness and intention for solving environmental problems. Moreover, the pre-service chemistry teachers who had been given courses regarding the environment and environmental issues were highly motivated to integrate their acquirements into their teaching plans. So it could be concluded that teacher education programs should include some courses to help the pre-service teachers to enrich their knowledge on environmental issues and problems in addition to the existing environment-related ones.

Likewise, Karatekin (2013) studied with 824 pre-service teachers from social studies, classroom teaching, science, and geography majors. Research aimed to investigate and compare the environmental literacy levels of pre-service teachers in terms of their majors. Questionnaire of Environmental Literacy test including 5 subscales (personal information, affective tendencies towards environment, environmental

behaviour, environmental knowledge, and cognitive skills) was utilized. Descriptive analysis revealed that students teachers participating to this study got the highest mean score with respect to affective dimension whereas got lowest regarding cognitive skills. In addition, student teachers were found to have moderate environmental knowledge. Considering the behaviour dimension, pre-service teachers of all majors indicated deficient behaviours. Highest contribution was made with respect to physical protection and individual and social persuasion dimensions. On the other hand, low contribution was made political and legal behaviour. Therefore, it was observed that pre-service teachers' environment literacy scores containing all components' were found at a medium level. Moreover, results of One Way Analysis of Variance (ANOVA) indicated that student teachers' environmental literacy levels differentiated in terms of their majors. Follow up analysis indicated that geography teachers significantly had the highest environmental literacy level than pre-service teachers educated in social studies and pre-service teachers educated in science education. Researcher suggested that education in universities should be designed to enhance all components of environment literacy regardless of majors.

In an experimental study, Kılıc (2010) conducted an action-oriented program to promote pre-service science teachers pro-environmental behaviours. Project-based intervention was carried out with 72 junior pre-service science teachers for 14 weeks, 52 hours. Intervention included 5 different projects. Students were expected to search the literature about environmental problems in the literature search project, to prepare a lesson related to an environmental subject adhering to elementary science education curriculum in the problem-based learning (PBL) in environmental education project, to collect environmental news from local newspapers in local newspaper project, to investigate the environmental problems of their local area in autopsy of the city in terms of environmental pollution project. After the intervention, 33 pre-service science teachers the questionnaire voluntarily. Questionnaire was consisted of two open-ended questions which were prepared by the researcher. In this regard, students were asked about their favourite projects and their responsibility in this project. They were also asked to compare their pro-

environmental behaviours before and after this project. Content analysis results indicated that in the beginning, the ignorance of the student teachers about the conservation of environment was obvious as well as their willingness to learn. Moreover, since their awareness was really low, they didn't have much idea about what exactly the environmental degradation was and what it could do to their daily lives and the place they lived. When the intervention was over, they had reached a fine and adequate level of knowledge about the conservation and began to adopt pro-environmental behaviours as well as their positive attitudes towards the environmental protection. Moreover it is true that their awareness increased highly and so did their behaviours accordingly. Comparing their situations and behaviours of before and after the intervention, the success of the project-based intervention was note-worthy. So, it can be said that universities have great responsibility in this sense; they ought to include more courses and programs about environment in their educational programs and encourage both the sustainability of the nature and the people to change their lifestyles for the benefit of the environment. So in short it was suggested that problem-based methods of learning and projects in which practical science skills are required should be utilised in teacher training programs so that their points of views would change and begin to develop pro-environmental behaviours.

There were also some studies conducted with elementary and high school students in Turkey (Alp, Ertepinar, Tekkaya & Yilmaz, 2006; Cavas, Cavas, Tekkaya, Cakiroglu & Keserciklioglu, 2009; Onur, Sahin & Tekkaya; 2012; Tuncer et al., 2005; Yilmaz, Boone & Andersen, 2004). For instance, Yilmaz, Boone and Andersen (2004) examined Turkish elementary and middle school students' environmental attitudes with respect to gender, age and education level. A total of 458 students participated to the study from public schools in Ankara. Attitude toward Environmental Issues Scale with 51 items was administered to the participants. The results of the items were evaluated with Rasch software. Results revealed the fact that it is hard for Turkish students to accept the priority of conserving the environment over industrialization or economic growth or to have free right to use lands which may be because of the fact that Turkey is still a developing country and that students

generally focus on the industrialization rather than environmental issues. Results also indicated that there was positive relationship between the students' science course success and their environmental attitudes. In other words, a student with high science achievement also had more positive environmental attitudes. This relationship might be associated with that the more a student learns and discuss about the environment, the more positive attitude she/he will develop towards the environment. Regarding grade level, ANOVA results indicated that students at 4, 7, and 8 grades revealed more favourable environmental attitudes than 5 and 6 graders. A t-test was utilized to examine the differences in terms of gender, socio-economic status and the location of school with the students from elementary and middle schools. Among the students of elementary schools in Turkey, no significant difference was founded in terms of gender; yet was found among the middle school students. Female students of were found to have much friendly behaviours toward environment when compared to males. Among elementary school students there occurred a difference in terms of the places they lived and the socio-economic status of their parents as such; the students living in the urban areas with well -off parents with high status were found to be more favourable towards environmental issues in terms of attitudes than those who lived in suburban areas with parents with low status. Environmental attitudes of the students' did not differentiate among middle school students in terms of school location and socio-economic status. Study indicated no difference between elementary and middle school students' environmental knowledge level although middle school program include more courses on environmental issues and other environmental experiences such as field trips.

Likewise, Tuncer et al. (2005) investigated Turkish students' attitudes towards the environment in terms of school type and gender. The data were gathered from 1497; 6th, 7th, 8th, and 10th grade students from public ($n=603$) and private schools ($n=892$) in Ankara. Students' attitudes were measured via Environmental Attitude Questionnaire. Regarding the scale attitude had has four dimensions: general awareness of environmental problems (AEP), general attitude toward solutions (GAS), awareness of individual responsibility and attitude through changing lifestyle

(AIR), awareness of national environmental problems (ANEP). In order to examine the effects of school type and gender on dimensions of attitude two-way multivariate analysis of variance (MANOVA) was utilized. The results revealed significant differences between the students educated in public and private schools and also between gender regarding scores of each dimension of the questionnaire.

Similarly, Cavas, Cavas, Tekkaya, Cakiroglu, and Keserciklioglu (2009) analysed the 9th grade students' attitudes toward the environment, their interest in learning about environmental protection, and the role of gender on these variables. The Relevance of Science Education (ROSE) questionnaire was implemented with 1260 students (680 girls and 580 boys) from 63 high schools and 21 cities in seven different geographic regions. Results indicated a moderate level of interest toward environmental protection. Although, boys tended to be interested in more environmental protection issues when compared to girls, girls' were found to have more favourable than boys. Thus, researchers suggested that researchers in educational area have to give importance to the differences between genders and develop methods to attract both genders to learn about environmental protection and adopt positive attitudes towards the environment in Turkey. Finding of this study could be benefited for the improvement of environmental educational programs conducted in Turkey.

Alp et al. (2006) also conducted a study investigating the environmental knowledge and attitudes (intent- behave- affect) and the locus of control of the elementary school students. A total of 1140 students (562 girls, 578 boys) studying at 6th, 8th, and 10th grade levels participated to the study. Children's Attitudes and Knowledge Scale was implemented to the participants. As a result of the study, students' environmental knowledge including issues about animals, water, energy, recycle, and pollution was found to be low in all grade levels. Students' knowledge level increased in parallel with their grade levels. In terms of environmental attitude, students showed a little enthusiasm to make sacrifices or efforts for protecting the environment. However they stated their concerns about the environmental problems

and also stated that they were actively engaged with the solution of environmental problems. In terms of locus of control, the results revealed that elementary school students didn't have strong locus of control. There was a decrease from 6th grade through 10th grade students regarding general environmental attitudes and its dimensions (behaviour, intention, and affect). With respect to gender, girls had higher scores on both knowledge and attitude scores than boys. However, mean difference on knowledge scale was not statistically significant. Researchers also built a model in the scope of this study. A Multiple Regression Analysis was conducted to reveal the significant predictors of responsible behaviour. Model depicted that the linear combination of environmental knowledge, behavioural intentions, affects and locus of control could account for nearly 58% of the variance in pro-environmental behaviour. Results indicated that environmental affects ($\beta=.51$) and behavioural intentions ($\beta=.33$) were positively associated with environmentally friendly behaviours. Moreover, positive relation between internal locus of control and behaviour was founded ($\beta=.07$) which meant that students who had stronger locus of control seemed to exhibit more friendly behaviours towards the environment. On the other hand knowledge was found to have a negative association with environmentally friendly behaviour ($\beta=-.08$). Researchers suggested a model regarding the environmentally responsible behaviours and the predictor variables of that model might be necessary for better understanding the determinants of Turkish students' behaviours. Moreover, like qualitative and longitudinal studies some further studies are required to examine more elaborately the attitudes of Turkish students towards environment and the formation of true environmental concepts.

More recently, Onur, Sahin, and Tekkaya (2012) conducted a study to assess elementary school students' environmental attitudes (ecocentric, anthropocentric, apathy), value orientations (egoism, biospherism, and altruism), and environmental concern with respect to gender. 952 students from public schools residing in rural areas of north-eastern Turkey participated to the study. Environmental attitude of the participants were measured by Environmental Attitude and Apathy Scale and Environmental Use Scale. Value orientations of the elementary school students were

examined by Environmental Motive Concern Scale. Lastly, environmental concern was assessed by 21 items which were previously used in NEETF/Roper Survey. Regarding findings of environmental attitude, elementary school students attitude toward environmental generally were found to be ecocentric rather than anthropocentric and apathy. In other words, elementary grade students were found to give value to nature for its own sake instead of human benefit. They also did not think that environmental threats have not been exaggerated. Considering value orientations, students tended to think themselves (egocentric) rather than nature (biospheric) or other people (altruistic). Environmental concern results indicated a high mean score referring that students were concerned about the environmental issues. Findings of this study provide some useful suggestions which are thought to be helpful in contributing to the enhancing of the environmental education in Turkey with the educators, teachers, curriculum developers, textbook authors and parents. Bearing the importance of having ecocentric attitudes in mind, parents should also strive for amending their children's attitudes towards environment and also be aware of the consequences of their personal actions regarding their relation with the nature as well as the educators, teachers, curriculum developers or textbook authors. Similarly, the context of the school programs should be highlighting the importance of the relation between humans and nature as well as the relations between environmental values and economic growth. Results also revealed that girls reported more concern about environment and were found to have more ecocentric attitude toward environment than boys. In parallel, boys were likely to have more anthropocentric attitudes, and more apathy towards the environment. Gender role was found to be insignificant with respect to egoistic, biospheric, and altruistic value orientations. Therefore, for eliminating the inequality between genders, educators need to focus on increasing the concern of boys for the environment.

In summary, it is crucial to comprehend which factors enhance the environmental behaviours and which inhibit. Factors promoting the environmental behaviours have been handled from different theoretical perspectives in many studies with pre-service teachers abroad and in Turkey. The pattern among knowledge, attitude, locus of

control and behaviour seems to be almost the same for all research regardless of environmental behaviour types. Pre-service science teachers generally have inadequate environmental knowledge but they have positive attitudes toward environmental and they feel responsibility and power on the solution of environmental problems. However, they still have not developed intended environmentally friendly behaviours. Therefore, there are gaps between these variables and behaviour. In order to find out this gap and to better define the environmentally friendly behaviour, maybe some other variables should be used in addition to those abovementioned. There is a need for a study related to environmentally friendly behaviours of pre-service teachers with new additional variables. In this regard, environmental knowledge, environmental attitude, and locus of control which are the most popular predictors of EFB were selected for the current study. In addition to these, pre-service teachers' optimistic and pessimistic perceptions as psychological factors toward environmental issues also included in the scope of this study. Moreover, gender, hometown, being a member of any environmental organization, and taking courses related to environmental issues are also determining in identifying the profile of Turkish pre-service science teachers.

2.7 Predictors of Environmentally Friendly Behaviours

In the light of the studies presented above, the details about the cognitive and psychological variables chosen specifically for the present study will be handled in the following parts.

2.7.1 Cognitive Factors

As knowledge is required for basic understanding of environment and environment related issues (UNESCO, 1978), numbers of studies have been addressed individuals' environmental knowledge levels in the last three decades. Research indicated that different knowledge types used in many studies were named as; knowledge of environmental action strategies, knowledge of ecology and environmental issues, and knowledge of environmental problems and issues, etc.

(Hines et al., 1986/87; Hornik, Cherian, Madansky, & Narayana, 1995; Hsu & Roth 1999; Marcinkowski, 2001). More recent studies, on the other hand, used knowledge in different forms such as concrete versus abstract (Barr, 2003), advanced versus basic (Pe'er et al., 2007). However different the environmental knowledge is named and used, the common thread to all this is the existence of a relationship between the pro-environmental behaviour and knowledge.

Literature includes studies trying to examine the environmental knowledge as one of the predictors making an explanation for the variances in the environmental friendly behaviour (Barr, 2003; Hines et al., 1986/87; Hsu & Roth, 1999; Hwang et al., 2000; Fielding & Head, 2012). The argument suggesting that there is a connection between environmentally friendly behaviour and environmental knowledge, either strong or weak is a suggestion on which most of the researchers have reached a consensus. For example, Hsu and Roth (1999) came up with a result that knowledge of action strategies and perceived skills in using environmental action strategies were one of the most powerful predictor of EFB. Similarly, Sia et al. (1985) found out really strong ties between the perceived knowledge of environment action strategies and environmental behaviours. Marcinkowski (1988) stated in his study that knowledge of action strategies are efficient and sufficient alone to explain the 40% of the variances in environmental responsible behaviour Likewise, the knowledge of action strategies accounted for nearly 34% of the variances in environmental behaviour in Sivek's study (1989). The study of Barr (2003) made the knowledge of action strategies more specific by extending questions as where and what to recycle to the participants. Results indicated a direct effect of this concrete knowledge on recycling behaviour. Research stated that concrete knowledge is related to behavioural knowledge which could be benefitted for the problems. On the other hand, abstract knowledge refers to causes, solutions of environmental issues. Studies using knowledge of environmental issues, and ecological concept also found significant relation with environmental behaviour (Bourbonari et al., 2013; Esa, 2010; Pe'er et al., 2007).

Although it is almost clear that having appropriate environmental knowledge enhances environmental action, many studies have revealed that pre-service teachers have inadequate environmental knowledge (Boubonari et al., 2013; Karatekin, 2013; Pe'er et al., 2007; Teksoz et al., 2010; Tuncer et al., 2009). There are a few studies that claim otherwise (Esa, 2010; Sadık & Sarı, 2010). As presented in detail in the previous parts, Tuncer et al. (2009) reported that pre-service teachers exhibited insufficient level of environmental knowledge. In particular, Pe'er et al. (2007) stated that student teachers seemed to be more knowledgeable about fundamental ecological process and concepts than they were on environmental action strategies, global and local environmental issues. On the other hand, Esa (2010) reported high level of environmental knowledge of pre-service biology teachers about energy sources and definitions of terms on ecology, sources of pollution, the ozone layer, biodegradable materials and ecology.

To conclude, although knowledge is considered as a precursor variable for intended behaviour and action (Disinger, 2001), low or moderate level of environmental knowledge was observed in studies. Even though it seems that it is truly hard for individuals to develop pro-environmental behaviour without having appropriate knowledge on the environment, knowledge cannot be said to be the only required factor. Because psychological factors should also be paid attention since they create the necessary stimulation for turning the knowledge into pro-environmental behaviour.

2.7.2 Psychological Factors

There are too many non-educational factors which are also sophisticated and thus their effects shouldn't be underestimated. Based on this, the discussion given below on the effects of non-educational factors is not regarded as exclusive; yet, has made significant contributions to the scope of present study.

2.7.2.1 Attitude

As a psychological component, environmental attitude represents a set of values and beliefs regarding the feelings, pros or cons of an individual and what he/she favours or disfavours in terms of environment or the objects related to the environment (Hines et al., 1986/87). Newhouse (1990) suggested that one of the most effective variable associated with environmental behaviour is attitude.

Many studies have been conducted to investigate the relationship between environmental attitude and environmentally friendly behaviour. In this regard, some studies defined attitude as a predictor of EFB (Boubonari et al., 2013; Esa, 2010; Hines et al., 1986/87; Hsu & Roth, 1999) whereas some studies did not (Hwang et al., 2000; Tuncer et al., 2009). In an early study, Hines et al. (1986/87) investigated the relationship between environmental attitudes and environmental behaviour with a meta-analysis study. They observed a moderate positive relationship between environmental attitudes and environmental behaviour. Makki, Abd-El-Khalick, and Boujaoude (2003) conducted a study with 660 Lebanon secondary students' to determine the relationship between environmental attitude and their commitment to environmentally friendly behaviours. Results indicated a significant and high correlation between environmental attitudes and environmental behaviour ($r=.77$, $p<.01$). Meinhold and Malkus (2005) examined pro-environmental attitudes and environmental behaviours of 848 adolescents. High correlation between attitude and behaviours was observed a ($r=.45$, $p<.001$).

There are different points of views, too such as attributing the attitudes towards phenomenon to the value orientations. Therefore, the link between underlying values and environmental attitudes has been investigated in environmental education research for a long time. In 1978, Dunlap and Van Liere proposed the New Environmental Paradigm (NEP) which was different from early approaches. Attitudinal behaviour was evaluated in terms of having ecocentric or biocentric feelings. For instance, an individual having biocentric attitude helps nature as a part

of it rather than outside of the nature. In a similar way, Thompson and Barton (1994) classified attitude toward environment as ecocentric (or biospheric), anthropocentric, and environmental apathy. Ecocentric view refers to concern for nonhuman objects and ecosystems even though the conservation of those requires sacrifices. Anthropocentric view on the other hand, refers to concern for human beings yet; conservation is only reasonable if it satisfies human needs. Lastly, environmental apathy represents any concern on the environmental issues. In that vein, Thompson and Barton (1994) conducted two studies with 115 individuals in order to measure ecocentric-anthropocentric attitudes and environmental apathy toward environment. Results indicated that individuals appreciating the nature for its own sake (ecocentric attitude) expressed less environmental apathy than ones who tended to conserve environment only for human benefits (anthropocentric). Moreover, results also revealed that individuals who possessed ecocentric attitude were more likely to conserve the environment and join environmental organizations than individuals reflecting anthropocentric attitude. Schultz and Zelezny (1999) conducted a study to examine the relationship between attitudes (ecocentric, anthropocentric, and apathy) and values (openness to change, conservatism, self-transcendence, and self-enhancement). Participants of the study were 120 undergraduates at universities from English and Spanish speaking countries. Participants' environmental attitudes and values were examined by Thompson and Barton's (1994) scale and the revised New Environmental Paradigm (NEP) scale (Dunlap et al., 2000). Findings of the study revealed that self-transcendent values were associated with NEP and ecocentrism positively. In addition, the self-enhancement value was negatively related to NEP and ecocentrism yet; positively related to anthropocentrism.

In brief, attitudinal motives are highly important in adopting positive attitudes towards the environment. Ecocentric or anthropocentric motives that individuals have may play key roles in the decision making process for a specific behaviour. The effect of environmental attitudes over the pro-environmental behaviour was also confirmed by the related literature.

2.7.2.2 Internal Locus of Control

The psychological construct of locus of control predicts that an individual's behaviour is guided by his or her perception that certain behaviour will lead to an expected reinforcement (Rotter 1966). Lever, Pinol and Urlade (2005) explained that, from individual's perspective, locus of control is the motivating force that leads the individual to act in a particular manner. Locus of control both consists of internal and external dimensions. External LOC is based on the belief that changes happen by chance or by others power (e.g. God or government). So people with external LOC generally do not participate in activities to bring about change. On the other hand, internal LOC is an internal motive that leads to the expectation that his/her actions will cause changes. As a result, this type of individual is more likely to engage in activities (Hines et al., 1986/87).

One of the first attempts about LOC and ERB was performed by Huebner and Lipsey (1981). They aimed to assess the relationship between LOC and willingness to act responsible environmentally behaviour with activist and non-activist group. The results indicated that LOC was significantly associated with environmentally activism and personal conservation attitudes. Additionally, it was reported that activist people had more internal locus of control than non-activists. After, Hines et al. (1986/87) made meta-analysis in fifteen studies in terms of LOC and responsible environmental behaviour. Findings of the study revealed that those who had internal locus of control were more likely to be engaged in responsible environmental behaviour than those with external locus of control. In another study, Allen and Ferrand (1999) tried to investigate the importance of "personal control" or locus of control in predicting environmentally friendly behaviour. The questionnaire focused on four predictors including social desirability, personal control, self-esteem, and belonging. Results showed that personal control was a strong predictor of environmentally friendly behaviour. In this study, the measure of personal control used by the researchers focused on individuals' feelings that they could contribute to solving environmental problems.

First and unique attempt on assessing internal LOC with a specific content was made by Smith-Sebasto and D'Acosta in 1995. Researchers developed the Environmental Action Internal Control Index (EAICI) in order to measure college students' internal locus of control with respect to specific issues, and environmental responsible behaviour. Other studies have shown that internal locus of control is positively correlated with environmentally-responsible behaviour. Smith-Sebasto and D'Acosta (1995) developed the Environmental Action Internal Control Index (EAICI). A preliminary study showed that EAICI successfully used specific environmental actions to predict self-reported environmentally-responsible behaviour in college students based on locus of control (Smith-Sebasto & D'Acosta, 1995). The EAICI can be used to help environmental educators assess whether their programs promote an internal locus of control of their participants.

More recently, Chao (2012) tested Hines's model of responsible environmental behaviour (REB) and Ajzen's theory of planned behaviour (TPB) in his study. 180 university students were randomly selected from dormitories in Taiwan. Model testing procedure also revealed the correlation coefficients between variables in the models. Moderate and positive correlation was found between self-reported environmental behaviour and environmental locus of control (ELOC) ($r=.23$) and between attitude and ELOC ($r=.38$). Fielding and Head (2011) also investigated the correlation between environmental behaviour, locus of control, and knowledge. 18-24 ($n=2192$) years-olds and ($n=1529$) 12-17 years old young Australians participated to the study. Results revealed that there was a moderate and positive correlation between LOC and pro-environmental behaviour ($r=.31$) and between LOC and knowledge ($r=.15$) for 18-24 years old young Australians. Similar results also documented in a Turkey case. Alp et al. (2008) conducted a study in order to investigate elementary school students' environmental friendly behaviour and its predictors. 1140 students participated to the questionnaire and results indicated that intention, LOC, environmental affect were significant predictors of environmentally friendly behaviour.

To sum up, individual's locus of control can have an effect on the decisions he/she makes regarding a specific behaviour. Related literature also supported the effect of LOC on environmentally friendly behaviour.

2.7.2.3 Optimism and Pessimism

Optimism and pessimism refer to positive and negative predictions about the future. If future predictions are positive, this perception is called as optimism (Fischer & Leitenberg, 1986). As an example, there are lots of social and environmental problems in the 21st century and if people tell not to worry about the problems, they are regarded as optimistic. On the other hand, if people warn us about these problems, they are labelled as pessimistic. Although, the concept "optimism and pessimism" sounds simple, actually it has complicated effects on human behaviour. Deciding on the good or bad effects of being an optimistic over the behaviour is a challenging area for psychologists and educators. If an individual convinces him/herself that his/her future life will worsen; he/she may be unwilling to work in order to improve future life (McKinley, 2008) whereas Hatfield and Job (2001) mentioned that if individuals do not worry about their future, they will not be willing to take precautions. At that point, research has attempted to investigate the role of the optimism on human attitude and behaviour.

Weinstein (1980) conducted a study with college students and asked them how much was their chance to experience bad events or good events when compared with their friends. Students responded that their chance to experience negative events was less than their friends. They also believed that they had much more chance to experience positive events when compared with their friends. This type of optimism bias is named as "comparative optimism". Comparative optimism was as "a belief that one is less likely to experience negative events and more likely to experience positive events than are other people" (Shepperd, Carroll, Grace, & Terry, 2002, p. 65). In this respect, many studies concerning crimes, disasters, accidents revealed that people feel themselves closer to experience positive events when compared with

other people. For example Hoorens, Smits, and Shepperd (2008) conducted a study with 17-24 years students and they were asked to list 10 events that might occur in the future (e.g. getting married, having children, illnesses, accidents, divorcing etc.), after that students rated these events with respect to desirability and controllability. Study revealed a comparatively optimistic perception about controllable, desirable and neutral future events.

Besides, the matter that whether optimism can be linked to environmental orientation measures is crucial (Mc Elwee & Brittain, 2009). In that vein, comparative optimism was also investigated for environmental risks in a study with one hundred college students (Pahl, Harris, Todd, & Rutter, 2005). Students were asked to rate three hazards (nuclear power, air pollution, water pollution) in terms of whether they would occur in their local area or not. Participants were found to display comparative optimism for all environmental risks regardless of being a part of an activist group or not. This means that there is no evidence in order to support that comparative optimism inhibits or encourages pro-environmental behaviour. Contrary to these findings, Hatfield and Job (2001) suggested that pro-environmental behaviour could be prevented by optimism bias. They conducted a study with college students in order to investigate if students had optimism bias with respect to environmental hazards. Results showed that subjects tended to believe that environmental problems were less likely to occur in their local area and optimism bias differentiated regarding local or global level. Gifford et al. (2009) also supported these findings in a study investigating the spatial and temporal optimism for the first time with an international sample. Comparative optimism bias was found to be affected by geographic distance (spatial) such as local, national, global; and time (temporal) such as 10 years earlier, currently, and in 25 years. Generally countries tended to show spatial optimism bias about environmental problems and this can be resulted from media emphasizing global environmental problems too much in their programs. Contrary to spatial optimism, all countries were pessimistic about the future regardless of local, national or global level. It is concluded from the findings that 'if we are aware of the global environmental problems then we are pessimistic about

global future'. Results also revealed that optimistic spatial bias inhibited pro-environmental behaviour because people underestimated or ignored the local problems. Similarly, O'Brien (2007) conducted campus-wide survey with undergraduate and graduate students from all colleges and departments during 2007 spring semester in United States. Results of the study demonstrated that the majority of the respondents were likely to reveal that the environmental quality declined a lot in the past ten years. On the other hand, if they were consider about "local" environmental problems, most of the participants tended to believe that the environmental quality of their local area would remain the same in the future.

To conclude, people are not hopeful about their future. However, they have comparative and unrealistic optimism toward their local area. Review of the small number of studies in this area indicated that relationship between optimism/pessimism and behaviour produce mix results.

CHAPTER 3

METHOD

The previous chapters discussed the purpose and the significance of the study and also presented the related literature. The following chapter addresses the design of the study major, characteristics of the population and sample, instruments of the study and the procedure followed in order to collect data and explain the methods which were used to analyse the data.

3.1 Design of the Study

This study is a correlational research due to the nature of the questions included in the research, the definitions of the sample and population, the procedures of data collecting, the statistical techniques used in analysing the data and the generalizations of the findings of the study. The research questions mainly addressed pre-service science teachers' profile in Turkey and the variables associated with environmentally friendly behaviours. A sample of junior and senior pre-service science teachers administered a series of self-reported instruments prepared for the specified purposes. In order to provide validity and reliability issues of the instruments pilot studies were conducted and evidences for validity and reliability issues were examined. Then, descriptive analyses were conducted to identify the profile of the sample more deeply. After that, in order to provide necessary information to make clear interpretations for causal relationships between variables path analysis was used to propose the model. In Figure 3.1, there is given the data analyses of the present study, the instruments and a flow-chart describing the participants.

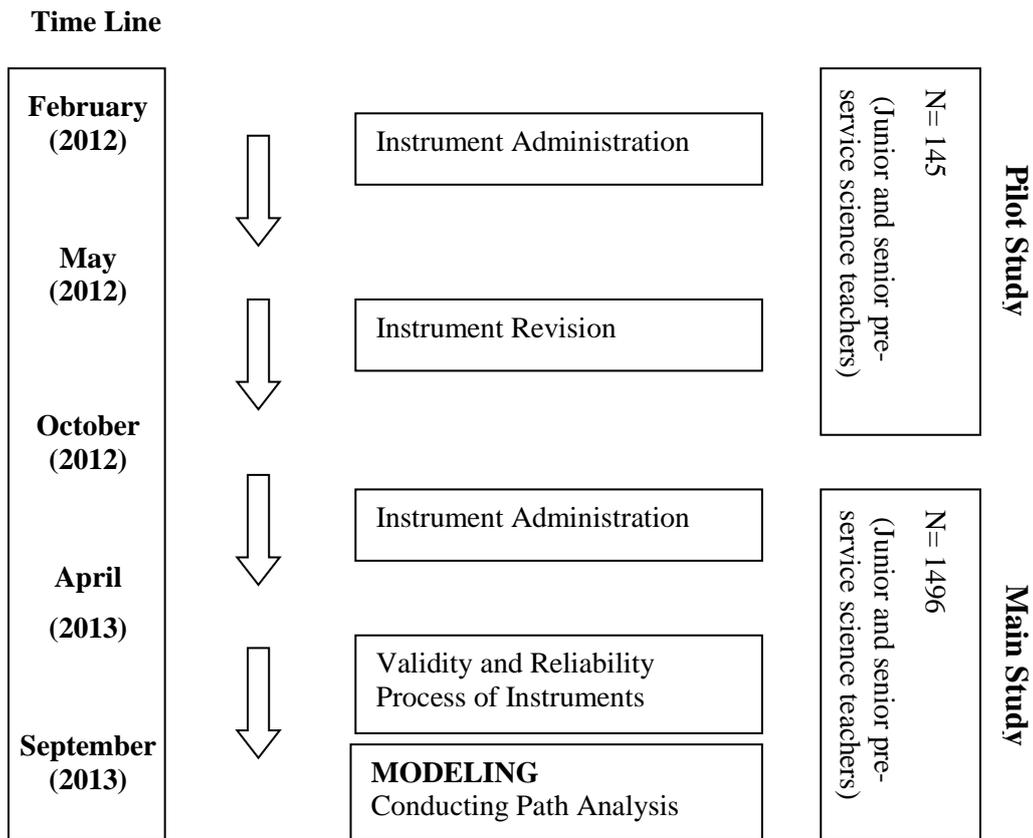


Figure 3.1 Overview of the present study

3.2 Population and Sample

As the population of the study was determined as all junior and senior pre-service science teachers in Turkey, this is a nationwide study. Pre-service science teachers generally enrol in some courses related to environmental issues and pedagogical content knowledge in their third and fourth years of undergraduate programs. Therefore, focusing on junior and senior pre-service science teachers seemed to be more appropriate to be defined as the population of the study. Considering representativeness of sample, statistical regions were decided to be used instead of geographical regions. Geographical regions of Turkey were determined based on only debatable geographic features of the provinces whereas statistical regions were

identified considering economic, social and geographic properties of the provinces (Ozcaglar, 2003).

Table 3.1 The list of selected provinces in each statistical region

Statistical Regions	Sub-Region	Provinces	Selected Provinces
İstanbul	Istanbul sub-region	İstanbul	İstanbul
East	Bursa sub-region	Bursa, Eskişehir, Bilecik	Bursa
Marmara	Kocaeli sub-region	Kocaeli, Yalova, Bolu, Sakarya, Düzce	Bolu
West	Tekirdağ sub-region	Tekirdağ, Kırklareli, Edirne	-
Marmara	Balıkesir sub-region	Balıkesir, Çanakkale	Çanakkale
West	Ankara sub-region	Ankara	Ankara
Anatolia	Konya sub-region	Konya, Karaman	Konya
Central Anatolia	Kırıkkale sub-region	Kırıkkale, Nevşehir, Kırşehir, Niğde, Aksaray	Aksaray
	Kayseri sub-region	Kayseri, Sivas, Yozgat	-
Aegean	İzmir sub-region	İzmir	İzmir
	Aydın sub-region	Denizli, Muğla, Aydın	Denizli
	Manisa sub-region	Manisa, Uşak, Kütahya, Afyon	-
Mediterranean	Adana sub-region	Adana, Mersin	Adana
	Antalya sub-region	Antalya, Isparta, Burdur	-
	Hatay sub-region	Hatay, Osmaniye, K.Maraş	-
West Black Sea	Zonguldak sub-region	Zonguldak, Karabük, Bartın	-
	Samsun sub-region	Samsun, Amasya, Çorum, Tokat	-
	Kastamonu sub-region	Kastamonu, Sinop, Çankırı	Kastamonu
East Black Sea	Trabzon sub-region	Rize, Trabzon, Artvin, Giresun, Ordu, Gümüşhane	Trabzon
South East Anatolia	Gaziantep sub-region	Gaziantep, Kilis, Adıyaman	-
	Şanlıurfa sub-region	Diyarbakır, Şanlıurfa	Diyarbakır
	Mardin sub-region	Batman, Mardin, Siirt, Şırnak	-
Central East Anatolia	Malatya sub-region	Elazığ, Malatya, Tunceli, Bingöl	Elazığ
	Van sub-region	Van, Hakkari, Bitlis, Muş	-
North East Anatolia	Erzurum sub-region	Erzincan, Erzurum, Bayburt	-
	Ağrı sub-region	Kars, Iğdır, Ardahan, Ağrı	Kars

2003 Socio-Economic development of provinces and <http://www.dpt.gov.tr>

According to Turkish Statistical Institute (Türkiye İstatistik Kurumu; TUIK, 2005), Turkey has 12 statistical regions and 26 sub-regions (see Table 3.1). Since most of these statistical regions include more than one province, at least one province was selected from every statistical region. Provinces were selected based on the existence

of senior and junior science education students. Therefore, all statistical regions were represented by reaching 15 provinces and 18 universities. The sample of this study was totally 1497 junior and senior pre-service science teachers (76.79% were female, and 23.21% were male) in 2012-2013 academic year; The Central Anatolia Region had the highest contribution with 390 (25.9%) participants while Southeast Anatolia Region had the lowest contribution to the sample with 51 (3.39%) participants. Number of participants with respect to gender, province, and region were presented in Table 3.2. The mean age of the students was 21.47 years ($SD=1.92$).

Table 3.2 Region and province statistics across gender

Sub-Region	Provinces	Gender (N)			TOTAL (N)	
		M*	F**	N***	Province	Region
Istanbul sub-region	İstanbul	20	55	-	75	
Bursa sub-region	Bursa	11	43	-	54	263
Kocaeli sub-region	Bolu	17	64	-	81	
Balıkesir sub-region	Çanakkale	19	34	-	53	
Ankara sub-region	Ankara	51	233	1	285	
Konya sub-region	Konya	11	49	-	60	390
Kırıkkale sub-region	Aksaray	14	31	-	45	
İzmir sub-region	İzmir	21	99	-	120	227
Aydın sub-region	Denizli	21	86	-	107	
Adana sub-region	Adana	32	100	3	135	135
Trabzon sub-region	Trabzon	38	141	1	180	285
Kastamonu sub-region	Kastamonu	26	79	-	105	
Şanlıurfa sub-region	Diyarbakır	15	36	-	51	51
Malatya sub-region	Elazığ	18	60	-	78	146
Ağrı sub-region	Kars	31	35	2	68	
TOTAL		345	1145	7	1497	

* female, **male, ***not identified

Detailed information about the profiles of pre-service science teachers were provided in Table 3.3. There were 944 (66.3%) junior and 516 (31.4%) senior students in the sample. With regard to hometown, most of the participants grew up in cities (58.78%), then in districts (27.54%), and lastly in rural areas (13.68%). 300 (20%) pre-service science teachers did not take any courses related to environmental issues. 524 (35.1%) participants took only one, 308 (20.6%) of them took two, 154 (10.3%) of them took three and more courses related to environmental issues. Majority of the participants, that is 1296 (86.6%) of the participants, were not a member of any environmental organization.

Table 3.3 Profile of pre-service science teachers

Demographic Variables	Frequency			Percentage	
	F*	M**	N***	F	M
Grade					
Junior	759	185	4	66.3	53.5
Senior	359	157	2	31.4	45.4
Missing	26	4	1	2.3	1.2
Location					
Rural Area	129	73	-	11.4	21.5
District	294	97	1	26.0	28.5
City	708	170	5	62.6	50.0
Missing	13	6	1	1.1	1.7
Courses Taken					
None	320	80	-	28.2	23.4
1	481	134	4	42.4	39.2
2	220	88	1	19.4	25.7
3	92	25	1	8.1	7.3
More	22	15	-	1.9	4.4
Missing	9	4	1	0.8	1.2
Membership of an environmental organization					
Yes	152	38	-	13.3	11.1
No	991	305	6	86.7	88.9
Missing	1	3	1	0.1	0.9

* female, **male, ***not identified

3.3 Variables

In the study, the variables are labelled as exogenous and endogenous variables with respect to proposed model on environmentally friendly behaviour and its associated variables. Exogenous variable is a synonymous with independent variable and endogenous variable is synonymous with dependent variable. Exogenous variables cause fluctuations on the values of endogenous variables in the model. However, changings in exogenous variables cannot be explained by other variables in the model (Byrne, 2010).

This study includes one exogenous variable named as; knowledge of environmental issues. Environmental knowledge was measured by multiple choice questions. There are 6 endogenous variables namely; spatial optimism, temporal pessimism, ecocentric attitude, anthropocentric attitude, locus of control and environmentally friendly behaviour. All endogenous variables were measured with Likert type scales and they were continuous variables.

3.4 Data Collection Instruments

The data collection instrument used in this study has six distinct parts. The first part of the instrument known as the Demographical Questionnaire designed to provide information about pre-service teachers' gender, university, area of hometown, status of membership of environmental organization, and number of lessons taken related to environmental issues. The second part includes the Turkish version of the Behaviour Inventory of Environmental Action (BIEA). The third part of the instrument aims to reveal pre-service teachers' ecocentric and anthropocentric attitudes with Environmental Attitude Scale (EAS). The fourth part includes Environmental Future Scale (EFS) in order to measure pre-service teachers' spatial optimism and temporal pessimism level, fifth part of the instrument consists of the Turkish versions of the Environmental Action Internal Control Index (EAICI). The last part contains the Knowledge of Environmental Issues Scale (KEIS).

After mentioning about the instruments in detailed, reliability and validity of each instrument were presented in the following subsection.

Demographic Questionnaire

Four questions were designed primarily to provide information about pre-service teachers' background in order to describe characteristics of our sample more deeply. Gender, name of the university, area of hometown, status of membership of environmental organization, and number of lessons taken related to environment were obtained by using this questionnaire.

Behaviour Inventory of Environmental Action: A One-Year History

Behaviour Inventory of Environmental Action (BIEA) scale was used to measure five categories of environmental behaviours, namely; ecomanagement, consumer, persuasion, and political and legal actions (Marchinkowski, 1988).

Scale also included empty lines for additional actions. In other words, participants were asked to write additional actions that they do in their daily life if there is. Considering pilot analysis results, one new item (I attend environmental friendly campaigns like battery collection campaigns) added to the ecomanagement dimension of the scale in the main study. So, additional actions were not asked in the main study. Finally, there were six items on consumer, persuasion, political and legal actions, and seven items on ecomanagement sub-dimension in the current study. It was a self-report scale that requires to rate pre-service teachers' general actions in a five point scale ranging from 'always' to 'never' (i.e., 1=never, 2=rarely, 3=sometimes, 4=often, 5=always).

Environmental Attitude Scale (EAS)

In order to measure attitudinal motives of pre-service science teachers, 21 likert type items with a 5 point response scale ('strongly agree' to 'strongly disagree') was used

(Thompson & Barton, 1994). Scale assessed participants' attitudinal views regarding to environment. These attitudinal motives named as ecocentric and anthropocentric attitude. Ecocentric attitudes were measured with twelve items reflecting the intrinsic value of nature, feelings of relaxation pertaining to being out in nature, and being aware of a connectedness between humans and nature. Concerning the assessment of anthropocentric attitudes, most of the nine anthropocentrism items emphasize a concern associated with the decreased quality of human life as a result of environmental degradation. Turkish adaptation of the scale was made by Onur et al. (2012).

Environmental Future Scale (EFS)

Scale was used in order to measure respondents' spatial optimism and temporal pessimism levels (Gifford et al. 2009). In the adaptation process of the scale, ten environmental issues which are water resource, air pollution, biodiversity, acid rain, vehicle traffic, population growth, natural areas, radiation and nuclear waste, agricultural soil, and visual pollution were used from the original scale out of twenty to make the scale more meaningful for Turkish culture. Moreover, five environmental issues were added (waste, global warming, climate change, ozone layer depletion, and energy) considering The Environmental Inspection Report of Turkey in 2011. Finally, pre-service science teachers' spatial optimism and temporal pessimism levels were determined with fifteen environmental issues in local and global perspective. Participants' spatial optimism levels were rated based on three spatial levels (my area, my county, and world) with five-point scales ranging from 1 (very bad), 3 (acceptable) to 5 (very good). Temporal levels rated by two levels (now and future) with five-point scales ranging from much worse to much better (e.g., 1=much worse, 2=worse, 3=no different, 4=better, 5=much better). To obtain pre-service science teachers' spatial optimism scores, participants' local scores subtracted from global scores for both temporal levels. Therefore, two spatial optimism scores were gathered in terms of current and future conditions. In a similar way, teachers' temporal pessimism scores, was calculated by subtracting expected

future scores and today scores for local and global spatial levels. Thus, two temporal pessimism scores were gathered in terms of local and global conditions.

Environmental Action Internal Control Index (EAICI)

Short version of EAICI (Smith-Sebasto, 1992) with 11 Likert-type items ('strongly agree' to 'strongly disagree') was implemented in the present study. EAICI scale was designed to measure participants' perception in order to reveal if participants feel the power of his/her actions have effect on solving environmental problems or not.

Knowledge of Environmental Issues Scale (KEIS)

The scale was prepared to assess pre-service science teachers' knowledge about local and global environmental issue based on earlier research (Leeming, Dwyer, & Bracken, 1995; Dunlap, Van Liere, Merting, & Jones, 2000; O'Brien, 2007). Environmental issues were selected considering Environmental Inspection Report of Turkey released in 2011. According to this report, air pollution, water use and resource, waste management and recycling, biological diversity were identified as crucial environmental issues in Turkey. In this regard, eight questions related to those concepts were included to the scale. Moreover, literature revealed that, misconceptions between global warming and ozone depletion concepts is another hot topic issue in environmental education area. Therefore, two questions were added to the scale which was aimed to point out the misconception between global warming and ozone depletion. Furthermore, two questions related to energy use and energy sources which were another hot topic added to the scale. Issues used in the scope of Environmental Future Scale also took into account while selecting questions for knowledge scale. Parallel environmental issues were selected for both scales. Finally, twelve multiple choice questions were selected for the aim of determining knowledge of environmental the participants. ITEMAN analysis was conducted in order to assist in determining the extent to which items are contributing to the reliability of the scale and which response alternatives are functioning well for each item. Cronbach alpha value reported as 0.56 which is acceptable (Leeming, et al., 1995).

3.5. Validity and Reliability Issues of the Instruments

In order to provide reliability and validity of the instruments, construct, convergent, discriminant, and nomological validity of the instruments were discussed detailed in following parts.

3.5.1. Content Validity of the Instruments

The adaptation of the BIEA, EAICI, and EFS were performed by the researcher. One instructor from the Department of Modern Languages checked the translated items. After the first translation process, the adapted instruments were checked by two instructors from the Faculty of Education at METU according to the content and format. Instructors were experts on environmental education area. Therefore content-related evidence of validity of the instruments was provided by the judgments of people who were experts of the content.

3.5.2. Construct Validity of the Instruments

Construct validity of the instruments were provided by factorial validation of the instruments. As Environmental Future Scale and Knowledge of Environmental Issues Scale had no factor structure in nature, factorial validation was not an issue for these scales. On the other hand Behaviour Inventory of Environmental Action scale, Environmental Action Internal Control Index, and Environmental Attitude Scale has factor structures. Therefore, explanatory and/or confirmatory factor analyses were conducted with these instruments. Explanatory factor analysis was conducted via SPSS 21 and confirmatory factor analysis was performed by AMOS 21. Eigenvalues, factor loadings, and screeplot statistics were taken into consideration while predicting EFA results. On the other hand model fit indices were used to interpret CFA results. CFA and EFA results of instruments were discussed deeply in following parts.

Behaviour Inventory of Environmental Action

BIEA scale indicated two factor dimensions instead of five sub-dimensions (ecomangement, consumer, persuasion, political, and legal) in the pilot study. So, confirmatory factor analysis (CFA) was decided to repeat to understand if the main study supports two factor structures or not. However, in cases where the models do not fit, model is needed to be diagnosed rather than interpreting the different factor solutions (Taylor & Pastor, 2007). Therefore before conducting CFA, areas of misfit were investigated by examining the standardized residuals. Removing standardized residuals exceeding $|3|$ from the data can be a way to diagnose misfit (Byrne, 2010). Out of 1497 possible standardized residuals, 245 of them were greater than $|3|$. In spite of repeating CFA without these extreme values, model still did not fit.

In the second step, the data were submitted to EFA using SPSS 21 in order to determine if there were plausible models that could explain the relationships among the items. Although results revealed a four-factor model regarding to eigenvalues (and percentage of variance explained); 8.98 (29.93%), 3.17 (10.58%), 1.26 (4.20%), 1.09 (3.63), both sizable drop of the percentage of total variance values from the second to the third factor and scree plot (see Figure 3.2) were guided researcher to rotate and interpret model with two-factor.

Two-factors were rotated using direct oblimin rotation. Due to the exploratory nature of the analysis, factors should be allowed to correlate (Taylor & Pastor, 2007). Interfactor correlation value of two factors (.37) supported this judgment. Although the model could not explain more than the half of the total variance (40.51%), two-factor solution was the most informative and interpretive model for this study.

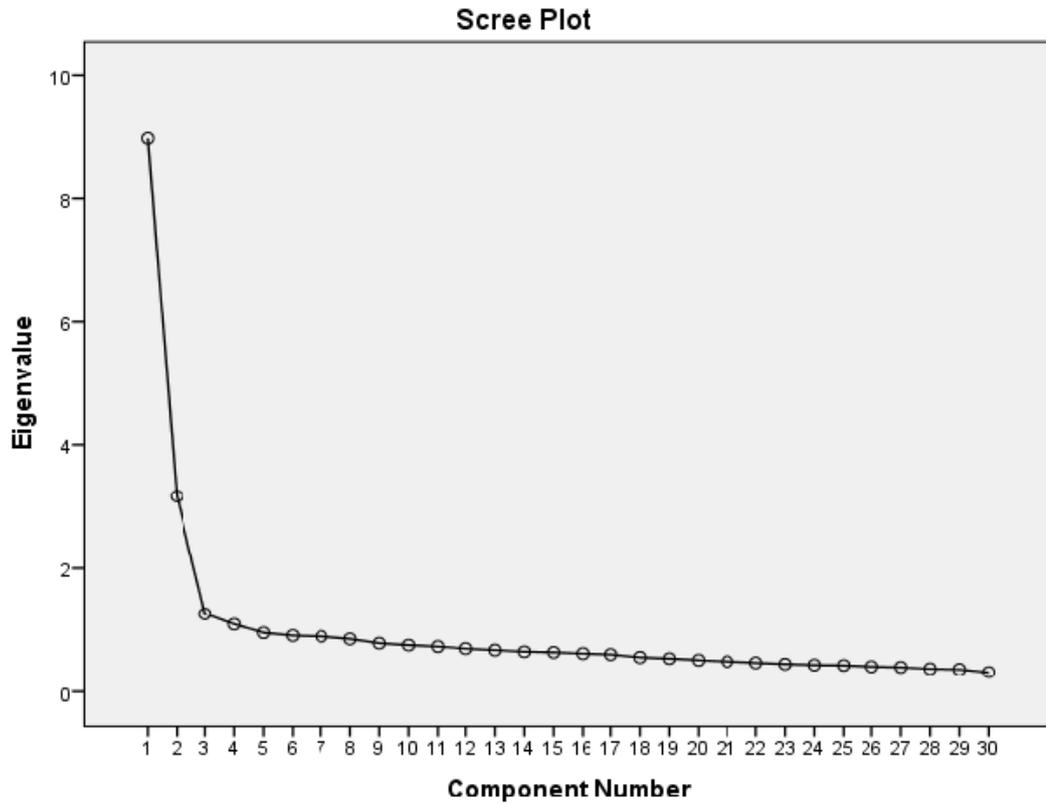


Figure 3.2 Scree plot of exploratory factor analysis

Although the original scale includes five subscales, two-factor solution indicated that items belonged two subscales instead of five (see Table 3.4). In the two-factor model, ecomanagement and consumer subscales loaded to the same factor. Two items also loaded to this factor from persuasion subscale. These two items reflected persuasion of ecomanagement and consumer actions. Namely, all items in the first factor included recycling, buying recyclable or recycled products, conserving water or energy, stop littering, stop buying aerosols, stop using harmful pesticides and persuasion of these actions.

Table 3.4 Explanatory factor analysis pattern (and structure) for two-factor model

Items	Components	
	Light Green Actions	Dark Green Actions
Ecomanagement	Used an alternative form of transportation (e.g., mass transit, bicycle, carpooling)	.39 (.32)
	Taken steps to reduce water use	.57 (.56)
	Recycled materials such as paper, glass, plastic, metals, or organic refuse	.51 (.53)
	Taken steps to improve wildlife habitat or food supplies (e.g., plant trees or flowers; built bird houses or feeders)	.58 (.64)
	Picked up litter or trash	.48 (.53)
	Taken steps to reduce energy used for heating, cooling, and/or lighting	.53 (.57)
	Participated to environmentally friendly campaigns (battery collection campaign etc.)	.53 (.53)
Consumer	Paid membership fees to or donated money to conservation /environmental groups (local, state, national, international)	.45 (.51)
	I avoided purchasing products directly associated with damage to wildlife or their habitats (e.g., products tested on animals, fur products, non-dolphin safe tuna)	.63 (.58)
	Avoided buying products with non-recyclable, non-biodegradable , or excessive packing	.66 (.66)
	Stopped buying products which cause pollution (e.g., aerosols, styrofoam, toxic chemicals or pesticides)	.45 (.48)
	Purchased products made, in whole or in part, from recycled materials (e.g., some paper and plastic products)	.54 (.60)
	Purchased products packaged in refillable, returnable or recyclable containers (e.g., aluminium cans, deposit bottles)	.65 (.62)
Persuasion	Encouraged an individual or group involved in some kind of destructive environmental behaviour to stop (e.g., to stop littering, buying aerosols, using harmful pesticides)	.60 (.63)
	Encouraged others to help the environment (e.g., to recycle, buy recyclable or recycled products, conserve water or energy)	.76 (.76)
	Encouraged one or more individuals to support “pro” environmental positions or candidates	.55 (.61)
	Prepared or passed out literature supporting the solutions of environmental problems/issues.	.57 (.63)
	Signed or distributed a petition asking a person/ group/ company/ institution to take an action to improve the environment.	.74 (.71)

Table 3. 4 (continued)

Items	Components	
	Light Green Actions	Dark Green Actions
Prepare or publicly display “pro” environmental messages (e.g., posters, buttons, t-shirts, bumper stickers)		.74 (.72)
Passed out materials or gathered signatures in support of “pro” environment policies or legislation (e.g., flyers, petitions)		.81 (.77)
Political	Supported or voted for a “pro” environmental laws, regulations, or programs	.45 (.52)
	Participated in political meetings or hearings concerning environmental policies or plans (e.g., city council meetings, public hearings)	.74 (.75)
	Ran for or served in any position with the intent of supporting the environment (e.g., students council, youth organizations)	.75 (.75)
	Supported or voted for a “pro” environment candidate	.51 (.53)
Legal	Provided information for testimony at a legal hearing on an environmental issue	.44 (.53)
	Reported the illegal collection of live plants or animals to authorities (e.g., in parks, preserves, or sanctuaries)	.54 (.60)
	Persuading others not to break environmental laws or informing others they are breaking such laws.	.31 (.32)
	Reported violations of fishing, trapping, or hunting laws to authorities.	.70 (.68)
	Reported pollution violations to authorities(e.g., littering, dumping)	.67 (.71)
	Helped authorities patrol areas for the purpose of enforcing environmental laws	.67 (.72)

Kagawa (2007) identified the actions like changing purchasing habits, recycling and saving energy or water as the “light green actions”. Therefore, first factor of BIEA scale was determined to be defined as “light green actions” in the current study. On the other hand, second factor consist of items related to mainly with political and legal actions. Three items from persuasion subscale also loaded to second factor. These three items included persuasion of political and legal actions (i.e. support “pro” environmental positions, prepared or passed out literature, signed or distributed a petition). Second factor including political, legal and persuasion of these actions called as “dark green actions” (Kagawa, 2007). Finally, light green actions consisted of 16 items reflecting actions performing directly in the nature to or with a monetary

support. On the other hand, dark green actions included using political means and enforcing existing laws with 15 items.

EFA result indicated that two-factor model reflects Turkish people understanding of environmental actions better instead of five factor structure. In other words, our environmental actions are still primitive with only two factors (light and dark green actions). After identifying two factors with EFA, proposing factor structures was checked by analyses of covariance structures within the framework of the confirmatory factor analytic (CFA) model via AMOS 21. In order to validate the factor structure of the data, observed and predetermined model which were representing the factors was observed.

Table 3.5 Goodness-of-fit indices of the model for BIEA

Fit Index	Calculated Values	Expected Values
χ^2	2012.187	small
df	374	-
χ^2 /df	5.38	$2 < < 5$
CFI	.90	$> .90$
RMSEA	.054	$< .80$
90% CI for RMSEA	.052 - .056	narrow
SRMR	.06	$< .10$

Note. CFI=Comparative Fit Index, RMSEA=Root Mean Square Error of Approximation, SRMR=Standardized Root Mean Square Residual.

The CFA results supported the two-factor structure of BIEA. AMOS 21 output revealed that standardized estimates of parameters in the model and all t-values were significant at $p < 0.05$ indicating that each item (observed variable) significantly related with its related factors (latent variable). Moreover, model fit indices also indicated a good model (see Table 3.5). Chi-square value was 2012.187 with 374 degrees of freedom ($p = < 0.001$) indicating significant value. Although insignificant chi square value is expected for a good fit, chi-square statistics reaches to significant level with large samples (Hair, Black, Babin, & Anderson, 2010). Therefore, other fit indices should be examined to determine whether model fit the data or not. Considering normed chi-square (NC), the value of χ^2/df was founded as 5.38 which

is almost between expected values (Byrne, 2010). Comparative fit indices (CFI) value founded as .90 for the current model indicating a good fit (Bentler, 1990). Regarding the root mean square error of approximation (RMSEA) was produced .054 that is less than .80 indicating a good fit (Hu & Bentler, 1999). Lastly, standardized root mean square residual (SRMR) value was found as .06 which is less than critical value (.10) (Byrne, 2010). Therefore, all fit indices indicated a good fit for two-structure model of BIEA scale.

Table 3.6 Latent variables, observed variables, β , λ_x , R^2 , and δ of BIEA

Latent Variable	Observed Variable	β	λ_x	δ	R^2
Light Green Actions	EFB1	.24	0.40	.94	.06
	EFB2	.39	0.64	.85	.15
	EFB5	.51	0.84	.74	.26
	EFB9	.49	0.91	.76	.24
	EFB11	.50	0.96	.75	.25
	EFB13	.63	1.13	.61	.39
	EFB17	.61	1.03	.62	.38
	EFB18	.53	0.86	.72	.28
	EFB19	.59	1.04	.65	.35
	EFB21	.47	0.82	.78	.22
	EFB23	.55	1.02	.70	.30
	EFB24	.72	1.21	.49	.51
	EFB26	.60	0.97	.64	.36
	EFB30	.57	1.04	.68	.32
EFB31	.49	1.00	.76	.24	
Dark Green Actions	EFB3	.53	1.00	.72	.28
	EFB4	.61	1.21	.73	.37
	EFB6	.47	0.86	.78	.22
	EFB7	.59	1.22	.65	.35
	EFB8	.60	0.83	.64	.36
	EFB10	.57	1.10	.66	.33
	EFB12	.64	1.11	.59	.41
	EFB14	.66	1.11	.56	.44
	EFB15	.72	1.18	.48	.52
	EFB16	.42	0.90	.82	.18
	EFB20	.71	1.29	.49	.51
	EFB22	.69	1.28	.52	.48
	EFB25	.71	1.32	.50	.50
	EFB27	.71	1.31	.50	.50
EFB28	.55	1.23	.68	.32	
EFB29	.68	1.17	.58	.46	

Furthermore, standardized (β) and unstandardized (λ_x) estimates, the ratio of explained variance to total variance (R^2), and the measurement error (δ) gave also information about each of observed variable (items) (see Table 3.6).

Unstandardized values (λ_x) predicts the item covariance matrix and useful for comparing solutions of different groups. On the other hand, standardized values (β) predicts the item correlation matrix and useful for compare items within group. As an example, Item-24 almost had three times influence ($\beta=.72$) on light green actions as did Item-1 ($\beta=.24$). Moreover, R squared indicated the changes on latent variables (factors) resulted from observed variables (items). Considering R^2 , 51% of the changes in light green actions resulted from Item-24 ($R^2=.51$). Accordingly, measurement error of Item-24 was founded as .49 (1-.51). Mentioned statistics give chance to compare items with in their factor structure.

Finally, evaluation of the model according to the goodness-of-fit indices and estimate solutions showed that there is a good fit between model and the data. It was confirmed that BIEA can be used to assess the pre-service science teachers' environmentally friendly behaviour with light and dark green action factors.

Environmental Action Internal Control Index and Environmental Attitude Scale

Two separate CFA were conducted to confirm the one-factor structure of EAICI and two factor structure of EAS.

The CFA results supported one-factor structure of EAICI and two-factor structure of EAS with significant standardized estimates of parameters. In other words, all t-values of observed variables (items) were significant at $p=.05$ level. Model fit indices also indicated goodness-of-fit indices (see Table 3.7).

Table 3.7 Goodness-of-fit indices of the model for EAICI and EAS

Fit Index	Calculated Value		Expected Values
	EAICI	EAS	
χ^2	154.720	621.137	small
df	39	140	-
χ^2 /df	3.97	4.44	$2 < < 5$
CFI	.98	.94	$> .90$
RMSEA	.044	.048	$< .80$
90% CI for RMSEA	.037 - .052	.044 - .052	narrow
SRMR	.02	.05	$< .10$

Note. CFI=Comparative Fit Index, RMSEA=Root Mean Square Error of Approximation, SRMR=Standardized Root Mean Square Residual.

Standardized (β) and unstandardized (λ_x) estimates, squared R (R^2), and the measurement error (δ) of items of EAICI and EAS were presented in Table 3.8 and for Table 3.9 respectively.

Table 3.8 Latent variables, observed variables, β , λ_x , R^2 , and δ of EAICI

Latent Variable	Observed Variables	β	λ_x	δ	R^2
Internal Locus of Control	LOC1	.69	1.00	.52	.48
	LOC2	.36	.59	.87	.13
	LOC3	.73	1.00	.47	.53
	LOC4	.79	1.07	.38	.62
	LOC5	.70	1.05	.52	.48
	LOC6	.82	1.10	.33	.67
	LOC 7	.76	1.07	.42	.58
	LOC8	.62	1.07	.61	.39
	LOC9	.57	.91	.68	.32
	LOC10	.56	1.00	.57	.43
	LOC11	.58	.96	.67	.33

In this case, Table 3.8 indicated that Item-3 almost had two times influence ($\beta=.73$) on internal locus of control as did Item-2 ($\beta=.36$). Considering R^2 , 67% of the changes in internal locus of control resulted from Item-6 ($R^2=.67$)

Accordingly, measurement error of Item-6 was founded as .33. Same relations among β , λ_x , R^2 , and δ are necessary for items of EAS (see Table 3.9).

Table 3.9 Latent variables, observed variables, β , λ_x , R^2 , and δ of EAS

Latent Variable	Observed Variables	β	λ_x	δ	R^2
Ecocentrism	Att1	.57	1.00	.67	.33
	Att3	.23	0.58	.95	.05
	Att4	.65	1.23	.57	.43
	Att7	.65	1.10	.58	.42
	Att9	.67	1.24	.55	.45
	Att11	.73	1.37	.46	.54
	Att13	.75	1.43	.44	.56
	Att15	.63	1.27	.60	.40
	Att16	.27	0.70	.93	.07
	Att17	.67	1.24	.55	.45
	Att18	.57	1.14	.68	.32
Att20	.43	0.93	.72	.18	
Anthropocentrism	Att2	.15	1.00	.98	.02
	Att5	.43	1.00	.82	.18
	Att6	.45	1.02	.80	.20
	Att8	.60	1.57	.64	.36
	Att10	.61	1.51	.63	.37
	Att12	.71	1.84	.50	.50
	Att14	.64	1.64	.60	.40
	Att19	.22	.95	.95	.05
	Att21	.43	.93	.81	.19

Eventually, model fit indices of EAICI and EAS with respect to criteria showed that there is a good fit between model and the data. It was confirmed that EAICI can be used to assess the pre-service science teachers' internal locus of control and EAS can be used to determine participants' environmental attitudes.

3.5.3. Convergent Validity of the Instruments

After getting evidence for factor structures of BIEA, EAICI, and EAS; convergent validity issue were considered due to understand if these factors correspond with each another or not. Convergent validity was provided through item loadings (β), item total correlations (r), Cronbach's alpha reliability coefficient (α), composite reliability scores (CR), and the average variance explained (AVE).

Reliability coefficients for subdimensions and for the overall scale were calculated separately by this formula:

$$CR = \frac{(\sum_{i=1}^n \lambda_i)^2}{(\sum_{i=1}^n \lambda_i)^2 + (\sum_{i=1}^n \delta_i)}$$

(CR= composite reliability, λ_i = i. unstandardized item weight and δ_i = i. error term of item)

The average variance explained (AVE) was evaluated with the help of the equation below:

$$AVE = \frac{\sum_{i=1}^n \lambda_i^2}{n}$$

(AVE= average variance explained, λ_i = i. unstandardized item weight and n= number of items)

Table 3.10 Item correlations, reliability coefficients, composite reliability, average variance explained values of BIEA and EAS

Scale	Factors	Item	Item Corr.		α	CR	AVE
			Lowest	Highest			
BIEA	Light Green Actions	16	.23	.69	.84	.80	.39
	Dark Green Actions	15	.45	.72	.90	.89	.30
Total					.91		
EAS	Ecocentric	12	.23	.72	.84	.86	.34
	Anthropocentric	7	.34	.73	.75	.66	.31
Total					.81		
EACI	Internal Locus of Control	11	.34	.83	.89	.89	.46

Item total correlations (r), Cronbach's alpha reliability coefficient (α), composite reliability scores (CR), and the average variance explained (AVE) was calculated by the equations below and presented in Table 3.10.

Considering convergent validity statistics, all item standardized weights (β) observed around .50 (see Table 3.6, Table 3.8, and Table 3.9). Item-total correlation values were founded neither negative nor too low indicating that item associated with the rest of the scale as the other items did. For reliability of the scales, Cronbach's alpha

reliability coefficient of all scales and factors were founded higher than .07. Regarding composite reliability and the average variance explained CR values were provided higher than AVE for all factors. These are the indicator of an acceptable convergent validity. As, poor convergent validity among factors pointed out the necessity of more factors, results confirmed that BIEA scale and EAS had two factors and EAICI had one factor.

3.5.4. Discriminant Validity of the Instruments

After getting evidence for convergent validity, ensuring discriminant validity also important for revealing if these factors actually identifying different concepts. In order to provide discriminant validity of the scales, square of coefficient (ASV) of all dimensions are need to be computed and compared with the explained mean variances (Σ AVE) of these dimensions. ASV was calculated by the square of the correlation value between the factors. Considering BIEA, correlation between light and dark green actions was .64. So, ASV value for was founded as .41 ($.64^2$) for BIEA scale. Similarly, correlation between ecocentric and anthropocentric attitude was .36 and ASV was found as .13 ($.36^2$) for EAS. Factors of BIEA and EAS indicated that their Σ AVE were higher than ASV which is an expected result for discriminant validity. Table 3.11 also indicated confidence intervals (CI), t-values and significance of t-values of scales. Confidence intervals was calculated as between .60 and .68 ($CI=.64 \pm 1.96*.02$) for BIEA scale and between .34 and .38 ($CI= .36 \pm 1.96*.01$) for EAS. These intervals did not cover “1”. Therefore, this is evidence for the scales did not have one-factor structure.

Table 3.11 Discriminant validity statistics

Scales	Factors	ASV	Σ AVE	t-value	P value	CI
BIEA	Light Green Actions Dark Green Actions	.41	.69	11.28	.000	.60 - .68
EAS	Ecocentric Attitude Anthropocentric Attitude	.13	.65	7.94	.000	.34 - .38

Ultimately, discriminant validity statistics of BIEA revealed that light and dark green actions actually identified different patterns. Similarly, ecocentric and anthropocentric attitude also specified different concepts within EAS.

3.5.5. Nomological Validity of the Instruments

In order to reveal if each factor behaves as it should within the scale, nomological validity of BIEA and EAS should be met. In this sense, coefficient between two factors was divided to its standard error and a value of $t = 35.5$, $p < .0$ was found for BIEA and a value of $t = 36$, $p < .01$ for EAS. This indicated that the relationship between the factors were moderate and statistically significant.

Results discussed above indicated that BIEA scale has content and construct validity. Namely, the items included by their scales had stronger relationships with existing model rather than with the other potential models.

3.6 Analyses of Data

Data were analysed in terms of three main parts. Firstly, preliminary data analysis was performed in order to handle missing data, normality, outlier check, and to meet assumptions of path analysis. The second part covers descriptive statistics of EFB and its associated variables. Finally, path analysis was conducted if hypothesized model fitted the sample data or not.

In order to analyse the data mentioned above, two statistical packages SPSS 21 and AMOS 21 were performed in this study. SPSS was utilized while detecting missing data and outlier, providing normality, conducting explanatory factor analysis, ensuring assumptions of path analysis, and lastly for descriptive statistics of the variables. Confirmatory Factor Analysis (CFA) and Path Analysis were conducted via using AMOS 21.

Missing Data Analysis

Missing data analysis was utilized before starting analysing the data. Firstly, all items of instruments were controlled in order to find out the percentage of the missing data. There were missing data in the sample however they were less than 5% of the answers. Moreover, they did not have any patterns between items. In this sense, missing values replaced by values estimated by the regression method depend on the assumption that the pattern of missing values does not depend on the data values (Kline, 2005). Participants who had any scores from one of the instruments were excluded from the analysis. Missing data replacement did not perform for these cases. Similarly, missing values in demographic variables (gender, grade etc.) were not replaced.

Normality

Path analysis, like other inferential statistic techniques, requires normally distributed data as prerequisite. Multivariate and univariate normality check was prior for data analysis. As there were no ways to assess multivariate normality with SPSS, univariate normality was a way to determine whether multivariate normality was provided or not (Stevens, 2002). Therefore, in the current study, univariate normality of the data was ensured by skewness and kurtosis values. George and Mallery (2003) claimed that values between -1 and +1 for skewness and kurtosis values may be accepted excellent; values between -2 and +2 are also acceptable. Kline (2005) also identified values for skewness and kurtosis values by using wide-ranges. According to him, skewness values higher than 3 and kurtosis values higher than 10 pointed out problematic data.

Outlier Check

Outliers on endogenous variables and exogenous variables detected different statistical methods. In order to measure outliers on endogenous variables in the model standardized residuals were computed. Standardized residual values greater

than three pointed out as an outlier (Stevens, 2002). Outliers on exogenous variables were detected via Leverage values. It is not necessary to exclude the data that seems outlier by using standardized residuals and Leverage values. According to Stevens (2002), outliers become influential on the data set when Cook's distances greater than 1.

Finding out multivariate outliers from a set of dependent variables is a more complicated process than detecting univariate or bivariate outliers. For multivariate normality, a statistic called Mahalanobis distance can be assessed. The Mahalanobis distance measures the distance of an individual case value from the centroid of all the cases for the dependent variables. If distance is getting longer, the observation becomes an outlier (Burdenski, 2000).

Descriptive Statistics

Then, mean, minimum and maximum values, standard deviation were used for explaining the profiles of the pre-service science teachers' demographic variables, environmental friendly behaviour and its associated variables via SPSS 21.

Path Analysis

In order to conducted path analysis, AMOS 21 statistical package was used. This program revealed an output including indices of the tested model. These indices are; Chi square (χ^2), degrees of freedom (df), probability level (p-value), minimum discrepancy/ degrees of freedom (CMIN/df), Comparative Fit Index (CFI), the root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR) were reported for model testing criteria. In order to obtain fit model, these indices should take acceptable values considering the criteria based on the literature. χ^2 significance value should be close to 0 and should have non-significant p value. However, chi square is very readily reaches significance with large samples sizes (>250) even when all other indices indicate a good fit. Therefore, it can be said that even if it is suggested to find non-significant results for chi square

statistic, it is expected to find significant results while studying with large samples (Hair, et al. 2010). Various cut-offs ranging from 2 to 5 were suggested for CMIN/df as cutoffs (Marsh & Hocevar, 1985). Comparative fit index (CFI) was also calculated and values close to 1 was considered as an indication of a very good fit (Bentler, 1990), and values above .80 are permissible (Hair et al., 2010). For RMSEA, the criteria were set to values less than .08 indicates a good fit (Hu & Bentler, 1999). Hu and Bentler (1999) recommended cutoff value of .06 for CI for RMSEA. The value of SRMR was set to be less than .10 (Byrne, 2010).

3.7 Threats to Internal Validity

In the present study, location and data collector characteristics threats might be the possible threats due to the nature of the sample. 17 different universities located in 14 different cities from 7 different regions were involved in the current study. As it is not feasible to make the application in the same place with the same data collector, researcher sent the optic forms to different locations and data collectors. In order to minimize this threat, “Recommendations for Implementations of Environmental Friendly Behaviour Scale” was prepared and sent to all data collectors. In this way, data collection process was tried to be standardized.

Subject characteristics threat occurs when characteristics of the participants is not controlled. In order to handle this threat, junior and senior pre-service science teachers selected from public universities.

Mortality may be another threat for a survey research. In this study, pre-service teachers were expected to complete all scales; in other words, they should have scores for each variable being measured. If there was deficiency of those scores, participants directly excluded from the study. In order to control this threat, a large sample size was tried to be reached.

Testing was not seen as a possible threat for this study. Since the scales are selected to measure different constructs and did not influence each other, testing was not a problem in terms of internal validity for the current study.

3.8 Threats to External Validity

In order to make generalization from sample to population, best representative sample should be selected from the population. In the current study, sample was drawn from the universities among 26 provinces considering the diversity of the sample.

In order to provide external validity, at least one university was selected from seven regions conveniently. Convenient sampling procedure depends on three criteria. Firstly, universities from some provinces were not included due to lack of science education department. Secondly, some science education departments of the universities did not have, junior and senior pre-service science teachers. Finding volunteer and eager data collectors from selected universities was the last criterion of the convenient sampling. As, this study was only conducted with junior and senior pre-service science teachers, results of the study cannot be generalized for the other graders and other departments.

CHAPTER 4

RESULTS

This chapter presented preliminary data analysis, the descriptive statistics, and the inferential statistics. In the preliminary data analysis, missing data, outlier, normality and linearity analysis were presented. The descriptive statistics part included item and total mean scores, standard deviations, and frequency distributions of all variables environmentally friendly behaviour, spatial, optimism, temporal pessimism, attitudinal motives, internal locus of control, knowledge of environmental issues used in the model. Finally, assumptions of path analysis and model testing process were presented in the inferential statistics part in depth.

4.1 Preliminary Analysis

Preliminary data analyses were conducted prior to descriptive and inferential analysis to edit the data to prepare it for further descriptive and inferential analysis. In this sense; missing data analysis, influential data points, univariate and multivariate normality, and linearity were checked to provide reliable results both for descriptive and inferential analyses.

Missing Data

Before the descriptive and inferential analyses, missing data analysis was conducted for each variable. As AMOS 21 software program run with a single sample size (N), replacing missing data procedure was necessary. First, the percentage of missing data was investigated to understand the amount of data loss. Then, data were checked in order to find out if missing values were random or there was systematic data loss pattern. The results revealed that missing data were less than 10% (see Table 4.1). A few missing values less than 10% on a single variable, in a large sample may be

ignorable if these missing were random (Hair, et al., 2010). And missing data patterns were found to be random. Accordingly, missing values were replaced by values estimated by the regression method and data analysis was continued.

Table 4.1 Missing data statistics of each variable in the model

Variables	# of items	N	Sample Size	
			Missing	%
Demographic Information				
Region	1	1497	-	-
University	1	1497	-	-
Hometown	1	1477	7	.47
Gender	1	1490	20	1.34
Environmental Knowledge*	12	1334	145	9.68
Environmental Attitude				
Ecocentric Attitude*	12	1354	143	9.55
Anthropocentric Attitude*	9	1428	69	4.61
Internal Locus of Control*	11	1439	61	4.07
Spatial Optimism				
Today*	15	1399	98	6.55
Future*	15	1387	110	7.34
Temporal Pessimism				
Local*	15	1372	125	8.35
Global*	15	1394	103	6.88
Environmentally Friendly Behaviour				
Light Green Actions*	15	1382	115	7.68
Dark Green Actions*	16	1366	131	8.75

*replaced with regression method for further analyses

Outlier Analysis

Outlier analysis was conducted to detect influential data points for endogenous variable (knowledge) and the exogenous variables (spatial optimism, temporal pessimism, ecocentric attitude, anthropocentric attitude, locus of control and environmentally friendly behaviour) separately. Thus, standardized residuals, centred leverage value and cook's distance were computed. For exogenous variables, outliers were detected by examining standardized residuals. According to Stevens (2002), standardized residual values greater than $|3|$ were considered as unusual data points.

According to Table 4.2, it is observed that the range of standardized residuals was ranging from -2.16 to 3.07, indicating that there were a few identifiable outliers in the exogenous variables.

For endogenous variable, on the other hand, leverage value was computed for the purpose of checking outliers. To determine if there was an outlier, $(2k+2)/n$ (k is the number of predictors and n is the number of observations) formula was calculated as a criterion and Leverage values greater than this criteria should be carefully examined.

$$(2 \times 7) + 2 \div 1497 = 0.011$$

For the current study, criterion value was computed as 0.011 and Leverage values greater than 0.011 were determined as an outlier for the endogenous variable. Table 4.2 revealed that maximum Leverage value was 0.031 indicating the presence of outliers on the endogenous variable.

Table 4.2 Residual statistics for outliers

	Min	Max	<i>M</i>	<i>SD</i>
Standart Residuals	-2.16	3.07	.000	1.000
Centered Leverage Value	.00	.03	.005	.003
Cook's Distance	.00	.01	.001	.001

To check if these outliers on the endogenous and exogenous variables were influential or not, Cook's distances were calculated. Cook's distances values greater than 1 generally were considered as the presence of influential outliers which should be excluded from the data (Hosmer & Lemeshow, 2000, p.180). As seen in Table 4.2, the present study provided Cook's distances between 0.00 and 0.01. Since the Cook's distances were less than 1, it could be concluded that the outliers on the endogenous and exogenous variables were not influential. Therefore, there was no need to remove these cases from the data.

Normality

To provide the normality of the data both univariate and multivariate normality is necessary. If a set of variables is distributed as multivariate normal, then each variable must be normally distributed. Univariate normality was determined by the skewness and kurtosis values. Skewness values higher than 3 and kurtosis values higher than 10 indicated problematic data (Kline, 2005). Table 4.3 revealed that skewness and kurtosis values indicated normal distribution. Findings indicated that all variables were univariate normally distributed.

Table 4.3 Univariate normality statistics

	Skewness		Kurtosis	
	Statistic	Std.Error	Statistic	Std.Error
Environmentally Friendly Behaviours	.214	.063	.490	.126
Locus of Control	-1.379	.063	2.295	.126
Spatial Optimism				
Today	-.437	.063	.341	.126
Future	-.740	.063	2.424	.126
Temporal Pessimism				
Local	.209	.063	.556	.126
Global	-.057	.063	.230	.126
Ecocentric Attitude	-1.485	.063	2.253	.126
Anthropocentric Attitude	-.378	.063	-.130	.126
Knowledge of Environmental Issues	-.028	.063	-.170	.126

As path analysis was conducted based on covariance structure and research indicated that kurtosis of the data affected the variance and covariance values of the path analysis, one of the critical assumption to be met in the conduct of path analysis is multivariate normality of the data.

To investigate multivariate normality, univariate normality of each variable is prerequisite. However, even if all variables are distributed normally, it is possible that the set of variables may not be distributed as multivariate normal. Thus, testing each variable only for univariate normality is not sufficient for providing multivariate normality. The multivariate normality of the observed variables in the models was

calculated via AMOS 21 (see Table 4.4). Findings revealed that kurtosis values were under the critical range for all models indicating data is multivariate normal.

Table 4.4 Multivariate normality statistics

	Kurtosis	
	Statistic	Critical Ratio
Model 1	9.68	16.69
Model 2	9.69	16.70
Model 3	6.74	11.62
Model 4	8.81	15.18

Finally, findings of normality tests indicated that data provided univariate and multivariate normality.

Overall, preliminary analysis results revealed that missing data and influential data points were ignorable. Then, univariate and multivariate normality of the variables were checked. Findings revealed that univariate and multivariate normality were provided. It, therefore, was reliable to conduct further descriptive and inferential analysis with this data set.

In the following part descriptive statistics were presented for each variable with respect to of whole sample as well as gender, hometown, and geographical regions.

4.2. Descriptive Statistics

Descriptive statistics were used to examine the profile of pre-service science teachers regarding environmentally friendly behaviours, attitudinal motives, environmental knowledge, spatial optimism, temporal pessimism and internal locus of control. Total mean scores and standard deviations, minimum and maximum values were primarily utilized in Table 4.5.

Table 4.5 Mean scores, standard deviations, minimum and maximum values of variables in the model

	Mean	SD	Min	Max
Environmentally Friendly Behaviour				
Light Green Actions	3.12	.68	1.14	5.00
Dark Green Actions	1.90	.67	.96	4.56
Total Score	2.57	.56		
Environmental Attitude				
Ecocentric Attitude	4.09	.73	1.08	4.83
Anthropocentric Attitude	3.39	.79	1.00	5.00
Internal Locus of Control	3.96	.82	.64	5.00
Knowledge of Environmental Issues	5.92	2.02	.00	12.00
Spatial Optimism				
Today	-.57	.82	-3.33	2.53
Future	-.44	.68	-3.07	4.33
Temporal Pessimism				
Local	-.76	.85	-3.80	3.07
Global	-.50	.79	-3.07	3.53

4.2.1 Environmentally Friendly Behaviour Profiles of Pre-Service Science Teachers

A self-reported instrument with 31 items was used to investigate the environmentally friendly behaviour profile of pre-service science teachers. Specifically, participants were asked to indicate how frequently they performed given behaviour in last one year. The average mean score of 2.57 ($SD=.56$), placed our participants very near “*sometimes*” for our measure of the environmentally friendly behaviours (see Table 4.5). To put it differently, Turkish pre-service science teachers sometimes engaged in environmentally friendly behaviours.

Although the original instrument addressed five behaviour categories (i.e. eco-management, consumer, legal, political, and persuasion) current study yielded two behaviour categories labelled as light green and dark green actions (see Chapter 3). Mean scores and standard deviations of environmentally friendly behaviour dimensions with respect to gender, hometown and geographical regions were depicted in Table 4.6 and Figure 4.1- 4.3, respectively.

Table 4.6 Mean scores and standard deviations of light and dark green actions with respect to gender and hometown

Hometown	Gender	Light Green Actions		Dark Green Actions	
		M	SD	M	SD
City	Male	2.99	.72	2.09	.75
	Female	3.14	.68	1.87	.66
	Total	3.11	.69	1.92	.68
District	Male	3.07	.76	1.99	.86
	Female	3.15	.65	1.86	.59
	Total	3.12	.68	1.89	.67
Rural Area	Male	3.08	.62	1.97	.74
	Female	3.19	.66	1.84	.65
	Total	3.14	.65	1.89	.69
TOTAL		3.12	.68	1.90	.67

As presented in the Table 4.6, pre-service science teachers had higher scores on light green action items ($M=3.12$, $SD=.68$) compared to mean scores gained by dark green actions ($M=1.90$, $SD=.97$), meaning that they preferred to engage in actions depending on physical action, monetary support or financial pressure more than political and legal actions. In other words, while sometimes engaging light green actions, pre-service science teachers rarely engaged in dark green actions. Table 4.6 also indicated that light green actions were engaged mostly by female pre-service science teachers who were used to live in rural areas ($M=3.19$, $SD=.66$). On the other hand, male pre-service science teachers from cities had the lowest score ($M=2.99$, $SD=.72$) regarding light green actions. Considering dark green actions, male participants from cities got the highest mean score ($M=2.09$, $SD=.75$) whereas female participants from rural areas ($M=1.84$, $SD=.65$) got the lowest.

With respect to gender, environmentally friendly behaviour score of female and male pre-service science teachers were the same with a mean of 2.51. Female and male participants' mean scores differentiated regarding dimensions of EFB. Female pre-service teachers gained higher score on light green action dimension. Female pre-service science teachers gained a mean score as 3.15 ($SD=.67$) while males' mean score was 3.02 ($SD=.71$) regarding light green actions. On the other hand, males ($M=2.00$, $SD=.77$) had slightly higher score from dark green actions than female

participants had ($M=1.87$, $SD=.64$). In brief, females were more likely to perform light green action and less likely to perform dark green actions, vice versa for male participants. These findings were expected considering the general characteristics of Turkish people. More specifically, females were found more sensitive regarding environmental protection in the scope of eco-management and consumer actions whereas males seemed more likely to engage with political and legal action types (see Figure 4.1).

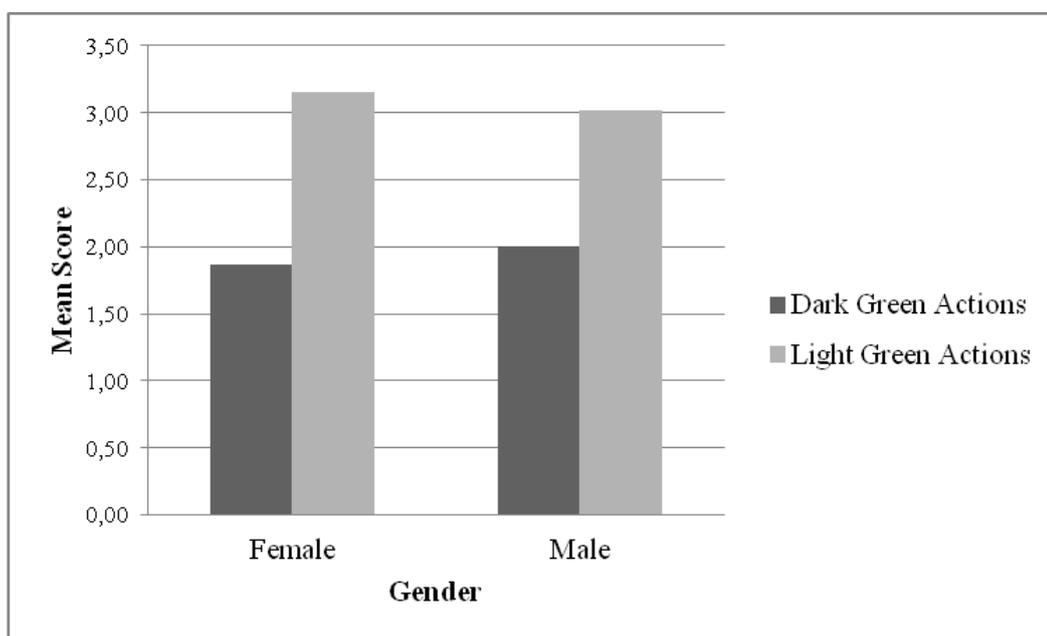


Figure 4.1. Mean scores of light and dark green actions across gender

Regarding the hometown of the participants, it was observed that environmentally friendly behaviour scores were too close to each other. Pre-service science teachers from districts produced a mean score of 2.45 ($SD=.59$) which was slightly higher than the mean scores of participants from rural areas 2.44 ($SD=.60$), and cities 2.43 ($SD=.60$). Mean scores of pre-service science teachers from different hometown acquired a different character via dimensions of EFB. Participants, who grew up in rural areas engaged in slightly more light green actions ($M=3.14$, $SD=.65$) than those lived in districts ($M=3.12$, $SD=.68$) and cities ($M=3.11$, $SD=.69$). On the other hand, participants from cities ($M=1.92$, $SD=.68$) tended to exhibit more dark green actions

compared to participants raised in districts ($M=1.89$, $SD=.67$) and rural areas ($M=1.89$, $SD=.69$). In fact, it can be said that pre-service science teachers living in rural areas were more likely to display behaviours related to physical action, monetary support or financial pressure than pre-service science teachers living in districts and cities. On the other hand, participants living in cities tended to engage more in political and legal actions when compared with participants from districts and rural areas (see Figure 4.2).

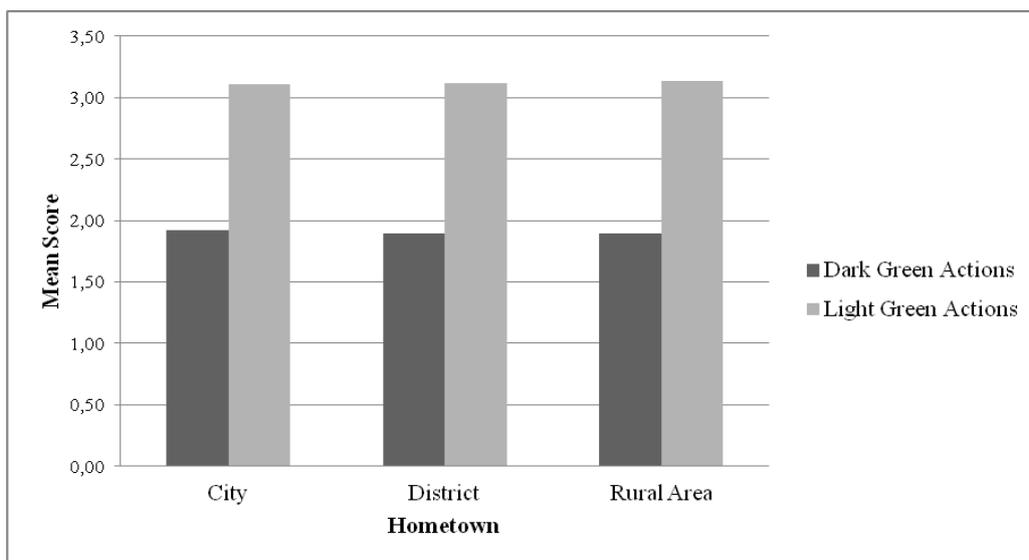


Figure 4.2 Mean scores of light and dark green actions across hometown

Pre-service science teachers' environmentally friendly behaviours were likely to change as a function of geographical regions of Turkey. Acknowledging that there was not extreme difference between mean scores, it was observed that participants from Region of Central Anatolia ($M=2.62$, $SD=.64$) produced the highest mean score which was above the average of all regions' EFB score ($M=2.57$). Region of Central Anatolia was followed by pre-service science teachers from Aegean with a mean of 2.52 ($SD=.61$). Furthermore, pre-service science teachers from Region of Black Sea ($M=2.41$, $SD=.56$), Mediterranean ($M=2.37$, $SD=.54$), Marmara ($M=2.36$, $SD=.57$), and Eastern Anatolia ($M=2.36$, $SD=.60$) produced moderate mean scores. The Lowest environmentally friendly behaviour mean scores were gained by participants from Region of Southeast Anatolia ($M=2.30$, $SD=.64$).

Considering the dimensions of EFB, Figure 4.3 indicated the pre-service science teachers' light and dark green action scores separately. Considering light green actions, participants studying in Region of Central Anatolia ($M=3.22$, $SD=.70$) achieved the highest score. Participants from Region of Aegean followed Central Anatolia with a mean of 3.21 ($SD=.67$) on light green action. After Central Anatolia and Aegean, pre-service science teachers from Region of Marmara produced mean score as 3.19 ($SD=.65$), followed by Black Sea ($M=3.05$, $SD=.62$). Mean scores were similar in the participants from Region of Mediterranean ($M=3.00$, $SD=.64$) and Eastern Anatolia ($M=2.97$, $SD=.60$). The lowest mean score for light green action was produced by pre-service science teachers from Region of Southeast Anatolia with a mean score of 2.83 ($SD=.71$).

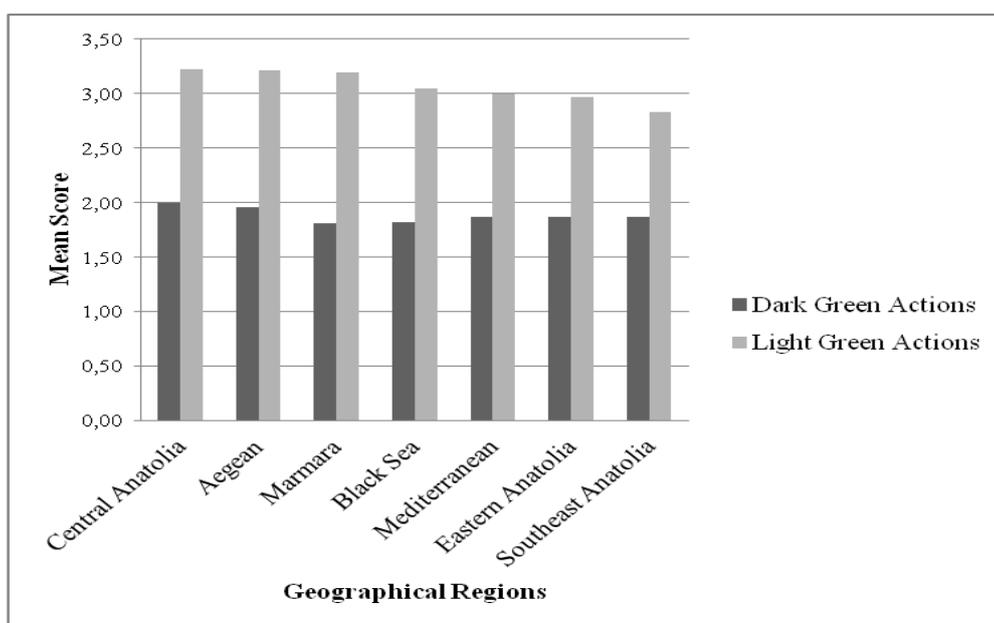


Figure 4.3 Mean scores of light and dark green actions across regions

Regarding dark green actions, pre-service science teachers from Region of Central Anatolia ($M=2.00$, $SD=.74$) and Aegean ($M=1.96$, $SD=.70$) had the highest scores. Pre-service science teachers educated in Region of Mediterranean, Eastern Anatolia, and Southeast Anatolia got the same score with a mean of 1.87. Moreover, Region of

Marmara ($M=1.81$, $SD=.64$) and Black Sea ($M=1.82$, $SD=.65$) got the lowest mean scores.

The descriptive analysis' results revealed that pre-service science teachers sometimes engage in environmentally friendly behaviours and preferred to exhibit light green action types beside dark green actions regardless of their geographical regions. Results also revealed that participants from Region of Central Anatolia and Aegean got the highest means scores for both light and dark green actions. Pre-service science teachers participating to the study from these regions engaged in behaviours including both light green actions such as; physical action, monetary support or financial pressure and dark green actions namely; political, legal actions. In other words, people exhibiting environmentally friendly behaviour should both recycle, and buy recycled products, also vote for a candidate supporting environmental protection as well as become a member of an environmental organization. This pattern was not applicable for the pre-service science teachers from Region of Black Sea and Marmara. Participants from these regions got moderate mean scores from light green action whereas low mean scores from dark green actions. It might be inferred that pre-service science teachers from Region of Black Sea and Marmara were likely to perceive light and dark green actions as separate and independent dimensions of EFB. On the other hand, participants from Region of Central Anatolia and Aegean perceived the integrity between the dimensions of EFB.

Table 4.7 Frequency distributions of participant responses to light green action statements and corresponding item means and standard deviations

Items	Percentage					Item M	Item SD
	Never	Rarely	Sometimes	Frequently	Always		
Used an alternative form of transportation (e.g., mass transit, bicycle, carpooling)	5	9	13	39	34	3.88	1.12
Taken steps to reduce water use	6	17	29	34	14	3.32	1.10
Recycled materials such as paper, glass, plastic, metals, or organic refuse	13	19	28	26	14	3.08	1.24
Taken steps to improve wildlife habitat or food supplies (e.g., plant trees or flowers; built bird houses or feeders)	10	25	28	23	14	3.07	1.20
Picked up litter or trash	8	24	34	25	9	3.03	1.08
Taken steps to reduce energy used for heating, cooling, and/or lighting	20	26	25	20	9	2.72	1.23
Participated to environmentally friendly campaigns (battery collection campaign etc.)	16	20	24	20	20	3.09	1.35
Paid membership fees to or donated money to conservation/environmental groups (local, state, national, international)	52	25	14	5	4	1.84	1.08
I avoided purchasing products directly associated with damage to wildlife or their habitats (e.g., products tested on animals, fur products, non-dolphin safe tuna)	12	16	20	30	26	3.51	1.25
Avoided buying products with non-recyclable, non-biodegradable, or excessive packing	10	24	33	23	10	3.00	1.12
Stopped buying products which cause pollution (e.g., aerosols, styrofoam, toxic chemicals or pesticides)	15	32	27	18	8	2.71	1.16
Purchased products made, in whole or in part, from recycled materials (e.g., some paper and plastic products)	12	31	33	18	6	2.75	1.07
Purchased products packaged in refillable, returnable or recyclable containers (e.g., aluminium cans, deposit bottles)	10	19	29	26	16	3.20	1.21
Encouraged others to help the environment (e.g., to recycle, buy recyclable or recycled products, conserve water or energy)	7	21	31	27	14	3.22	1.12
Encouraged an individual or group involved in some kind of destructive environmental behaviour to stop (e.g., to stop littering, buying aerosols, pesticides)	8	23	31	24	14	3.11	1.62
Avoided buying products with non-recyclable, non-biodegradable, or excessive packing	10	24	33	23	10	3.00	1.12

Percentages of item responses to the Involvement in Environmental Protection Scale also reflected that participants seemed to engage in light green actions (see Table 4.7). Concerning the light green actions, there were 16 five-point likert type items which measured eco-management actions referring physical actions in which people could work directly with the natural world, consumer actions referring monetary support or financial pressure, and persuasion of these actions. Participants' responses to the light green action items revealed that pre-service science teachers *sometimes* exhibited ($M=3.12$, $SD=.68$) light green actions including picking up litter or trash; recycling materials such as paper, glass, plastic, metals, or organic refuse and taking steps to reduce water use, as well as improving wildlife habitat or food supplies.

On the other hand, more than half (52%) of the participants claimed that they *never* paid membership fees to or donated money to conservation/environmental groups. 34 percent of pre service science teachers were reported that they *always* used an alternative form of transportation; 26% of them stated that they avoided purchasing products directly associated with damaging to wildlife or their habitats; and 20% of them stated their participation to environmentally friendly campaigns. it could be concluded from these results that the pre-service science teachers commonly engaged actions addressing responsibility as consumers such as changing habits, saving energy and/or water, recycling were most frequently articulated.

Dark Green Actions of the participants were presented in Table 4.8. There were 16 five-point Likert type items which measured political actions referring political means to help prevent or resolve environmental issues, legal actions referring support or enforce existing laws which were designed to help prevent or resolve environmental issues, and persuasion of these actions. The mean score of Dark Green Actions was 1.90 with the standard deviation of .67 indicating pre-service science teachers *rarely* engaged in actions addressing mainly political and legal actions in Turkey. Most of the pre-service science teachers reported that they *never* engaged in dark green actions, "writing letters to elected officials encouraging them to support environmental protection" (82%); passing out materials or gathering signatures in

Table 4.8 Frequency distributions of participant responses to dark green action statements and corresponding item means and standard deviations

Items	Percentage					Item M	Item SD
	Never	Rarely	Sometimes	Frequently	Always		
Provided information for testimony at a legal hearing on an environmental issue	33	32	33	9	3	2.16	1.07
Reported the illegal collection of live plants or animals to authorities (e.g., in parks, preserves, or sanctuaries)	12	32	32	17	7	2.09	1.17
Persuading others not to break environmental laws or informing others they are breaking such laws.	42	25	19	10	4	2.75	1.09
Reported violations of fishing, trapping, or hunting laws to authorities.	68	16	9	5	2	1.57	.97
Reported pollution violations to authorities(e.g., littering, dumping)	53	25	14	6	2	1.77	1.00
Helped authorities patrol areas for the purpose of enforcing environmental laws	44	29	39	17	2	1.94	1.04
Wrote letters to elected officials encouraging them to support environmental protection (e.g., legislation, funds for enforcement)	82	8	6	3	1	1.32	.78
Passed out materials or gathered signatures in support of “pro” environment policies or legislation(e.g., flyers, petitions)	71	15	9	4	1	1.51	.93
Supported or voted for a “pro” environmental laws, regulations, or programs	17	27	27	19	10	2.80	1.22
Participated in political meetings or hearings concerning environmental policies or plans (e.g., city council meetings, public hearings)	58	22	12	6	2	1.72	1.03
Ran for or served in any position with the intent of supporting the environment (e.g., students council, youth organizations)	65	16	11	6	2	1.66	1.06
Supported or voted for a “pro” environment candidate	47	20	16	12	5	2.08	1.24
Encouraged one or more individuals to support “pro” environmental positions or candidates	41	26	19	11	3	2.08	1.13
Prepared or passed out literature supporting the solutions of environmental problems/issues.	56	23	10	6	5	1.98	1.03
Signed or distributed a petition asking a person/ group/ company/ institution to take an action to improve the environment.	69	16	9	5	1	1.55	.95
Prepare or publicly display “pro” environmental messages (e.g., posters, buttons, t-shirts, bumper stickers)	68	16	9	5	2	1.58	.98

support of pro environmental policies or legislation (71%) or signing or distributing a petition asking a person/group/company/institution to take an action to improve the environment (69%). Relatively, few claimed they either *always* supported or voted for a “pro” environmental laws, regulations- or programs (10%) or reported the illegal collection of live plants and animals to authorities (7%). Only 1% stated that they wrote letters to elected officials encouraging them to support environmental protection.

To conclude, descriptive statistics revealed that compared to dark green actions, pre-service science teachers tended to exhibit light green actions regardless of their gender, hometown, and regions. It was inferred that pre-service science teachers might have more chance to perform actions namely; recycling, consumer actions like buying recycled products and so forth.

In the subsequent chapter, results regarding ecocentric and anthropocentric attitudinal views were presented.

4.2.2 Environmental Attitude Profile of Pre-service Science Teachers

In this section the responses of pre-service science teachers to the environmental attitudes and that whether these are ecocentric or anthropocentric were handled. The descriptive statistics involving mean scores, standard deviations of attitudinal motives with respect to gender, hometown and geographical regions were depicted in Table 4.9 and Figure 4.4-4.6 respectively.

As presented in the Table 4.9, pre-service science teachers’ responses produced a mean score of 4.09 ($SD=.73$) for ecocentric attitudes, and 3.39 ($SD=.79$) for anthropocentric attitude. In other words, predominantly, pre-service science teachers had an ecocentric worldview that they tended to value nature for its own sake. On the other hand, pre-service science teachers exhibiting anthropocentric attitude gave value to nature because of material or physical benefits it could provide for humans. In brief, Turkish pre-service science teachers seemed to give value to nature due to the sake of the nature itself, not for the benefits of human being. Table 4.9 also

indicated that ecocentric attitude were engaged mostly by female pre-service science teachers from rural areas with a mean of 4.17 ($SD=.65$). On the other hand, male participants from cities got the highest mean score regarding anthropocentric attitude ($M=3.48$, $SD=.67$). These results revealed that female participants living in rural areas tended to have positive attitude toward nature in ecocentric perspective, whereas male pre-service science teachers from cities had positive attitude toward nature due to anthropocentric attitudinal view.

Table 4.9 Mean scores and standard deviations of ecocentric and anthropocentric attitude with respect to gender and hometown

Hometown	Gender	Ecocentric		Anthropocentric	
		M	SD	M	SD
City	Male	3.94	.79	3.48	.67
	Female	4.14	.71	3.37	.83
	Total	4.22	.52	3.34	.69
District	Male	4.04	.75	3.44	.71
	Female	4.05	.76	3.40	.79
	Total	4.18	.59	3.38	.64
Rural Area	Male	4.06	.70	3.40	.75
	Female	4.17	.65	3.32	.80
	Total	4.18	.54	3.31	.66
TOTAL		4.09	.73	3.39	.79

When responses were examined with respect to gender (Figure 4.4), it was found that female pre-service teachers had higher scores on ecocentric dimension. Female pre-service science teachers gain a mean score as 4.22 ($SD=.54$) while males' mean score was 4.09 ($SD=.62$). On the other hand, male participants ($M=3.37$, $SD=.63$) got slightly higher mean score of anthropocentric view than females ($M=3.34$, $SD=.68$). In brief, females were more likely to exhibit ecocentric view than males indicating that male participants protected environment to enhance the quality of human life whereas females protect environment solely due to its own value.

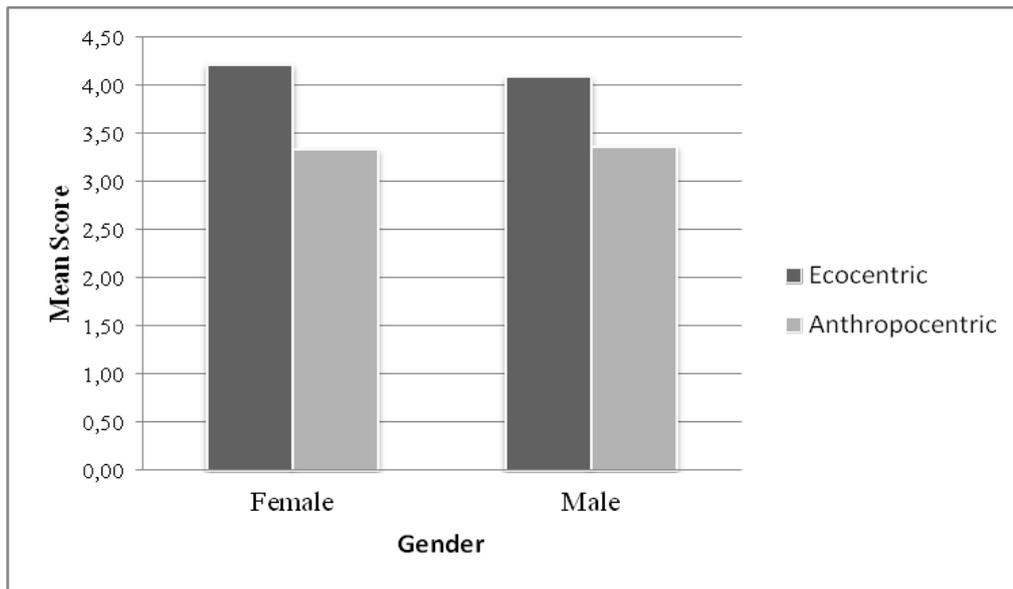


Figure 4.4 Mean scores of ecocentric and anthropocentric attitude across gender

Regarding hometown, mean scores of ecocentric views were found to be higher than those of anthropocentric views. Participants, who grew up in rural areas had higher tendency to exhibit slightly more ecocentric attitude ($M=4.22$, $SD=.52$) than those living in districts ($M=4.18$, $SD=.54$) and cities ($M=4.18$, $SD=.59$). In Parallel to the previous results, participants from cities ($M=3.34$, $SD=.69$) tended to endorse slightly more anthropocentric attitude compared to participants raised in districts ($M=3.38$, $SD=.64$) and rural areas ($M=3.31$, $SD=.66$). Thus, it can be said that environmental attitude tends to change as a function of hometown. In fact, pre-service science teachers living in rural areas were more likely to have positive attitudes toward nature for own its sake. On the other hand, participants living in cities tended to exhibit positive attitude toward nature for its benefits to human being Figure 4.5 indicated a clear picture with mean scores of ecocentric and anthropocentric views with respect to hometown of the participants.

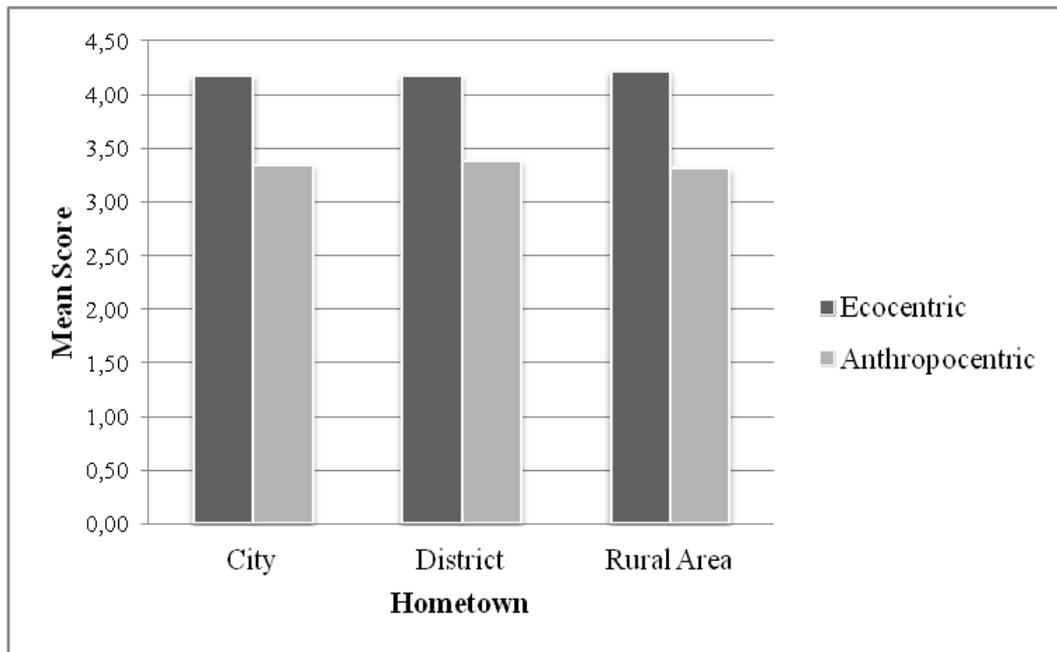


Figure 4.5 Mean scores of ecocentric and anthropocentric attitude across hometown

Mean scores of ecocentric and anthropocentric views with respect to geographical regions were presented in Figure 4.6. As is seen from the figure, ecocentric worldview is dominant for all regions. The highest score on ecocentric view was obtained by the participants educated in the Region of Central Anatolia ($M=4.26$, $SD=.54$), followed by Regions of Aegean and Mediterranean with a mean of 4.22. Participants from Region of Marmara ($M=4.20$, $SD=.54$), Black Sea ($M=4.17$, $SD=.55$), and Eastern Anatolia ($M=4.07$, $SD=.65$) had moderate mean scores. Pre-service science teachers participating to the study from Region of Southeast Anatolia produced the lowest score with a mean of 3.95 ($SD=.72$).

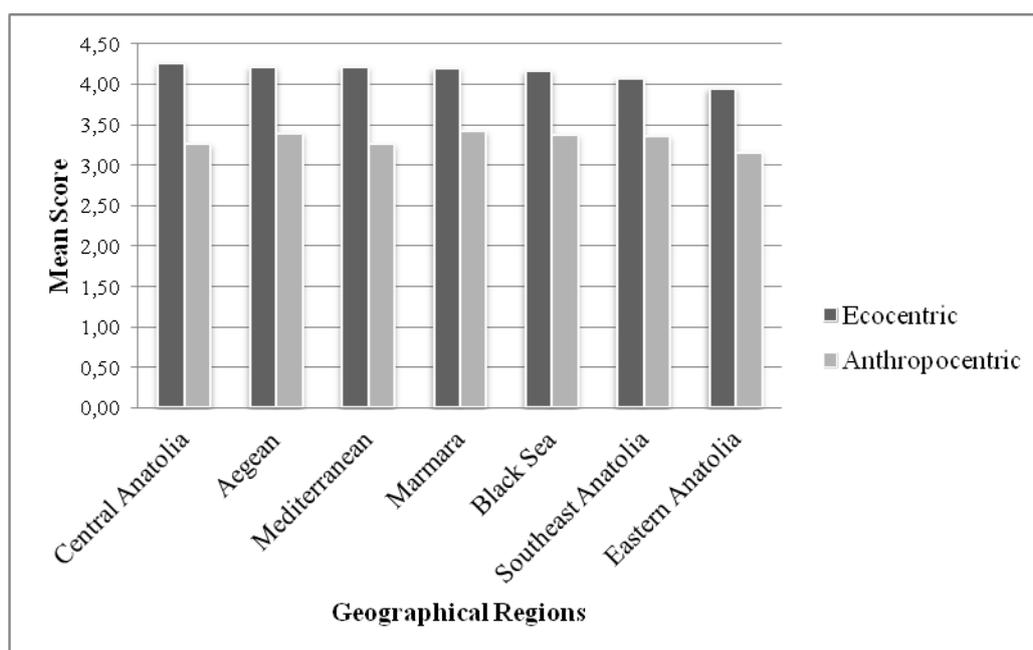


Figure 4.6 Mean scores of ecocentric and anthropocentric attitude across regions

Regarding anthropocentric attitude, participants from Region of Marmara got the highest score with a mean of 3.42 ($SD=.60$) indicating that participants from Marmara exhibited positive attitude toward environment due to the concern of quality of human being. Pre-service science teachers educated in Region of Aegean produced the second highest score with respect to anthropocentrism ($M=3.40$, $SD=.70$). After Aegean, participants from Region of Black Sea ($M=3.38$, $SD=.63$) and Eastern Anatolia ($M=3.36$, $SD=.64$) had close mean scores. The Lowest anthropocentric mean scores were produced by participants from Region of Mediterranean ($M=3.26$, $SD=.69$) and Southeast Anatolia ($M=3.16$, $SD=.74$).

In the light of these results, mean scores of ecocentric and anthropocentric items were interpreted together and different patterns were observed. The first pattern was observed where the means scores of ecocentric and anthropocentric views were both in the same range. For example, Region of Eastern Anatolia had the lowest mean scores on both ecocentric and anthropocentric attitude. On the other hand, pre-service science teachers from Region of Black Sea had the second highest mean scores on

both ecocentric and anthropocentric view. It could be inferred from these results that participants from Eastern Anatolia tended to have unfavourable attitude toward environment either in ecocentric and or anthropocentric perspective than participants from Black Sea. Another pattern was observed where the mean scores of ecocentric and anthropocentric views were in the opposite range. As an illustration, pre-service science teachers from Region of Central Anatolia had the highest mean score on ecocentric attitude and the lowest mean score on anthropocentric attitude implying pre-service science teachers in this region had positive attitude toward nature only because of nature's own value.

Table 4.10 Item descriptive summary for the ecocentric items of the EAS

Items	Percentage					Item M	Item SD
	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree		
Human are as much a part of the ecosystem as other animals	2	3	3	13	79	4.65	.82
Sometimes animals seem almost human to me	7	13	27	32	21	3.47	1.17
Being out in nature is a great stress reducer for me	2	3	9	31	55	4.35	.89
Nature is valuable for its own sake	1	2	7	25	65	4.51	.79
It makes me sad to see natural environments destroyed	2	2	6	28	62	4.45	.87
Sometimes when I am unhappy I find comfort in nature	2	3	9	34	52	4.32	.85
I need time in nature to be happy	1	4	12	38	45	4.21	.90
Sometimes it makes me sad to see forests cleared for agriculture	2	4	11	34	49	4.24	.94
I prefer wildlife reserves to zoos	8	11	23	29	29	3.60	1.23
One of the most important reasons to conserve is to preserve wild areas	2	3	7	38	50	4.31	.86
I can enjoy spending time in natural settings just for the sake of being out in nature	2	5	15	42	36	4.05	.93
One of the worst things about overpopulation is that many natural areas are getting destroyed for development	3	6	13	38	40	4.06	1.02

Specifically, regarding ecocentric items (see Table 4.10), the highest mean score was reported by the item indicating the perception of human as a part of ecosystem

($M=4.65$, $SD=.82$), followed by the item referring the value of nature for its sake ($M=4.51$, $SD=.79$) and the item related to the sadness of seeing natural environments destroyed ($M=4.45$, $SD=.87$). Great majority (92%) of pre-service science teachers indicated their *agreement* on the item with the idea that “human are as much a part of the ecosystem as other animals”. After, a notable number of pre-service teachers (90%) *agreed* on the items indicating “nature is valuable for its own sake” and “it makes me sad to see natural environments destroyed”. On the other hand, a small amount of pre-service science teachers (20%) indicated their *disagreement* on the item with the idea that “sometimes animals seem almost human to me”. Furthermore, participants had *disagreement* on (19%) the item that “I prefer wildlife reserves to zoos”.

Considering anthropocentric attitude items (Table 4.11), it was observed that the highest mean score was reported by the item that “it bothers me that humans are running out of their supply of oil” ($M=4.17$, $SD=.93$) whereas item indicating protection of only economically important plants and animals had the lowest means score ($M=2.11$, $SD=1.19$). When frequencies of the statements were taken into consideration, it was observed that great majority (81%) of pre-service science teachers indicated their *agreement* on the item with the idea that “it bothers me that humans are running out of their supply of oil”, followed by item indicating “The most important reason for conservation is human survival” (79%). On the other hand, notable number of pre-service science teachers (70%) indicated their *disagreement* on the item that “only economically important plants and animals should be protected”. Furthermore, half of the pre-service teachers (50%) *disagreed* on the item that “the thing that concerns me most about deforestation is that there will not be enough lumber for future generations”.

Table 4.11 Item descriptive summary for the anthropocentric items of the EAS

Items	Percentage					Item M	Item SD
	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree		
It bothers me that humans are running out of their supply of oil	2	4	13	38	43	4.17	.93
The thing that concerns me most about deforestation is that there will not be enough lumber for future generations	26	24	19	17	14	2.71	1.39
One of the best things about recycling is that it saves money	9	20	26	29	16	3.23	1.20
Nature is important because of what it can contribute to the pleasure and welfare of humans	5	11	14	32	38	3.86	1.19
The most important reason for conservation is human survival	3	7	11	30	49	4.13	1.09
We need to preserve resources to maintain a high quality of life	7	12	22	33	26	3.58	1.20
Continued land development is a good idea as long as a high quality of life can be preserved	9	15	25	30	21	3.39	1.23
Only economically important plants and animals should be protected	48	22	10	11	9	2.11	1.34
The worst thing about the loss of the rain forest is that it will restrict the development of new medicines	14	19	34	21	12	2.97	1.19

On the other hand, pre-service science teachers remained to be uncommitted to the items regarding with the ideas that “sometimes animals seem almost human to me” (27%), “I prefer wildlife reserves to zoos” (23%), “one of the best things about recycling is that it saves money” (26%), “continued land development is a good idea as long as a high quality of life can be preserved” (25%). These results showed that, Turkish pre-service science teachers conflicted with these items in state of having ecocentric and anthropocentric views.

In the subsequent chapter, results regarding spatial optimism and temporal pessimism levels were presented.

4.2.3 Spatial Optimism and Temporal Pessimism Profile of Pre-service Science Teachers

Pre-service science teachers' spatial optimism and temporal pessimism levels were identified through Environmental Future Scale (EFS; Gifford et al. 2008). Each environmental issue were evaluated based on today and future conditions regarding local, national and global levels (Table 4.12).

Table 4.12 Means scores and standard deviations of current and expected environmental conditions regarding local, national, and global

	Current		Future	
	M	SD	M	SD
Local	3.20	.69	2.45	.84
National	2.87	.51	2.17	.77
Global	2.64	.58	2.14	.88

Spatial Optimism

In order to investigate if pre-service science teachers had spatial optimism regarding today and future conditions, mean scores of global optimism score and local optimism score were compared. As a reminder, midpoint of five point Likert type scale was “3” indicating environmental problems were at acceptable level. According to Table 4.12, current environmental quality was perceived as good condition at local level with a mean of 3.20 ($SD=.69$) and thought to be acceptable at national level ($M=2.87$, $SD=.51$) and worsen at global levels ($M=2.64$, $SD=.58$). Similarly, spatial optimism bias was emerged for future conditions of environmental problems. Referring to future conditions, pre-service science teachers expected that environmental quality would worsen when spatial geographic distance increased from local ($M= 2.45$, $SD=.85$) to global ($M= 2.14$, $SD=.84$). Therefore, these findings revealed that, optimism mean scores decreased as spatial geographic distance increased from local to national and to global at both two temporal levels (today and future). In other words, increasing optimism scores from local to global indicated

that pre-service science teachers had spatial optimism bias regarding both current and future environmental problems.

To obtain pre-service science teachers' spatial optimism scores, participants' local scores subtracted from global scores for both temporal levels. Therefore, two spatial optimism scores were gathered in terms of current and future conditions. In this way, current spatial optimism mean scores of pre-service science teachers were found as .57 ($SD=.82$) and future spatial optimism level found as .31 ($SD=.70$). As a reminder, mean scores above zero indicated good perception toward their local area when compared to World whereas mean scores below zero. These positive mean scores indicated that Turkish pre-service science teachers seemed to be having spatial optimism for both current and future conditions. To state it more clearly, pre-service science teachers tended to perceive that environmental problems in their local area *is* and *will* be in better conditions compared with World's situation.

Current and future spatial optimism scores were also interpreted regarding gender (see Figure 4.7), hometown (see Figure 4.8), and regions of Turkey (see Figure 4.9).

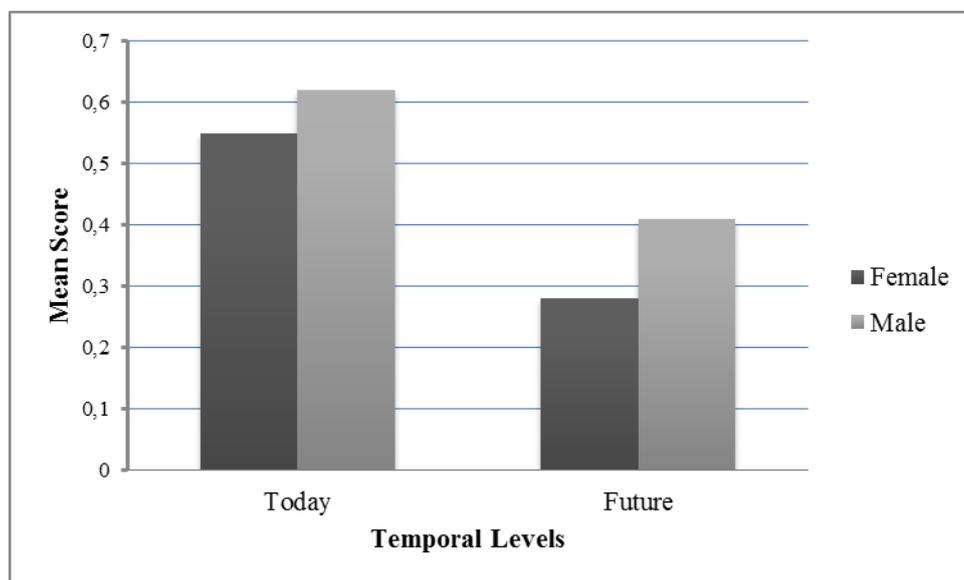


Figure 4.7 Mean scores of today and future spatial optimism levels across gender

According to Figure 4.7, male pre-service science teachers tended to be more spatially optimistic both for temporal levels ($M_{Today}=.62$, $SD=.92$; $M_{Future}=.41$, $SD=.80$) than females ($M_{Today}=.55$, $SD=.78$; $M_{Future}=.28$, $SD=.70$). Namely, male pre-service science teachers tended to have a perception that ‘environmental problems are and will be in a better situation compared with global problems’.

Figure 4.8 revealed that pre-service teachers from rural areas ($M_{Today}=1.15$, $SD=.98$; $M_{Future}=.83$, $SD=.87$) were observed to be more optimistic at both temporal levels when compared with participants from district ($M_{Today}=.70$, $SD=.81$; $M_{Future}=.40$, $SD=.71$) and city ($M_{Today}=.37$, $SD=.69$; $M_{Future}=.14$, $SD=.58$) levels. It can be said that spatial optimism levels of participants decreases as spatial geographic distance decreases from city to rural area. In other words, the more the hometown develops (rural area to district to city), the more the spatial optimism level decreases. These results revealed that as participants living in cities are exposed to more industrialization, population growth, etc. than rural areas and districts, they tend to be more concerned about environmental problems and this made them less optimistic about their local area (Tikka, Kuitunen & Tynys, 2000).

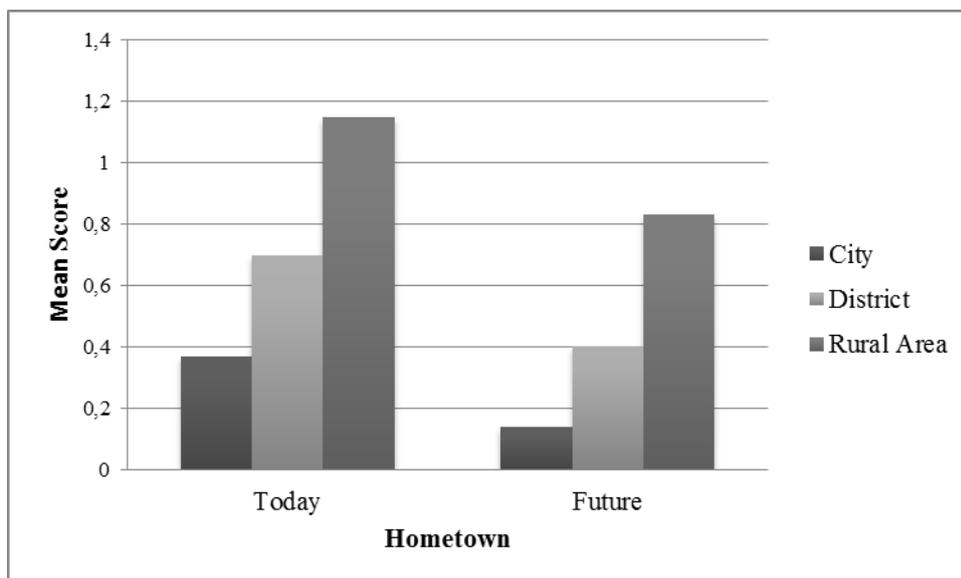


Figure 4.8 Mean scores of today and future spatial optimism levels across hometown

Figure 4.9 revealed the spatial optimism mean scores regarding regions of Turkey. As is seen from the figure, pre-service science teachers from Region of Aegean; got the highest mean score regarding spatial optimism bias both for today ($M=.72$, $SD=.83$) and expected future ($M=.43$, $SD=.75$). In other words, participants from this region tended to perceive that their local area is and will be in better situation compared with world.

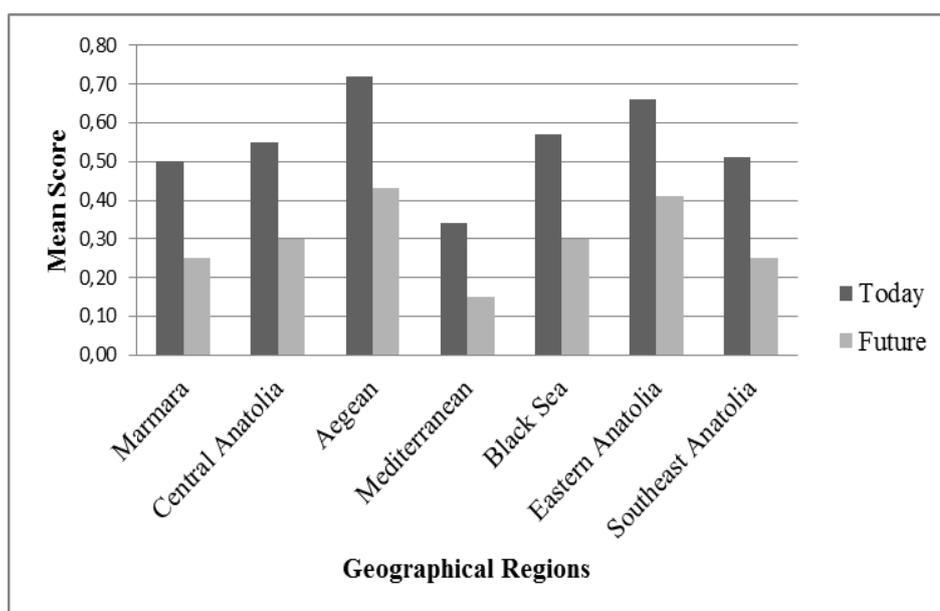


Figure 4.9 Mean scores of today and future spatial optimism levels across regions

Following, participants from Region of Eastern Anatolia produced the second highest mean score in terms of spatial optimism bias both today ($M=.66$, $SD=.88$) and expected future ($M=.41$, $SD=.72$). Then, Region of Black Sea ($M_{Today}=.57$, $SD=.82$; $M_{Future}=.30$, $SD=.72$), Marmara ($M_{Today}=.50$, $SD=.22$; $M_{Future}=.25$, $SD=.68$), Central Anatolia ($M_{Today}=.55$, $SD=.77$; $M_{Future}=.30$, $SD=.68$), and Southeast Anatolia ($M_{Today}=.51$, $SD=.88$; $M_{Future}=.29$, $SD=.77$) had relatively low spatial optimism scores for both current and future conditions. The lowest today and future spatial optimism level was observed in the participants from Region of Mediterranean ($M_{Today}=.34$, $SD=.68$; $M_{Future}=.15$, $SD=.57$). Results revealed that pre-service science teachers participating to the study from Region of Aegean and Eastern Anatolia had

an optimistic perception on both current and future conditions of local environmental problems. In other words, pre-service science teachers from these regions had higher spatial optimism bias level compared to other regions. Pre-service science teachers from Region of Mediterranean seemed to have less optimism about the current and future of local environmental problems.

Temporal Pessimism

In order to investigate if pre-service science teachers had temporal pessimism regarding local and global environmental issues, mean scores of today and future pessimism scores were calculated. As a reminder, midpoint of five point Likert type scale is “3” indicates that environmental problems will at acceptable level. Table 4.12 depicted that pre-service science teachers expected worse environmental conditions in the future for all spatial levels (local, national, and global). Expected future scores ($M=2.14$, $SD=.88$) of the participants were higher than today’ score ($M=2.64$, $SD=.58$) at global level meaning that Turkish pre-service science teachers were pessimistic about their future in global level. Similarly, local ($M_{future}=2.45$, $SD=.84$; $M_{today}=3.20$, $SD=.69$) and national ($M_{future}=2.17$, $SD=.77$; $M_{today}=2.87$, $SD=.51$) environmental problems also revealed pessimistic future expectations of pre-service science teachers.

To obtain pre-service science teachers’ temporal pessimism scores, pre-service science teachers' present scores were subtracted from expected future scores for both spatial levels. Therefore, two temporal pessimism scores were gathered in terms of local and global conditions. In this way, local temporal pessimism mean score of pre-service science teachers was found as $-.75$ ($SD=.85$) and global temporal pessimism mean score was found as $-.50$ ($SD=.79$). These negative mean scores indicated that Turkish pre-service science teachers seemed to be having temporal pessimism for both local and global conditions. To put it more precisely, pre-service science teachers tended to perceive that ‘environmental problems *will* become much worse in their local area and World’. In addition, mean scores also revealed that local

temporal pessimism was higher than global temporal pessimism. In fact, pre-service science teachers were likely to have more pessimistic perceptions of the conditions of environmental problems that will take place in their local area.

Figure 4.10, 4.11, and 4.12 included mean scores of local and global temporal pessimism regarding gender, hometown, and regions respectively. Figure 4.10 revealed that both male ($M_{Local}=-.65$, $SD=.82$; $M_{Global}=-.44$, $SD=.76$) and female ($M_{Local}=-.79$, $SD=.86$; $M_{Global}=-.52$, $SD=.80$) pre-service science teachers tended to be pessimistic about the future of local and global environmental problems. Considering local condition, female pre-service science teachers tended to be more pessimistic than males.

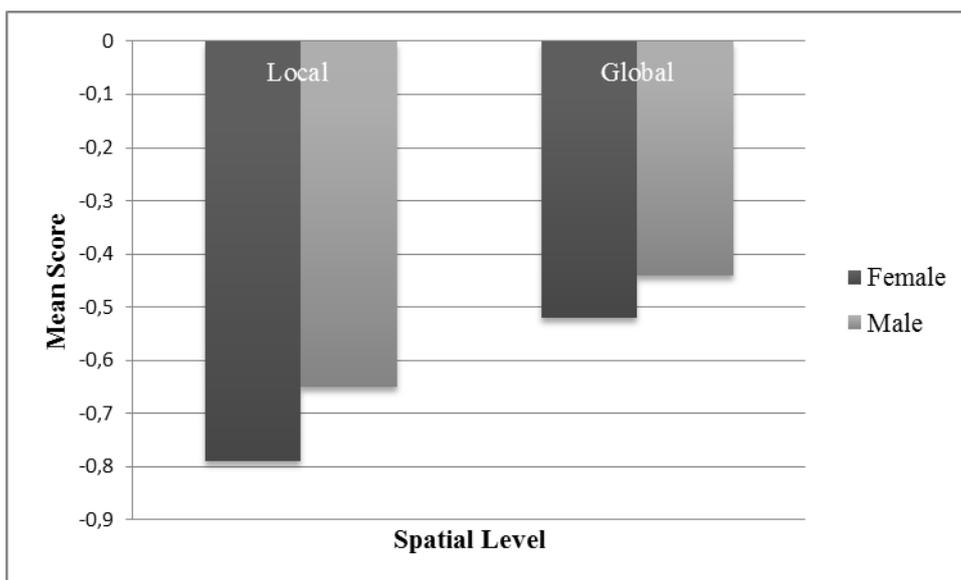


Figure 4.10 Mean scores of local and global temporal pessimism across gender

According to Figure 4.11, considering small difference, pre-service science teachers from rural areas ($M_{Local}=-.79$, $SD=.92$) and districts ($M_{Local}=-.80$, $SD=.82$) tended to have more temporal pessimism than participants from cities ($M_{Local}=-.72$, $SD=.85$) at local perspective. On the other hand, participants from districts ($M_{Global}=-.50$, $SD=.77$) and cities ($M_{Global}=-.50$, $SD=.82$) were likely to have more temporal pessimism than participants from rural areas ($M_{Global}=-.47$, $SD=.75$) at global

perspective. As cities were exposed to more environmental problems, participants from cities were likely to see the world in a pessimistic perspective in the future compared to today. Interestingly, on the other hand, they were slightly less pessimistic on local environmental problems. This might be caused from unconscious rejections of bad events on local area.

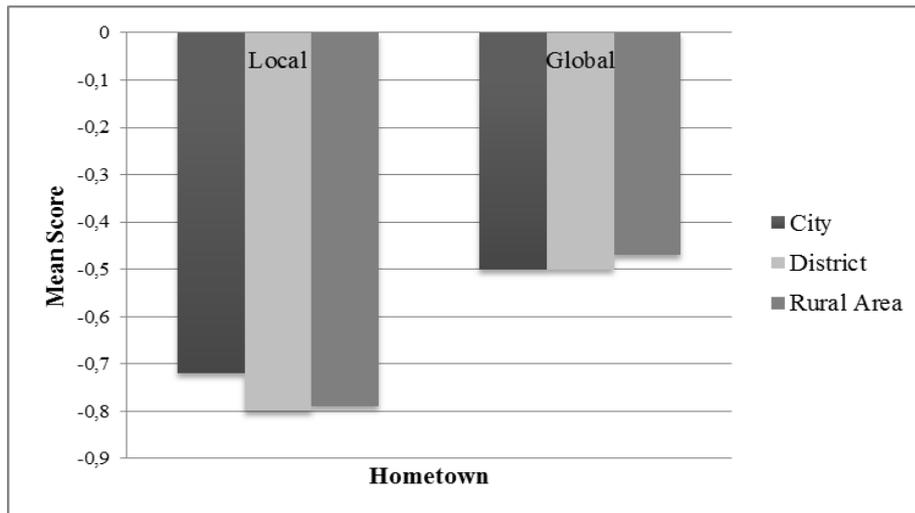


Figure 4.11 Mean scores of temporal pessimism across hometown

Figure 4.12 indicated the local and global temporal pessimism mean scores of the regions of Turkey. As seen from the figure, pre-service science teachers from all regions tended to perceive that global environmental problems will get worsen in the future globally ($M_{Mediterranean} = -.62, SD=.78$; $M_{Marmara} = -.53, SD=.80$; $M_{Aegean} = -.51, SD=.75$; $M_{BlackSea} = -.49, SD=.81$; $M_{CentralAnatolia} = -.49, SD=.83$; $M_{EasternAnatolia} = -.47, SD=.61$; $M_{SoutheastAnatolia} = -.04, SD=.94$). Considering local conditions, participants from Region of Southeast Anatolia got the lowest temporal pessimism mean score ($M = -.26, SD=.84$) indicating participants from this region perceived that environmental problems in their local area will not increase too much in the future. Moreover, pre-service science teachers from Central Anatolia ($M = -.74, SD=.91$), and Eastern Anatolia ($M = -.72, SD=.78$) got almost the same temporal pessimism mean scores regarding local environmental conditions of their region. Furthermore, pre-service science teachers educated in Region of Mediterranean ($M = -.82, SD=.76$),

Marmara ($M=-.78$, $SD=.84$), Black Sea ($M=-.76$, $SD=.88$), and Aegean ($M=-.81$, $SD=.79$) tended to exhibit higher temporal pessimism than other regions.

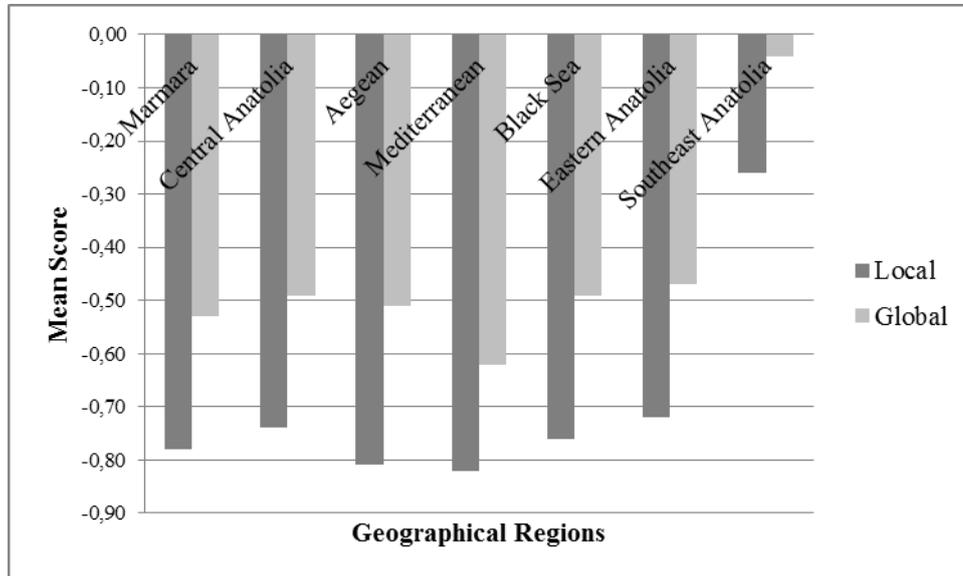


Figure 4.12 Mean scores of temporal pessimism across regions

After investigating pre-service science teachers' optimism levels spatially and pessimism levels temporally regarding gender, hometown and regions, item descriptive summary presented below.

Item Descriptive Summary

The descriptive results of the item analysis for the current and expected situation of selected environmental problems were presented in Table 4.13. According to the item mean scores of current condition, pre-service teachers had the highest optimistic level by the item that “water resource and quality” issue at local level and “biological diversity” at national ($M=3.49$, $SD=.97$) and global ($M=3.36$, $SD=1.11$) levels. Considering future expectations, participants were most pessimistic about the impact of “ozone layer depletion” at local ($M=2.14$, $SD=1.13$) national ($M=1.92$, $SD=1.04$), and global ($M=1.74$, $SD=1.05$) levels. They had also pessimistic views about the “impact of vehicle traffic” at national level ($M=2.37$, $SD=.96$).

Table 4.13 Item descriptive summary of local, national and global environmental issues in terms of their current and expected situations

Environmental Issues	Current						Expected					
	Local		National		Global		Local		National		Global	
	M	SD	M	SD	M	SD	M	SD	M	SD	M	SD
Water resource and quality	3.57	.98	3.12	.84	2.87	.91	2.75	1.16	2.35	1.07	2.10	1.15
The amount of waste	2.97	1.05	2.58	.93	2.53	1.06	2.46	1.19	2.22	1.16	2.14	1.24
Quality of air	3.38	1.21	2.97	.90	2.68	.93	2.56	1.20	2.25	1.05	2.04	1.09
Climate change	3.43	.99	3.14	.93	2.67	.98	2.52	1.10	2.24	1.04	1.97	1.06
Biological diversity	3.36	1.01	3.49	.97	3.36	1.11	2.54	1.08	2.44	1.10	2.28	1.19
Acid rain	3.20	1.22	3.00	.99	2.67	.95	2.46	1.13	2.23	1.05	2.02	1.11
The environmental impact of vehicle traffic	2.94	1.24	2.37	.96	2.40	1.07	2.28	1.21	1.92	1.06	1.93	1.15
The environmental impact of human population	3.09	1.11	2.64	.93	2.45	1.04	2.43	1.17	2.10	1.08	1.96	1.13
Visual pollution	3.04	1.22	2.59	.95	2.58	1.04	2.53	1.23	2.21	1.14	2.13	1.19
The state of natural areas	3.33	1.15	2.97	.92	2.78	1.01	2.51	1.16	2.21	1.07	2.06	1.12
Ozone layer depletion	2.92	1.03	2.61	.87	2.30	.97	2.14	1.13	1.92	1.04	1.74	1.05
The management of radiation and nuclear waste	3.16	1.19	2.76	.96	2.39	.98	2.44	1.18	2.12	1.07	1.91	1.13
The quality of soil for agricultural purposes	3.54	1.09	3.31	.92	2.82	.89	2.58	1.18	2.34	1.07	2.07	1.07
Global warming	2.97	1.02	2.68	.85	2.35	.98	2.16	1.12	1.94	1.04	1.78	1.10
Energy scarcity	3.12	1.03	2.87	.85	2.69	.96	2.37	1.15	2.15	1.08	2.03	1.16

These results revealed that pre-service science teachers had the highest optimism level about the current condition of water resource and quality and high pessimism level about the future of ozone layer depletion at local level. Pre-service science teachers also have pessimistic perception of the future of ozone layer depletion at national and global level too.

After mentioning spatial optimism and temporal pessimism perceptions of pre-service science teaches, their internal locus of control profiles were presented below.

4.2.4 Internal Locus of Control Profile of Pre-service Science Teachers

Locus of control profile of pre-service science teachers were investigated by administrating eleven items Internal Locus of Control Scale (EAICI). Specifically, participants were asked to explore to what extent they believed that their individual actions could and affect the environment. Results revealed that pre-service science teachers *agreed* with the idea that their actions would will solve environmental problems ($M=3.96$, $SD=.82$). To put it differently most of the pre-service science teachers believed that their individual actions had a role on the solution of the environmental problems (see Table 4.14).

Table 4.14 Mean scores and standard deviations of internal locus of control with respect to gender and hometown

Hometown	Gender	M	SD
City	Male	3.75	.87
	Female	4.06	.77
District	Male	3.86	.78
	Female	3.98	.87
Rural Area	Male	3.70	.88
	Female	3.38	.75
TOTAL		3.96	.82

Table 4.14 also indicated that female pre-service science teachers from cities perceive the highest power of their actions of environmental problems with a mean of 4.06 ($SD=.77$). On the other hand, female participants from rural areas got the

lowest mean score ($M=3.38$, $SD=.75$) referring that they did not feel any control over environmental problems.

The mean scores of locus of control were presented in Figure 4.13- 4.15 with respect to gender, hometown, and regions. Figure 4.13 showed that female participants ($M=4.11$, $SD=.65$) had more internal locus of control than male participants ($M=3.85$, $SD=.75$), implying that female pre-service science teachers were more likely to believe in the effectiveness of their actions on the environmental problems than males.

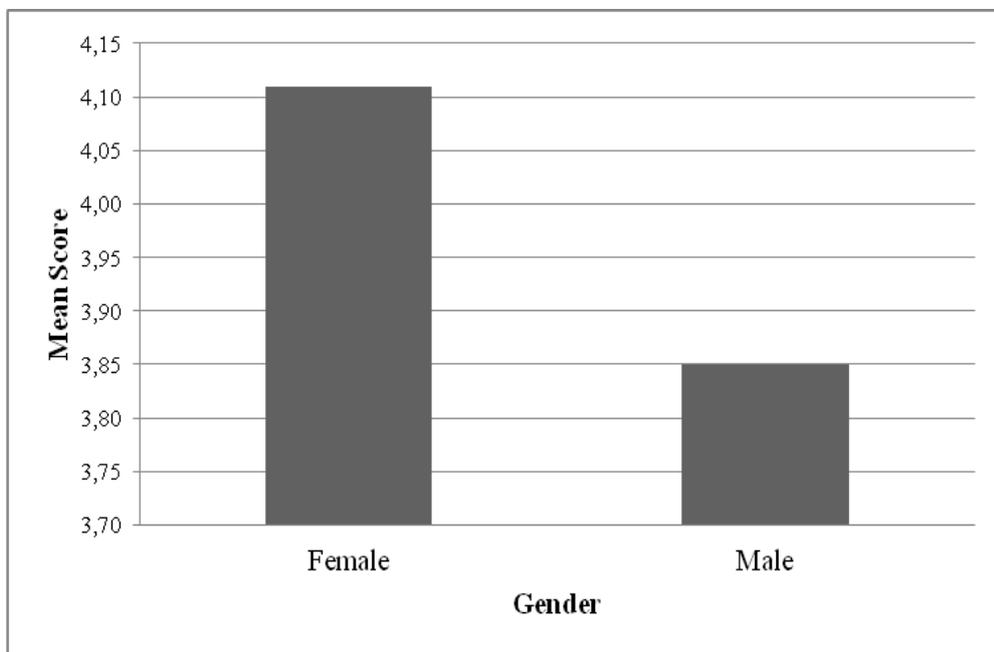


Figure 4.13 Mean scores of internal locus of control across gender

Referring to differences, it can be said that participants from rural areas ($M=3.94$, $SD=.74$) tended to have less internal locus of control when compared with participants from cities ($M=4.07$, $SD=.67$) and districts ($M=4.06$, $SD=.67$). These results implied that pre-service science teachers growing up in cities and districts tended to be aware of the impact of their actions on environmental problems compared with pre-service science teachers from rural areas (see Figure 4.14).

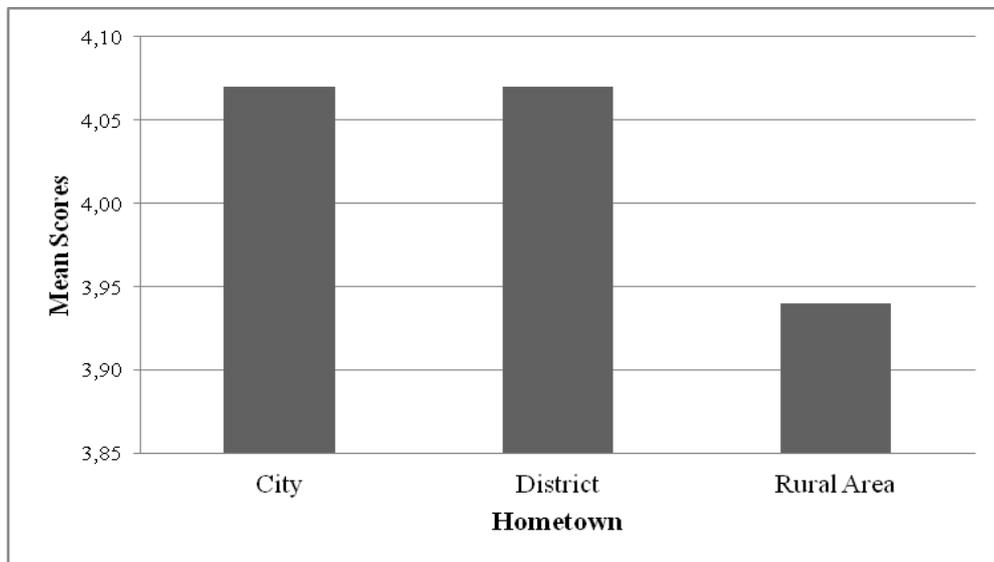


Figure 4.14 Mean scores of internal locus of control across hometown

Figure 4.15 revealed the mean scores of internal locus of control with respect to geographical regions of Turkey. Results revealed that participants from Central Anatolia got the highest mean score regarding to internal LOC with a mean of 4.15 ($SD = .69$). Central Anatolia was followed by the pre-service science teachers from Mediterranean with a mean of 4.13 ($SD = .67$). Participants from Region of Marmara and Aegean produced a third of the highest score with a mean of 4.11. Then, pre-service science teachers educated in Region of Black Sea ($M=3.98$, $SD=.71$) and Eastern Anatolia ($M=3.93$, $SD=.67$) were coming sequentially. The lowest internal locus of control level was produced by pre-service science teachers from Region of Southeast Anatolia ($M=3.60$, $SD=.75$).

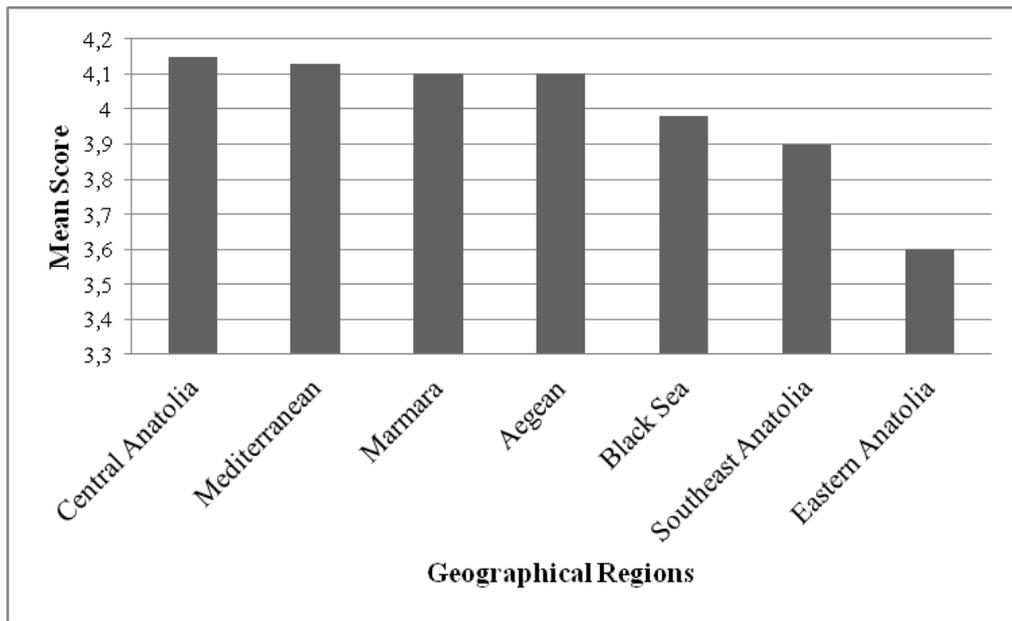


Figure 4.15 Mean scores of internal locus of control across regions

When frequencies of the statements were taken into consideration, great majority of the pre-service science teachers (87%) indicated their *agreement* on the item with the idea that “buying products packaged in containers that either can be reused or recycled or are made of recycled materials” and “reducing the amount of my household trash by reusing or recycling items to the fullest extent possible”. On the other hand, 22% of the pre-service science teachers indicated their *disagreement* on the item that “attending a community meeting that involves concern over a local environmental issue”. Moreover, 29% of the participants were also *unsure* with the same statement. Pre-service science teachers were also *unsure* about the benefit of using LPG or diesel instead of petrol in their car to enhance environmental problems. All internal locus of control items can be seen from Table 4.15.

Table 4.15 Item descriptive summary for the dimensions of the LOC

Items	Percentage					Item M	Item SD
	Strongly Disagree	Disagree	Unsure	Agree	Strongly Agree		
... learn about the recycling facilities in my area	3	5	8	42	42	4.16	.95
... attend a community meeting that involves concern over a local environmental issue	6	16	29	35	14	3.34	1.09
... buy resource conservation devices, such as low- flow faucet aerators for my sinks and low-flow shower heads	2	3	9	43	43	4.20	.89
... buy products packaged in containers that either can be reused or recycled or are made of recycled materials	2	4	8	38	49	4.28	.89
... report someone who violates a law or laws that protect our natural to the proper authorities	2	6	15	40	37	4.03	.99
... reduce the amount of my household trash by reusing or recycling items to the fullest extent possible	1	4	8	39	48	4.28	.88
... set my home appliances, such as the refrigerator, dishwasher, water heater, etc. to 'energy saver' levels	2	4	9	35	50	4.27	.92
... take my old tires to a recycling center	4	8	16	33	39	3.94	1.12
... using LPG or diesel instead of petrol in my car	4	6	22	36	32	3.88	1.05
... carpool instead of driving alone	3	5	12	36	44	4.14	.99
... open windows for ventilation rather than using a fan or air conditioner	4	7	17	33	39	3.97	1.09

As can be concluded from these results, Turkish pre-service science teachers tended to perceive that eco-management (set their home appliances, such as the refrigerator, dishwasher, water heater, etc. to energy saver levels) and consumer (buy products packaged in containers that either can be reused or recycled or are made of recycled materials) had more effects on solving environmental problems than political actions (attend a community meeting). Therefore, they were likely to perceive the power of their individual actions including eco-management and consumer dimensions rather than political actions on environmental issues.

4.2.5 Environmental Knowledge Profile of Pre-service Science Teachers

Environmental knowledge profile of pre-service science teachers were determined through 12 multiple choice questions. Descriptive statistics including means, standard deviations and percentages of correct and unknown responses were computed. Results revealed that Turkish pre-service science teachers' knowledge

about local and global environmental issues were inadequate level ($M=5.92$, $SD=2.02$).

Table 4.16 Mean scores and standard deviations of knowledge of environmental issues with respect to gender and hometown

Hometown	Gender	M	SD
City	Male	6.06	1.72
	Female	5.96	2.01
District	Male	5.59	2.22
	Female	5.84	2.14
Rural Area	Male	6.11	2.19
	Female	5.94	1.88
TOTAL		5.92	2.02

Table 4.16 also indicated that male pre-service science teachers from rural areas had the highest score on knowledge ($M=6.11$, $SD=2.19$). On the other hand, female participants from districts got the lowest mean score ($M=5.84$, $SD=2.14$).

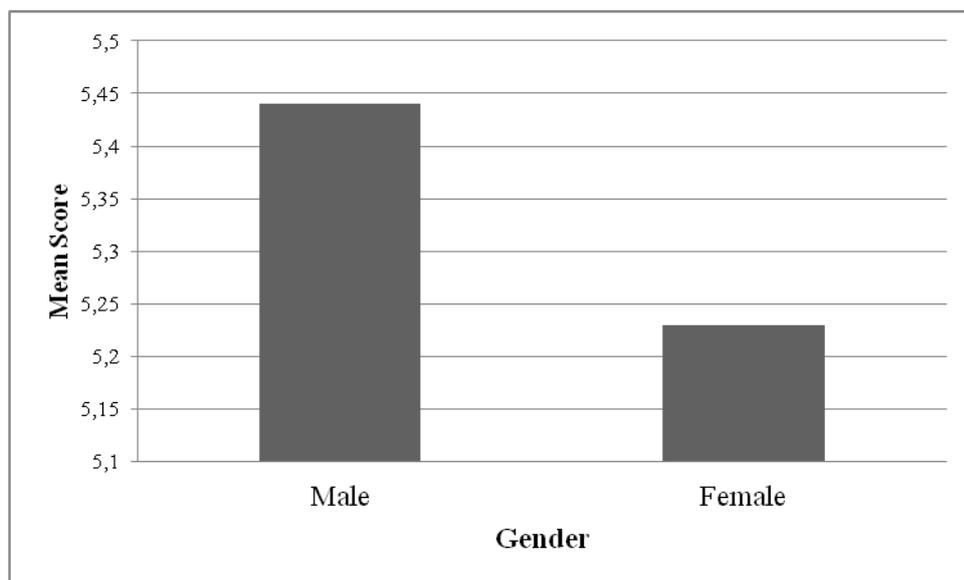


Figure 4.16 Mean scores of environmental knowledge across gender

The descriptive statistics of environmental knowledge were indicated in Figure 4.15 with respect to gender of the participants. Figure displayed that male participants' environmental knowledge mean scores ($M=5.44$, $SD=2.02$) were higher than females

($M=5.23$, $SD=2.15$) implying that male pre-service science teachers were more likely to have more information about environmental issues compared with female pre-service science teachers.

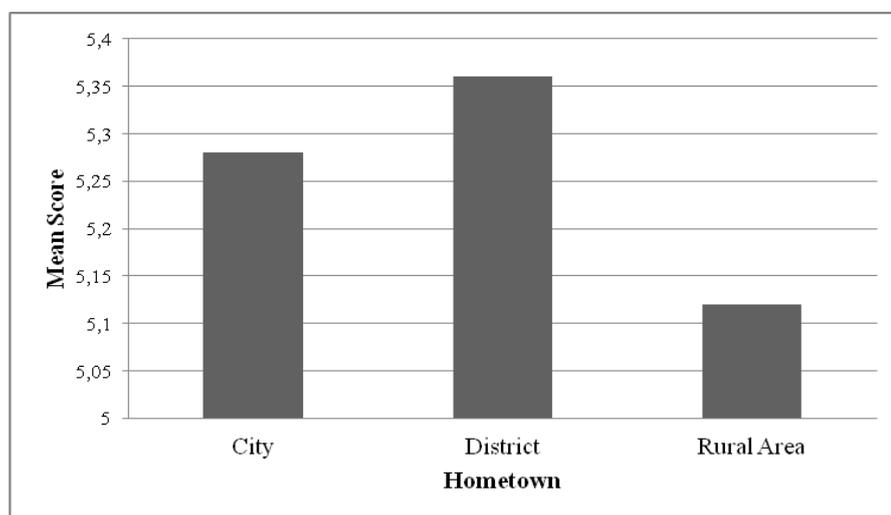


Figure 4.17 Mean scores of environmental knowledge across hometown

Figure 4.17 indicated that environmental knowledge mean scores differentiated via hometown of the participants. Considering these differences, participants growing up in rural areas ($M=5.12$, $SD=2.02$) and in cities ($M=5.28$, $SD=2.04$) seemed to have less environmental knowledge when compared with participants from districts ($M=5.36$, $SD=2.10$). These results revealed that pre-service science teachers who used to live in rural areas tended to have less education about environmental issues compared with pre-service science teachers who used to live in cities.

Figure 4.18 demonstrated that the mean scores of environmental knowledge regarding geographical regions of Turkey. The analysis revealed that pre-service science teachers got almost the same environmental knowledge mean scores regardless of regions. Participants from Region of Marmara got the highest score regarding to knowledge of environmental issues with a mean of 6.29 ($SD=1.81$). Subsequently, pre-service science teachers educated in Region of Mediterranean got a mean 6.17 ($SD=1.74$). Region of Mediterranean was followed by participants from

Region of Central Anatolia ($M=6.06$, $SD=2.09$) and Black Sea ($M=5.78$, $SD=2.05$). Then, participants from Region of Aegean ($M=5.74$, $SD=2.11$) had a low score. Southeast Anatolia ($M=5.56$, $SD=1.99$) and Eastern Anatolia ($M=5.43$, $SD=2.01$) produced the lowest mean scores.

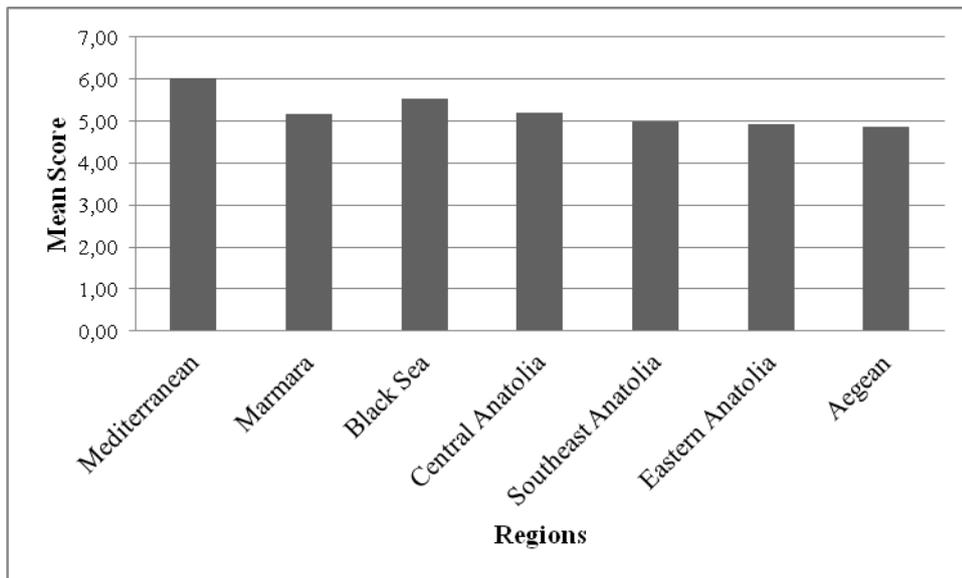


Figure 4.18 Mean scores of environmental knowledge across regions

The results of the item descriptive summary were presented in Table 4.17. Results showed that pre-service science teachers' environmental knowledge level was considerably low with a mean of 5.92 ($SD=2.02$) out of 12.00. While the highest mean score was reported in the question of what the main reason of recycling was ($M=.77$, $SD=.42$), the lowest mean score was achieved in the question of what the amount of world's usable and available water was with a mean of .12 ($SD=.33$). Most of the pre-service science teachers (70%) were not aware of the major source of carbon monoxide also.

Table 4.17 Item descriptive summary for environmental knowledge statements

	Item M	Item SD	Percentage		
			False	True	Don't Know
The main reason of global warming	.19	.39	60	20	20
The most common reason for extinction of animal species	.65	.48	28	66	6
Knowledge about materials considered hazardous waste	.72	.45	25	73	2
The material unable to be recycle and reused	.47	.50	42	47	11
The main reason of recycle	.77	.42	19	77	4
Recognition of renewable resource	.52	.50	25	53	22
How most electricity in Turkey is generated	.30	.49	63	30	7
Recognition of the amount of World's fresh and available water	.12	.33	52	12	36
The most responsible for creating acid rain	.34	.47	52	35	13
The biggest contributor of carbon monoxide	.27	.44	67	27	6
Protection provided by ozone in Upper Atmosphere	.60	.49	33	60	7
Where most of the garbage in Turkey is ended up	.34	.47	57	34	9

After mentioning descriptive and inferential statistics of all variables used in the model, path analysis part was presented at the below.

4.3 Path Analysis Results

In this part, results of path analysis will be examined. In this regard, assumptions of path analysis will be discussed. Then the answer of the research question presented below will be sought through presenting models fit indices and path coefficients.

- i. What is the nature of the relations among Turkish pre-service science teachers' environmentally friendly behaviours, environmental knowledge, attitudes, internal locus of control and their spatial optimism and temporal pessimism?

4.3.1 Assumptions of Path Analysis

The path model for this study was hypothesized based on causal relationship among selected variables and environmentally friendly behaviours. In order to obtain credible results, assumptions of path analysis should be met. Since path analysis is

essentially an extension and specific application of multiple regression, following assumptions of multiple regression are applicable for the current analysis:

1. The independent variables are fixed.
2. The independent variables are measured without error.
3. The mean of the residuals for each observation on the dependent variable over many replications is zero.
4. The relationship between the independent variables and the dependent variables is linear.
5. Errors associated with any single observation on the dependent variable are independent of (i.e., not correlated with) errors associated with any other observation on the dependent variable.
6. The errors are not correlated with the independent variables.
7. The variance of the residuals across all values of the independent variables is constant (i.e., homoscedasticity of the variance of the residuals).
8. The errors are normally distributed.

Assumptions 1, 2, and 3 are largely research design issues. In order to meet other assumptions (4, 5, 6, 7, and 8), each assumption will be discussed separately in the following parts.

Besides the assumptions discussed above, the following assumptions regarding correct model specification must be met:

1. The model must accurately reflect the actual casual sequence.
2. The structural equation for each endogenous variable includes all variables that are direct causes of that particular endogenous variable.
3. There is one-way causal flow in the model.
4. The relationships among variables are assumed to be linear, additive, and causal in nature; any curvilinear relations, etc., are to be excluded.
5. All exogenous variables are measure without error (Pedhazur, 1982; Tate, 1992).

No statistical procedures exist for evaluating these assumptions since they deal specifically with the degree to which the causal model has been correctly specified. In order to evaluate these assumptions, Tate (1992) suggested focusing on the credibility, reasonability, and utility of a proposed model.

The responsibility for assessing the assumptions of multiple regression was met by proper statistical procedures and assumptions related to path analysis laid on the researchers and their subjective judgments.

Normality of the Residuals and Linearity

The assumption of normality states that residuals are normally distributed with a mean of zero (Field, 2005). First, in order to check the normality assumption, histogram and P-P plot were examined. As shown in Figure 4.19, histogram of residuals and Figure 4.20, Normal P-P plot, errors were normally distributed.

Secondly, in order to check the linearity assumption, “P-P Plots” were examined. As presented in Figure 4.20, the points on the graph take the form of a line and there are no curvilinear patterns.

Therefore, there is a linear relationship between the dependent variable and independent variables. Accordingly, linearity assumption was not violated.

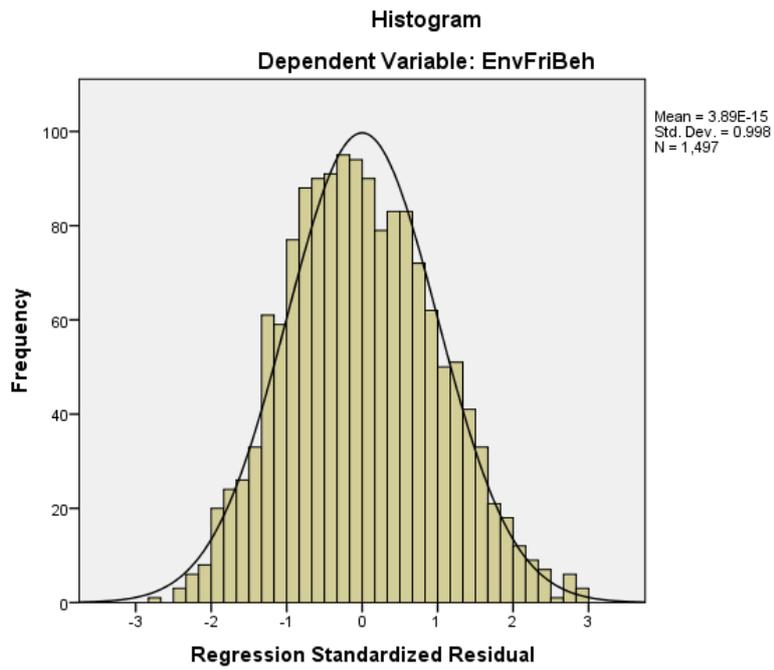


Figure 4.19 Histogram of residuals

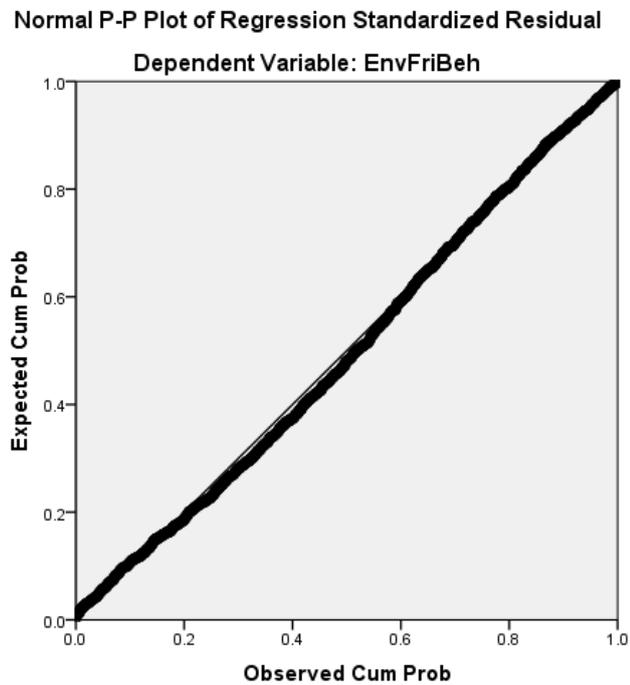


Figure 4.20 Normal P-P plot of residuals

Multicollinearity

Table 4.16 shows the bivariate correlations between variables. According to Tabachnick and Fidell (2001), bivariate correlation between two variables should be less than .90 to meet the multicollinearity assumption. As shown in the Table 4.18, these correlations are not higher than 0.90. In addition, all the VIF values are below 10 and tolerance statistics all above 0.2 (Field, 2005, p. 196), therefore data meet the multicollinearity assumption.

Table 4.18 Pearson product-moment correlations of variables in the model

	1	2	3	4	5	6	7	8	9
Environmentally Friendly Behaviour	1								
Locus of Control	.45**	1							
Ecocentrism	.51**	.59**	1						
Anthropocentrism	-.44**	-.19**	-.11**	1					
Spatial Optimism-Today	-.36**	-.25**	-.28**	.24**	1				
Spatial Optimism-Future	.27**	.30**	.29**	-.18**	.05	1			
Temporal Pessimism-Local	.17**	-.13**	-.14**	.14**	.33**	-.54**	1		
Temporal Pessimism-Global	-.15**	-.08*	.13**	-.08**	-.14**	.14**	-.002	1	
Knowledge	.35**	.40**	.39**	-.38**	-.25**	.22**	-.18**	.11**	1

* $p < .05$, two-tailed; ** $p < .01$, two-tailed.

Homoscedasticity

According to Field (2005), in order to meet homoscedasticity assumption, the variance of the residual terms should be constant at each level of the independent variables. Homoscedasticity assumption was checked by visual examination of the scatter plot of the standardized residuals. Examining Figure 4.21, the points are evenly dispersed around zero and no pattern existed in the scatter plot. Thus, homoscedasticity assumption was not violated.

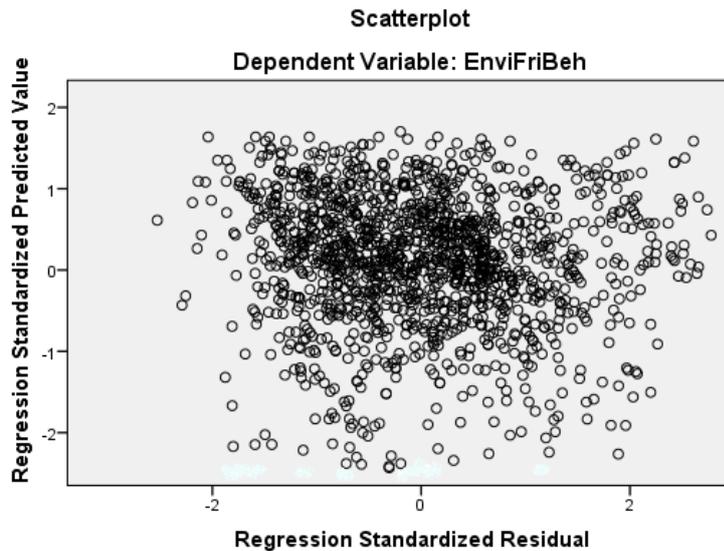


Figure 4.21 Scatter plot of predicted value and residual

Independence of Error

Independence of error means that the residual terms should be uncorrelated (Field, 2005). Durbin-Watson coefficient test was used to check this assumption. According to this test, the values less than 1 and greater than 3 showed some cause for concern. In this analysis, $d = 1.27$, so independence of error assumption was met.

After checking the assumption, path analysis was conducted to test the proposed model.

4.3.2 Results of Path Analysis

Path analysis was employed by making use of AMOS 21 to test the initial models which were used to represent the causal hypotheses of the researcher. The analysis will be presented in three parts: (1) the description of the initial models, (2) the model fit summary for each model and their modification indices, (3) and lastly direct, indirect, and total effects of revised models.

4.3.2.1 Initial Models

Based on the literature, four initial models were emerged from one main model (see Figure 4.22) in order to examine the relationships among environmental knowledge, ecocentric and anthropocentric attitude, internal locus of control, temporal pessimism, spatial optimism, and environmentally friendly behaviour. Each line presented in Figure 4.22 represents a direct effect of one variable on another.

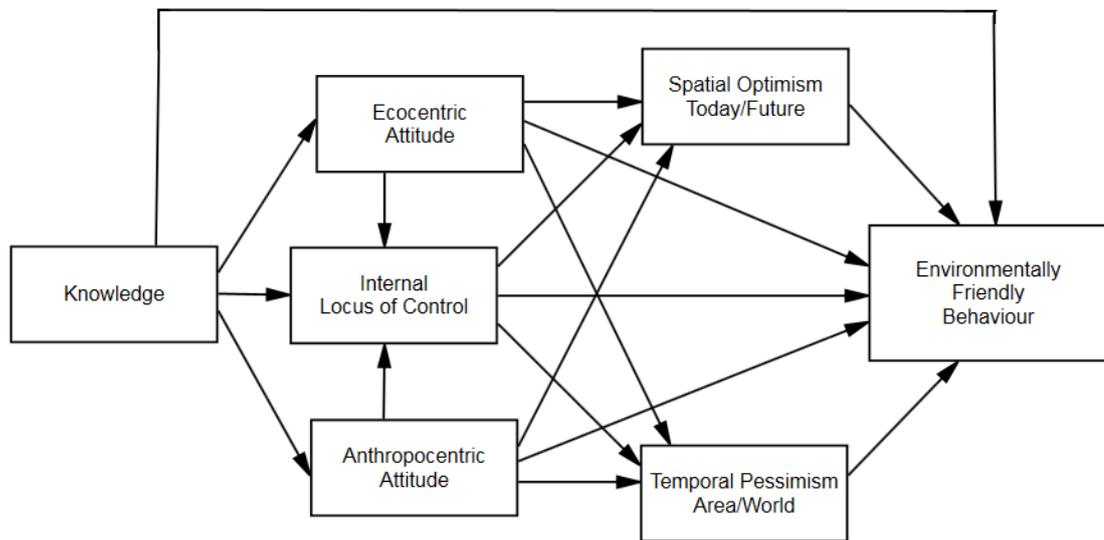


Figure 4.22 Proposed main model of environmentally friendly behaviour

Environmental knowledge, ecocentric and anthropocentric attitude, internal locus of control and environmentally friendly behaviour variables were constant for all initial models. However, models were differentiated by two variables: spatial optimism and temporal pessimism. First initial model posited *current condition of world* including current spatial optimism and global temporal pessimism variables. Second initial model represented *current condition of local area* included current spatial optimism and local temporal pessimism. In the third initial model, *future condition of world* was introduced by future spatial optimism and global temporal pessimism variables. Last initial model discussed *future condition of local area* via future spatial optimism and local temporal pessimism variables.

In following part, four initial models will be examined regarding the model fit indices and modifications index.

4.3.2.2 Model Fit Indices and Modification Index

Firstly, the theoretical model was tested with Turkish pre-service science teachers. Then, nonsignificant paths were deleted from the model. Model fit indices of initial models were examined to reveal if the models fit the data or not. In this purpose, a set of criteria was determined (see Table 4.19).

Table 4.19 Selected model fit criteria and acceptable fit interpretation

Selected Goodness of Fit	Criteria	Acceptable Level Interpretation
Chi-Square (χ^2)	Tabled χ^2 value	Compares obtained χ^2 value with tabled value for given df
χ^2/df	$2 < < 5$	Value ranging from 2 to 5 reflects a good model
χ^2 significance (p)	$p > .05$	Non significant χ^2 value reflects good fit
Comparative Fit Index (CFI)	$>.90$	Value close to 1 reflects a good model
Root-Mean Square error of Approximation (RMSEA)	$< .08$	Value less than .05 reflects a good model fit
90% Confidence Interval for RMSEA	Narrow	Narrow value reflects a confident RMSEA
Standardized Root Mean Square Residual (SRMR)	$< .08$	Value less than .08 reflects a good model fit

Various cut-offs ranging from 2 to 5 were suggested for chi-square(χ^2)/degrees of freedom (df) as cutoffs (e.g. Byrne, 1989; Carmines & McIver, 1981; Marsh & Hocevar, 1985). Comparative fit index (CFI) was also calculated and values close to 1 were considered as indications of a very good fit (Bentler, 1990), and values above .90 were permissible (Hair et al., 2010). For RMSEA, the criteria was set that values less than .05 indicated good fit (Browne & Cudeck, 1993), values ranging between .08 and .10 indicated mediocre fit, and those greater than .10 indicated poor fit (MacCallum, Widaman, Zhang, & Hong, 1999). The value of SRMR was set to be less than .08 (Byrne, 2010). When model testing criteria stated above were taken into consideration, goodness of fit indices for the model was found to be acceptable.

The summary of fit indices gathered from initial models and acceptable values of the criteria were presented in Table 4.20. According to the table, model fit indices of proposed models indicated some unacceptable values.

Table 4.20 Fit indices of the proposed (initial) models

Statistics	χ^2	df	χ^2/df	CFI	RMSEA	90% CI for RMSEA	SRMR
Initial Model-1	251.685	5	50.337	.905	.18	.16-.20	.07
Initial Model- 2	155.542	5	31.108	.941	.14	.12-.16	.06
Initial Model- 3	24.568	5	4.914	.992	.05	.03-.07	.02
Initial Model- 4	502.630	5	100.526	.824	.26	.24-.28	.09
Expected Values	small	-	2 < < 5	> .90	< .50	narrow	< .05

In order to handle with unfit indices, the modification indices yielded from AMOS 21 were taken into consideration. Modification results revealed that, all initial models needed an error covariance between temporal pessimism (area-world) and spatial optimism (today-future) variables. This was an expected result due to the fact that these variables were measured with the same scale and measured highly relevant patterns. Therefore, adding an error covariance between temporal pessimism and spatial optimism was thought to be reasonable as temporal pessimism and spatial optimism variables operating very close patterns in all models. After adding error covariance between these variables fit indices indicated good fit for all initial models.

When the significance of paths was examined, it was observed that there was only one insignificant path in all models which was between knowledge and EFB. As literature supported that there were studies indicating insignificant direct relationships between knowledge and EFB, this path was decided to be removed from all initial models.

After making necessary and reasonable changes in the initial models, revised models were formed and fit indices were represented in Table 4.21.

Table 4.21 Fit indices of the revised models

Statistics	χ^2	df	χ^2/df	CFI	RMSEA	90% CI for RMSEA	SRMR
Revised Model-1	12.678	4	3.169	.997	.038	.016-.063	.017
Revised Model-2	24.012	4	6.003	.992	.058	.037-.081	.022
Revised Model-3	9.049	4	2.262	.998	.029	.000-.055	.014
Revised Model-4	22.254	4	5.564	.994	.055	.034-.079	.020
Expected Values	small	-	2 < < 5	> .90	< .08	narrow	< .05

In this part, at the beginning, hypothesized models were tested to reveal the consistency between the initial models and the data. Model fit indices were examined and it was observed that some initial models needed revision. Later on, initial models were subjected to small changes on the basis of the modification index. Thus, revised models were gathered with an acceptable model fit indices. Here after, in the following part, direct, indirect and total effects of the four models will be examined.

4.3.2.3 Results of Direct, Indirect, and Total Effects of Revised Models

Based on the literature, Turkish pre-service science teachers' hypothetical path model of environmentally friendly behaviour with respect to current condition of world, current condition of local area, future condition of world and future condition of local area was developed via four revised models. Direct, indirect, and total effects were given for all revised models separately. Path coefficients were interpreted using Cohen's criteria (Cohen, 1988). As a reminder, according to Cohen (1988), standardized path coefficient (β) less than .10 may indicate small effect; value around .30 indicates medium effect and values above .50 indicate large effect.

Environmentally Friendly Behaviour Model with respect to the Perception of Current Condition of World

A path analysis was conducted to determine the causal relations among variables of knowledge of environmental issues, ecocentric and anthropocentric attitude, internal

locus of control, current spatial optimism, and global temporal pessimism, and environmentally friendly behaviour. All path coefficients were statistically significant in the model. The standardized path coefficients (Beta Weight) of direct effects were presented in Figure 4.23. Considering direct effects, the standardized path coefficients ranged from -0.06 to 0.52. Indirect and total effects were also mentioned in Table 4.22. According to the model, selected variables accounted for 45% of the variance in environmentally friendly behaviour.

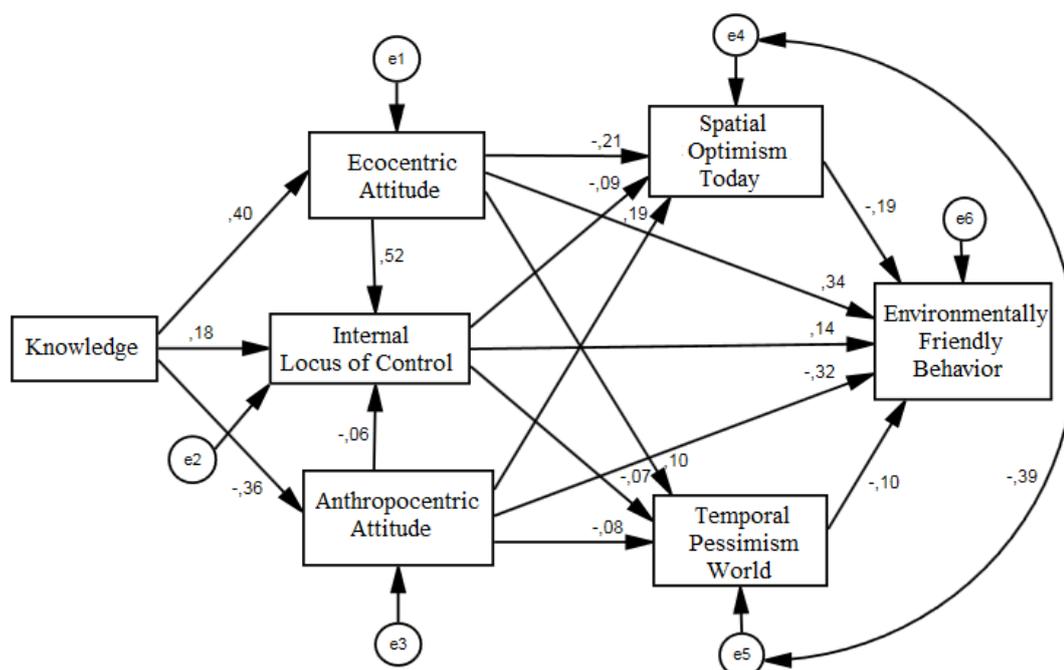


Figure 4.23 Standardized path coefficients for model-1

Direct Effects

Considering Figure 4.23, the arrow starts from the cause variable and points to the effect. Regarding variables associated with knowledge, it was observed that knowledge had a moderate effect on attitude. In more detail, knowledge affected ecocentric attitudinal views ($\beta = .40$) positively whereas affected anthropocentric attitude ($\beta = -.36$) negatively. These results indicated that pre-service science teachers who seemed more knowledgeable about environmental issues tended to protect

environment solely due to its own value. On the other hand, pre-service science teachers with less environmental knowledge were likely to protect environment to enhance the quality of their life. Moreover, knowledge had positive effect on internal locus of control ($\beta=.18$) indicating pre-service science teachers who were knowledgeable about environmental issues tended to perceive the power of their individual actions on solution of the environmental problems.

Concerning attitudinal motives, ecocentric attitude had a positive and large effect ($\beta=.52$) on internal locus of control whereas anthropocentric attitude had low and negative effect ($\beta=-.06$) indicating that pre-service science teachers protecting environment solely due to its own value tended to perceive the power of their individual actions had a role on solution of the environmental problems.

Furthermore, current spatial optimism and global temporal pessimism were directly affected from ecocentric view and anthropocentric view. There was a positive association between pre-service science teachers' current spatial optimism bias and anthropocentrism ($\beta=.19$) whereas negative association between pre-service science teachers' current spatial optimism bias and ecocentrism ($\beta=-.21$). These path coefficients indicated that pre-service science teachers protecting environment due to enhancing the quality of human life, had a perception that current environmental problems in their local area were better than world' situation. On the other hand, pre-service science teachers having a pessimistic perception about the future of our world had tendency to support ecocentrism ($\beta=.10$) rather than anthropocentrism ($\beta=-.08$). In other words, pre-service science teachers protecting environment solely due to its own value tended to expect a worse environmental problems in the future.

Regarding the variables associated with internal locus of control, current spatial optimism ($\beta=-.09$) and global temporal pessimism ($\beta=-.07$) were negatively associated with internal LOC referring pre-service science teachers' spatial optimism and temporal pessimism getting were higher when they had less perception of the power of their individual actions on solution of the environmental problems.

Regarding variables effecting environmentally friendly behaviour, the results of direct effects of path analysis revealed that pre-service science teachers' ecocentric ($\beta=.34$) and anthropocentric ($\beta=-.32$) attitude moderately predicted environmentally friendly behaviours referring that developing ecocentric attitudinal view resulted in an increased EFB. In other words, pre-service science teachers protecting environment solely due to its own value were likely to exhibit more environmentally friendly behaviours. Similarly, locus of control had moderate effect on EFB ($\beta=.14$) indicating pre-service science teachers with the power of their individual actions on solution of the environmental problems tended to engage more EFB. Finally, both current spatial optimism ($\beta=-.19$) and global temporal pessimism ($\beta=-.10$) negatively associated with EFB. In other words, if pre-service teachers perceived that environmental problems in their local area were in better situation and global environmental problems would worsen at future; they tended to behave less environmentally friendly.

Indirect Effects

In addition to direct effects, path analysis provides information about indirect effects. There are many indirect effects that are presented in Table 4.22. The highest indirect path coefficient was founded between environmental knowledge and behaviour ($\beta=.34$) which was attributed to the direct effect of knowledge on attitudinal motives and internal LOC. Knowledge had also indirect effects on current spatial optimism ($\beta=-.19$) and on global temporal pessimism ($\beta=.04$) which could be mainly attributed to the direct effect of this variable on ecocentrism, anthropocentrism, and internal locus of control. Moreover, knowledge had also indirect effect on internal locus of control ($\beta=.22$) through its direct effects on ecocentrism and anthropocentrism.

Other variables also had indirect effects on environmentally friendly behaviour. Indirect path coefficient of anthropocentrism on EFB was $-.04$ and ecocentrism on EFB was $.12$ which could be mainly originated from the direct effect of these variables on internal locus of control, global temporal pessimism and current spatial

optimism. Lastly, internal locus of control had indirect effect ($\beta=.03$) on EFB which might be caused from direct effect of this variable on current spatial optimism and global temporal pessimism. Thus, knowledge, ecocentric and anthropocentric attitude, internal locus of control had indirect effects on EFB.

Total Effects

Considering total effects, the strongest positive total effect on environmentally friendly behaviour was originated from the ecocentric view ($\beta=.46$) whereas the strongest negative total effect was originated from the anthropocentric view ($\beta=-.36$). The second highest positive total effect was .34 which was pertained by knowledge. Locus of control ($\beta=.17$) had the moderated positive total effect on environmentally friendly behaviour whereas global temporal pessimism ($\beta=-.10$) and current spatial optimism ($\beta=-.19$) had moderate negative total effects.

To conclude, these direct, indirect and total effects exposed the role of environmental knowledge, ecocentric and anthropocentric attitude, internal locus of control on pre-service science teachers' environmentally friendly behaviour. Results revealed that pre-service science teachers who were more knowledgeable about environmental issues, tended to give value to nature for its own sake rather than for human benefit. They were also likely to feel the power of their individual actions on solution of the environmental problems. The interpretation of these results may indicated that environmental pre-service science teachers with more environmental knowledge exhibited more environmentally friendly behaviour through ecocentric attitude and high internal locus of control. When results were analysed regarding optimistic and pessimistic perceptions of pre-service science teachers, it was revealed that both spatial optimism and temporal pessimism bias prevents developing environmentally friendly behaviour. In more detail, pre-service science teachers who had a perception that their local area was in better situation compared with world's situation tended not to behave environmentally friendly behaviour. Similarly, pessimistic perception

toward future of environmental problems of world inhibits developing environmentally friendly behaviour.

Environmentally Friendly Behaviour Model with respect to the Current Condition of Local Area

A path analysis was conducted to determine the causal relations among variables of knowledge of environmental issues, ecocentric and anthropocentric attitude, internal locus of control, current spatial optimism, and local temporal pessimism, and environmentally friendly behaviour. The standardized path coefficients for direct effects are graphically depicted in Figure 4.24. All the path coefficients indicating in the model were statistically significant. In the model, selected variables accounted for 46% of the variance in environmentally friendly behaviour. The coefficients ranged from $-.06$ to $.52$. Model-2 was different from Model-1 only in terms of spatial level of temporal pessimism. Local temporal pessimism was added to the model instead of global temporal pessimism.

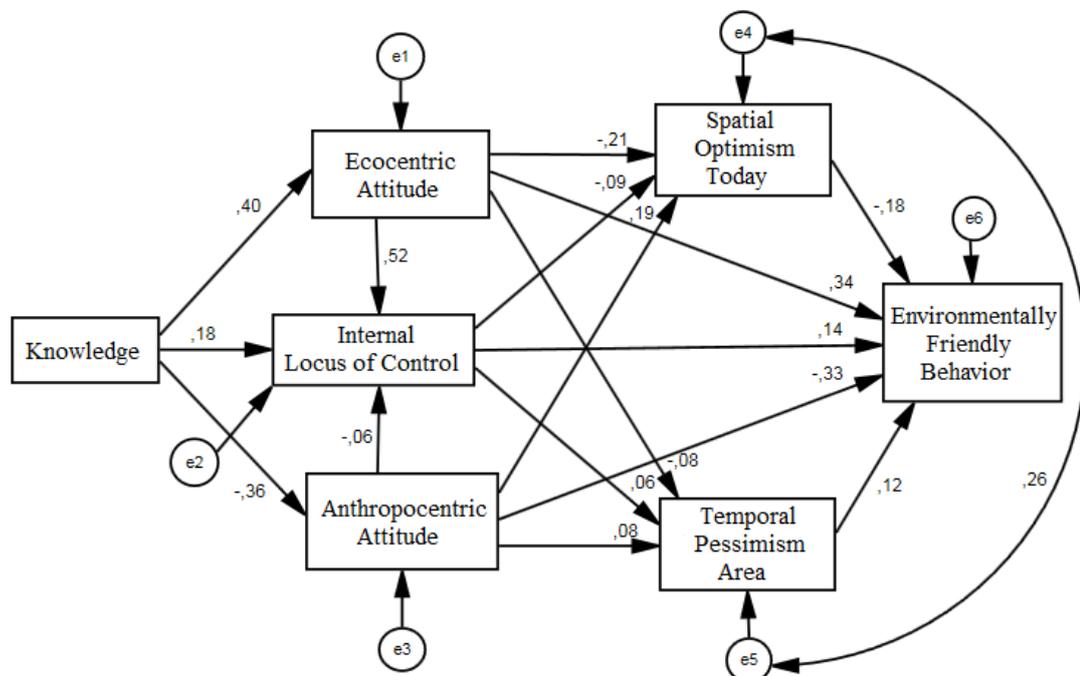


Figure 4.24 Standardized path coefficients for model-2

Direct Effects

As local temporal pessimism was included to the model instead of global temporal pessimism, path coefficients started from and point to this new variable changed. In More detail, pre-service science teachers' local temporal pessimism was negatively associated with ecocentric attitudinal views ($\beta=-.08$) and positively associated with anthropocentric attitudinal views ($\beta=.08$) and internal locus of control ($\beta=.06$). Moreover, path coefficient between local temporal pessimism and EFB was observed as .12. These findings revealed that, pre-service teachers with anthropocentric attitude and high internal locus of control tended to have local temporal pessimism about environmental issues and this pessimistic perception about local area enhanced developing environmentally friendly behaviour. In other words, pre-service science teachers who were pessimistic about the future of environmental problems in their local area seemed to be motivated to develop environmentally friendly behaviour by means of saving the environment for the sake of human populations. Adding new variable to the model also caused some negligible changes on other causal relationships.

Path coefficient between anthropocentric attitude and EFB increased from $-.32$ to $.33$ while path coefficients between spatial optimism ($\beta=-.18$) and internal LOC ($\beta=.14$) to EFB decreased.

Indirect Effects

There were also indirect effects differentiated from Model-1 (see Table 4.23). Knowledge had indirect negative effect ($\beta=-.04$) on local temporal pessimism which could be mainly attributed to the direct effect of this variable on environmental attitude and internal locus of control. Furthermore, ecocentric attitude had positive indirect effect on local temporal pessimism ($\beta=.03$) which may be mainly originated from the direct effect of this variable on internal locus of control.

Table 4.22 Direct, indirect and total path coefficients for model-1

Variables	Anthropocentric			Ecocentric			Locus of Control			Spatial Optimism- Today			Temporal Pessimism-World			Environmentally Friendly Behaviour		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Knowledge	-.36	-	-.36	.40	-	.40	.18	.22	.40	-	-.19	-.19	-	.04	.04	-	.34	.34
Anthropocentric Attitude	-	-	-	-	-	-	-.06	-	-.06	.20	-	.20	-.08	-	-.08	-.32	-.04	-.36
Ecocentric Attitude	-	-	-	-	-	-	.52	-	.52	-.21	-.05	-.26	.10	-.03	.07	.34	.12	.46
Internal Locus of Control	-	-	-	-	-	-	-	-	-	-.09	-	-.09	-.07	-	-.07	.14	.03	.17
Spatial Optimism-Today	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.19
Temporal Pessimism- World	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.10

Table 4.23 Direct indirect and total path coefficients for model-2

Variables	Anthropocentric			Ecocentric			Locus of Control			Spatial Optimism- Today			Temporal Pessimism-Area			Environmentally Friendly Behaviour		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Knowledge	-.36	-	-.36	.40	-	.40	.18	.22	.40	-	-.19	-.19	-	-.04	-.04	-	.34	.34
Anthropocentric Attitude	-	-	-	-	-	-	-.06	-	-.06	.20	-	.20	.08	-	.08	-.33	-.03	-.36
Ecocentric Attitude	-	-	-	-	-	-	.52	-	.52	-.21	-.04	-.25	-.08	.03	-.05	.34	.12	.46
Internal Locus of Control	-	-	-	-	-	-	-	-	-	-.09	-	-.09	.06	-	.06	.14	.03	.17
Spatial Optimism-Today	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.18
Temporal Pessimism- Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.12	-	.12

Total Effects

Considering total effects, knowledge ($\beta=-.04$) and ecocentric attitudinal views ($\beta=-.05$) of pre-service science teachers were negatively associated with local temporal pessimism whereas internal locus of control ($\beta=.06$) and anthropocentric attitude ($\beta=.08$) were positively. In Accordance with these total effects, local temporal pessimism was positively associated with EFB ($\beta=.12$).

In brief, these direct, indirect and total effects indicated that pre-service science teachers' pessimistic perception regarding the future of local environmental problems revealed different patterns from pessimistic perception regarding the future of global environmental problems. Pre-service science teachers with anthropocentric attitude tended to perceive that their local area would be in better condition and they also seemed to feel the power of their actions on the solution of the environmental problems. This pattern among anthropocentric attitude, internal locus of control, and local temporal pessimism produced a remarkable effect on EFB. As local temporal pessimism was positively associated with anthropocentric attitude, general expectation was that local temporal pessimism would have negative effect on EFB. But this was not the case, pre-service science teachers feeling worry about the future of their local area tended to develop friendly behaviours toward environment by means of valuing nature due to their benefits. In other words, their selfishness toward nature enhanced developing EFB with the support of their high internal locus of control.

Environmentally Friendly Behaviour Model with respect to Future Condition of the World

Model-3 revealed the standardized path coefficients of direct effects of knowledge of environmental issues, internal locus of control, ecocentric and anthropocentric attitude, global temporal pessimism, future spatial optimism and EFB (see Figure 4.25). Beside direct effects, indirect and total effects were presented in Table 4. 22. In the model, variables accounted for 43% of the variance in environmentally friendly behaviour. The coefficients ranged from -.06 to .52. Model-3 was differentiated from Model-1 with only temporal level of spatial optimism variable. Future spatial optimism level of pre-service science teachers was added to the model instead of current spatial level

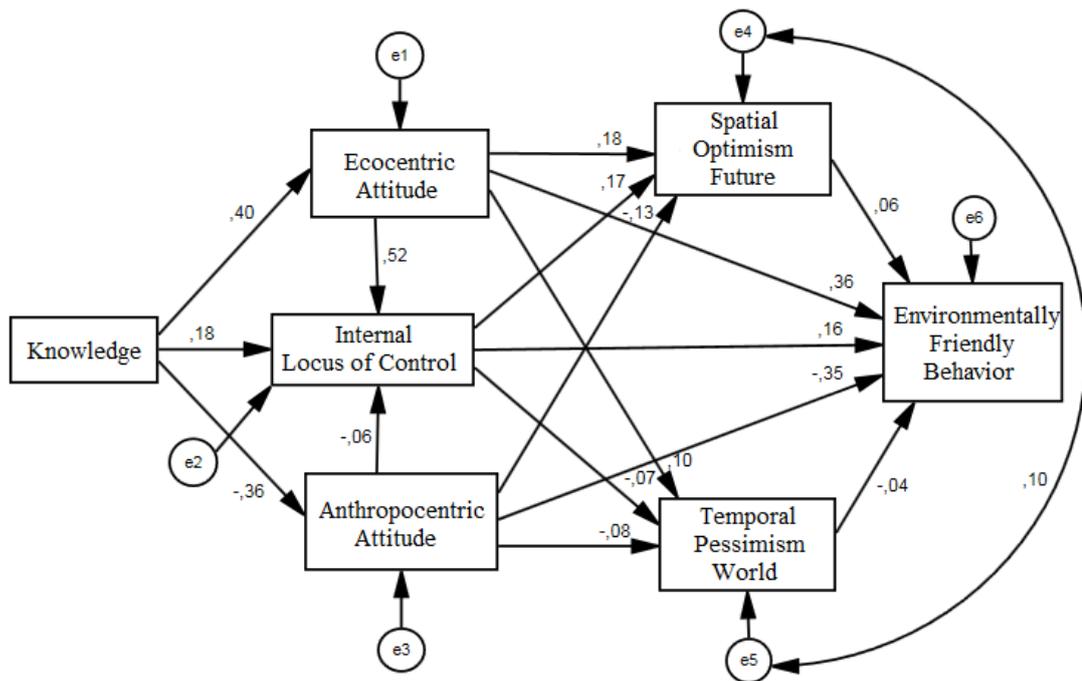


Figure 4.25 Standardized path coefficients for model-3

Direct Effects

As, future spatial optimism level of pre-service science teachers was added to the model instead of current spatial level, path coefficients starts from and point to this new variable changed. More detailed, pre-service science teachers' future spatial optimism was positively associated with ecocentric attitudinal views ($\beta=.18$) and locus of control ($\beta=.17$) whereas associated negatively with anthropocentric attitudinal views ($\beta=-.13$). Moreover, path coefficient between future spatial optimism and EFB was positive ($\beta=.06$). These findings revealed that, pre-service teachers with ecocentric attitude and high internal LOC were likely to have spatial optimism regarding future of environmental problems and this optimistic perception about future tended to support EFB. In other words, pre-service science teachers who were optimistic about the future of environmental problems in their local area seemed to be motivated to develop environmentally friendly behaviour by means of saving the environment for the sake of nature and perceiving the power of their individual actions on solution of the environmental problems.

Adding new variable to the model also caused some negligible changes different from the first model. Path coefficient between global temporal pessimism and EFB, decreased from $-.11$ to $-.04$ while path coefficients from ecocentric attitude ($\beta=.36$), anthropocentric attitude ($\beta=-.35$) and LOC ($\beta=.16$) to EFB increased.

Indirect Effects

There were also indirect effects on future spatial optimism (see Table 4.24). Different from Model-1, knowledge ($\beta=.19$) and ecocentric attitude ($\beta=.08$) had indirect positive effect on future spatial optimism. On the other hand, anthropocentric attitude had negative indirect effect ($\beta=-.01$) on future spatial optimism.

Total Effects

Concerning total effects, knowledge ($\beta=.19$), ecocentric attitude ($\beta=.26$), and internal locus of control ($\beta=.17$) had positive total effect on future spatial optimism whereas anthropocentric attitude ($\beta=-.14$) had negative. In Accordance with these total effects, future spatial optimism was positively associated with EFB ($\beta=.06$).

To summarize, these direct, indirect and total effects revealed that pre-service science teachers' optimistic perception regarding the future of their local environmental problems revealed different patterns from optimistic perception regarding the current condition of local environmental problems. In more detail, pre-service science teachers who had a perception that their local area would be in better condition compared with global environmental issues tended to have ecocentric attitude. They also seemed to feel the power of their actions on the solution of the environmental problems. This pattern among future spatial optimism, ecocentric attitude, and internal locus of control produced an expected result. Pre-service science teachers feeling optimistic about the future of their local area are more likely to develop friendly behaviours toward environment by means of ecocentric attitude and high internal LOC.

Table 4.24 Direct, indirect and total path coefficients for model-3

Variables	Anthropocentric			Ecocentric			Locus of Control			Spatial Optimism-Future			Temporal Pessimism-World			Environmentally Friendly Behaviour		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Knowledge	-.36	-	-.36	.40	-	.40	.18	.22	.40	-	.19	.19	-	.04	.04	-	.34	.34
Anthropocentric Attitude	-	-	-	-	-	-	-.06	-	-.06	-.13	-.01	-.14	-.07	-	-.07	-.35	-.01	-.36
Ecocentric Attitude	-	-	-	-	-	-	.52	-	.52	.18	.08	.26	.11	-.04	.07	.36	.09	.45
Internal Locus of Control	-	-	-	-	-	-	-	-	-	.17	-	.17	-.07	-	-.07	.16	.01	.17
Spatial Optimism-Future	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.06	-	.06
Temporal Pessimism-World	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-.04	-	-.04

Table 4.25 Direct, indirect and total path coefficients for model-4

Variables	Anthropocentric			Ecocentric			Locus of Control			Spatial Optimism-Future			Temporal Pessimism-Area			Environmentally Friendly Behaviour		
	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
Knowledge	-.36	-	-.36	.40	-	.40	.18	.22	.40	-	.19	.19	-	-.08	-.08	-	.34	.34
Anthropocentric Attitude	-	-	-	-	-	-	-.06	-	-.06	-.13	-.01	-.14	.08	-	.08	-.35	-.01	-.36
Ecocentric Attitude	-	-	-	-	-	-	.52	-	.52	.18	.08	.26	-.08	.03	-.05	.36	.09	.46
Internal Locus of Control	-	-	-	-	-	-	-	-	-	.17	-	.17	.06	-	.06	.14	.03	.17
Spatial Optimism-Future	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.13	-	.13
Temporal Pessimism-Area	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	.14	-	.14

Environmentally Friendly Behaviour Model with respect to Future Condition of Local Area

A path analysis was conducted to determine the causal relations among knowledge of environmental issues, ecocentric and anthropocentric attitude, internal locus of control, future spatial optimism, and local temporal pessimism, and environmentally friendly behaviour. All path coefficients were statistically significant in the model. In order to observe the direct causations among variables in Model-4, the standardized path coefficients were presented in Figure 4.26. Moreover, indirect relationships between variables and their total affects were provided in Table 4.25. 44% of the variance of environmentally friendly behaviour was explained by the variables in the model. The coefficients ranged from $-.06$ to $.52$.

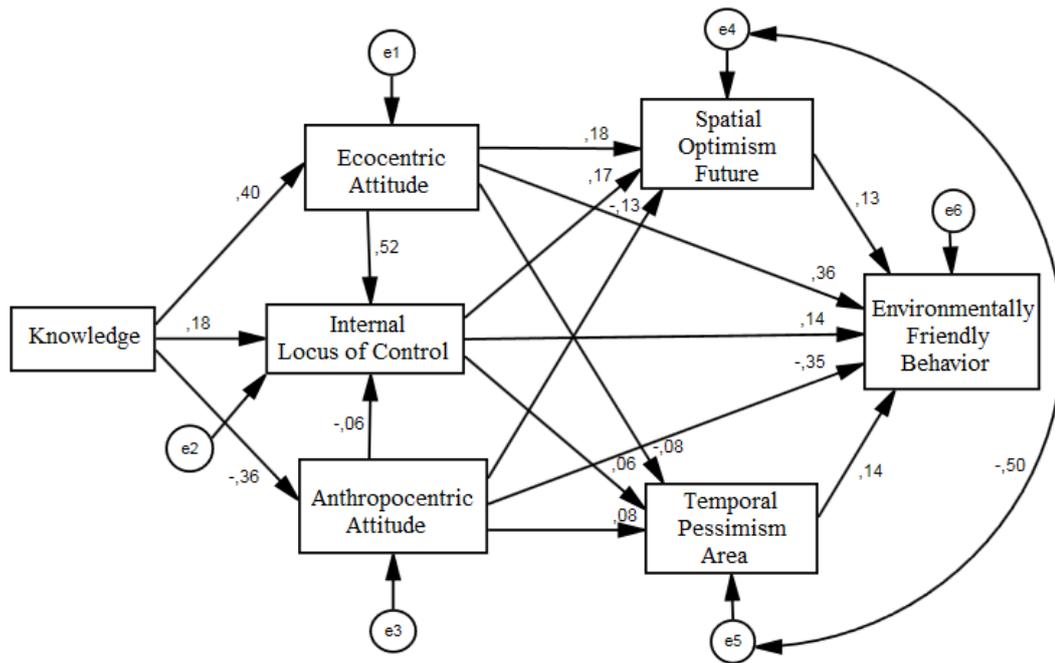


Figure 4.26 Standardized path coefficients for model-4

All paths coefficients in Model-4 were discussed in pieces while other models were presented in the previous chapters. However, Model-4 revealed some varying path coefficients due to using future spatial optimism and local temporal pessimism

variables together for the first time. Namely, path coefficient between future spatial optimism and EFB was .06 in Model-3 but this path coefficient increased to .13 in Model-4. Similarly, path coefficient between local temporal pessimism and EFB increased from .12 to .14. Results indicated that, future spatial optimism and local temporal pessimism together caused an increase in the effect on EFB.

4.4 Summary of Results

Four models were proposed and tested in the scope of the current study. Models differentiated in terms of optimism (either current or future) and pessimism (local and global) variables. In order to see different effects of these variables in a single figure, Figure 4.27 was prepared considering the main model (see in Figure 4.22). Black, pink and purple arrows show environmentally friendly behaviour model in terms of perception of current conditions of word. Black, pink and green arrows show environmentally friendly behaviour model in terms of the current condition of area. Black, blue and purple arrows indicate environmentally friendly behaviour model in terms of future conditions of world. Black, blue and green arrows indicate environmentally friendly behaviour model in terms of future condition of area.

Overall, all models agreed on the effect of knowledge on environmental attitudes and internal locus of control. Considering the association between knowledge and environmental attitude types, results showed that much knowledge about environmental issues was positively associated with ecocentric attitude and negatively associated with anthropocentric attitude. In other words, pre-service teachers who were knowledgeable about environmental issues were likely to protect environment for giving value only for nature. On the other hand, people valuing nature for its benefits for human being seemed not to have enough knowledge about environmental problems. Models also produced a common result that environmental knowledge had positive effects on internal locus of control. Namely, pre-service science teachers with more environmental knowledge tended to feel the power of

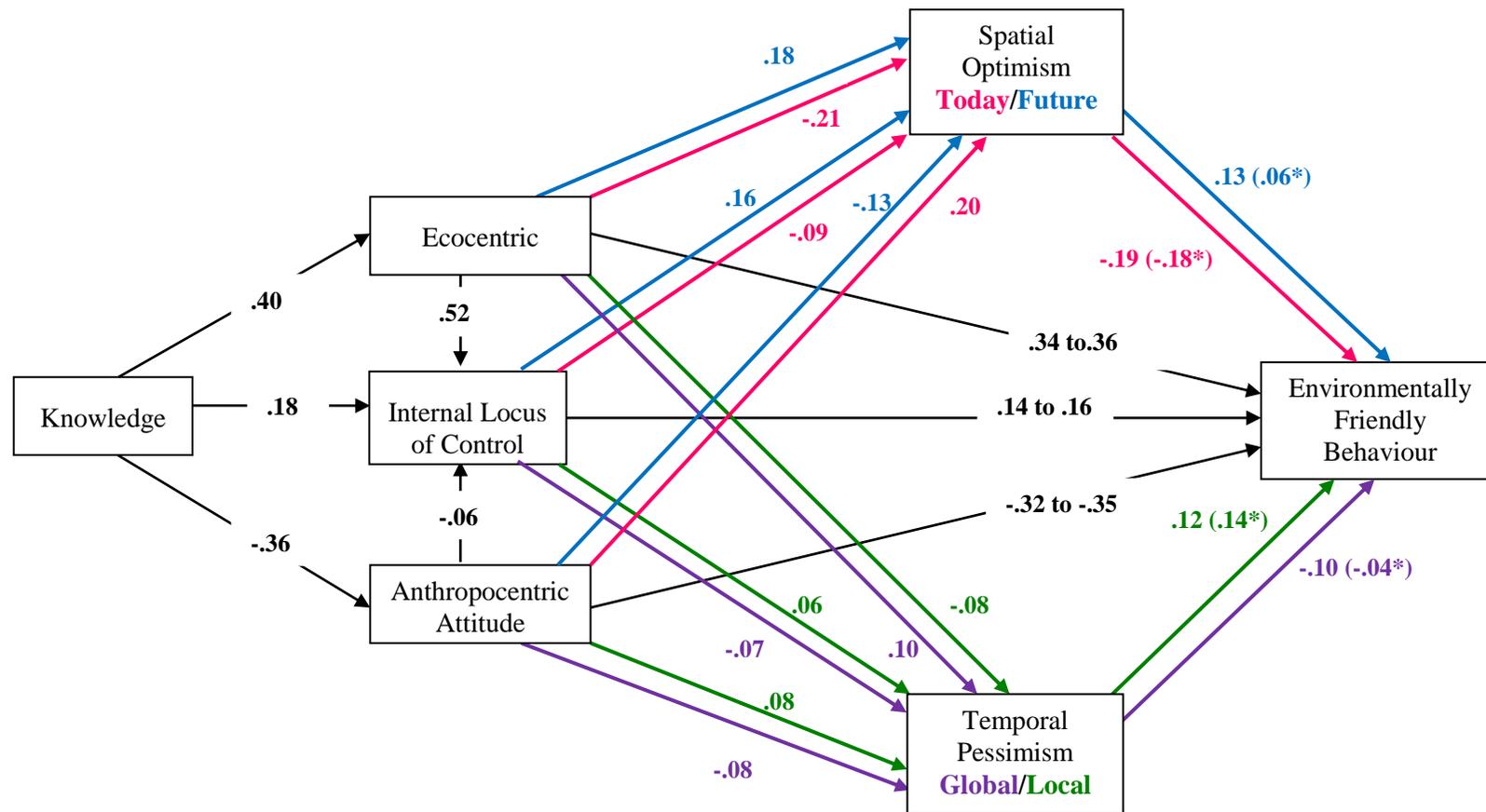


Figure 4.27 Environmentally friendly behaviour model of pre-service science teachers

Note. *since the levels of spatial optimism and temporal pessimism were tested within different models. Beta coefficients from spatial optimism, temporal pessimism, attitudinal views, and internal locus of control to environmentally friendly behaviour showed little change.

their individual actions on environmental problems. Moreover, path coefficients between attitudes and internal locus of control were the same for all models.

Concerning the relationship among environmental attitudes and internal locus of control, results indicated that pre-service science teachers giving value to nature for its own sake tended to feel the power of their actions on changing progress of environmental problems. On the other hand people concerning about environment for human interest seemed to have less internal locus of control.

Considering spatial optimism variable, results revealed that pre-service science teachers' current spatial optimism levels were negatively associated with ecocentric attitude and internal locus of control whereas future spatial optimism were positively. In other words, pre-service science teachers who had optimistic expectation about the future of local environmental problems tended to value nature for its own sake and they also felt the power of their individual actions on environmental problems. These relations revealed a pattern that future spatial optimism perception of pre-service science teachers was positively affected by ecocentric attitude and high internal locus of control. This pattern enhanced developing environmentally friendly behaviour. On the other hand, if pre-service science teachers had anthropocentric attitude and less internal locus of control, they would be likely to have a perception that their local area is in better condition and this pattern inhibit exhibiting environmentally friendly behaviour.

Regarding temporal pessimism variable, results indicated that pre-service science teachers' local temporal pessimism levels were positively associated with anthropocentric attitude and internal locus of control. In other words, pre-service science teachers who had pessimistic expectation about the future of local environmental problems tended to value nature for the benefit of human being and they also felt the power of their individual actions on environmental problems. Models indicated such a pattern that local temporal pessimism was positively affected by anthropocentric attitude and high internal locus of control enhanced

developing environmentally friendly behaviour. Based on related literature, general agreement is on supporting effect of ecocentric attitude on environmentally friendly behaviour. However, current study revealed that people with pessimistic perception about future of local environmental problems were motivated to develop EFB by means of their anthropocentrism. In other words, the reason of positive association between EFB and local temporal pessimism could be explained by the willingness to behave environmentally friendly due to taking care of nature for human benefit and having internal locus of control. On the other hand, study also revealed that pre-service science teachers' temporal pessimism regarding global environmental problems was positively associated with ecocentric attitude whereas negatively with internal locus of control. Interestingly, although people having global temporal pessimism had ecocentric attitude, their pessimism toward future of global environmental problems prevented exhibiting friendly behaviours. In other words, reluctance to exhibiting EFB could be explained by having pessimistic perception of world's future and deficiency of internal locus of control.

In brief, in the light of four models, fruitful results were reached on how selected variables affected pre-service science teachers' environmentally friendly behaviour. Results revealed that pre-service science teachers with sufficient environmental knowledge, ecocentric attitude, and high internal LOC and having future spatial optimism, and local temporal pessimism are expected to exhibit more EFB than pre-service science teachers having less environmental knowledge and less internal LOC, anthropocentric attitude, current spatial optimism and global temporal pessimism.

CHAPTER 5

CONCLUSION, DISCUSSION AND IMPLICATION

This chapter includes the discussions and the implications of the result. In this frame, the first part will hold a discussion on the comparison of the proposed models with national and international research studies. The second part is attributed to the implications and recommendation for further research.

5.1 Conclusion and Discussion of the Results

In this dissertation, four separate models were proposed and tested to provide better understanding of the predictors of environmentally friendly behaviours of pre-service science teachers in Turkey. To reflect this aim, a nation-wide study was conducted with 1496 pre-service science teachers from eighteen universities located in fifteen provinces in seven different geographical regions of Turkey. Although environmental knowledge, environmental attitude, and internal locus of control were the common constructs in each models, they differed in terms of spatial optimism (either today or future) and temporal pessimism (either local or global) levels.

In the first model; while linear combination of knowledge of environmental issues, attitudinal motives, internal locus of control, current spatial optimism and global temporal pessimism were accounted for 45% of the variance in environmentally friendly behaviour, in the second model, environmental knowledge, attitudinal motives, and internal locus of control, current spatial optimism, and local temporal pessimism were found to explain 46% of the variance in behaviour. In the third model, knowledge, attitudinal motives, and internal locus of control, future spatial optimism, and global temporal pessimism all together accounted for 44% variance in behaviour. Lastly, fourth model tested the effects of knowledge, attitudinal motives, internal locus of control, future spatial optimism, and local temporal pessimism on

behaviour. This model explained 43% of the variance in EFB. In short, these results showed that the models significantly explained appreciable amount of the variance in pre-service science teachers' environmentally friendly behaviours ranging from 43% to 46%.

In each model tested, *attitudinal motives* (either ecocentric attitude or anthropocentric) were found to be the most important constructs influencing pre-service science teachers' environmentally friendly behaviour, followed by environmental knowledge. Ecocentric attitude had a strong and positive (β ranging from .34 to .36) direct effect on behaviour whereas anthropocentric attitude had a negative effect on behaviour (β ranging from -.32 to -.35). Thus, pre-service science teachers who give value nature for its own sake tended to exhibit friendly behaviours toward nature. Such participants were more likely to perform both light green and dark green actions. For example, they seemed to be eager to recycle materials, take steps to reduce water use, participate to environmentally friendly campaigns, and encourage others to help the environment and also support or vote for a "pro" environment candidate. Conversely, pre-service science teachers who did not develop environmentally friendly behaviours seemed to adopt human-centred motives. In fact, Turkish pre-service science teachers seemed to give value to nature for the sake of the nature itself ($M=4.09$, $SD=.73$), rather than for the benefits of human being ($M=3.39$, $SD=.79$). In particular they believe that "humans are as much a part of the ecosystem as other animals", that "nature is valuable for its own sake", and that "it makes me sad to see that the natural environment is being destroyed". On the other hand, they did not agree on the idea that "only economically important plants and animals should be protected", that "the thing that concerns me most about deforestation is that there will not be enough lumber for future generations".

These findings are not surprising; as stated by Thompson and Barton (1994) among two different orientations toward the environment which were ecocentrism and anthropocentrism, the ecocentrism was the most preferred one to enrich environmentally friendly behaviour. People who appreciate nature tend to take part

in environmental organizations and also take steps for the preservation of nature. However people who support the preservation of nature for the good of humankind are found to exhibit apathetic behaviours towards environment and less likely to join environmental organizations. As ecocentric and anthropocentric individuals adopted environmental behaviour based on different underlying values, preserving nature motives which are stemmed from self-interested reasons might work in those with anthropocentric interest but might not with those ecocentric ones. Anthropocentric motives are not expected to support environmental behaviour because they could quickly be replaced if any other human benefit appears. For example, if one adopts environmental behaviour such as taking steps for reducing his/her water and electricity consumption due to self-interested reasons (e.g. to save money), he/she will expect to give up conservation actions when he/she could not save money. Therefore, individuals who develop an ecocentric attitude are more inclined to support the environment despite to the possibilities that this action might cost them unsettlement, challenge and money whereas individuals who develop anthropocentric attitudes are generally avoid from actions to support the environment since other human-centred values generally override the environmental actions.

Findings of current study are consistent with the studies which found a significant relationship between attitudinal motives and environmentally friendly behaviours (Nordlund & Garvill, 2002; Schultz & Zelezny, 1998; Schultz, Gouveia, Cameron, Tankha, Schmuck, & Franek, 2005; Thompson & Barton, 1994). Similar to our findings, Karpiak and Baril (2008) reported that university students adopt more ecocentric views compared to anthropocentric ones. Results also revealed that the students from biological science departments exhibit more ecocentric and less anthropocentric attitudes than the students of other departments. An explanation was made by the researchers as that studying biology might have a decreasing effect in terms of anthropocentric attitudes since it leads an in-depth understanding of the nonhuman life. Studying with college students, Schultz and Zelenzy (1998) tried to investigate the relation between attitudinal motives and environmental behaviour. They found that nature dimension of self-transcendence referring to ecocentric

motives play an important role on prediction of pro-environmental behaviour. There was found a positive correlation between ecocentric motives and environmental behaviour. In addition, results revealed a negative relation between self-enhancement (anthropocentric motive) and behaviour. Authors interpreted this negative link as that egoism prevents exhibiting environmental behaviour. They also suggested that behaviours requiring much effort for little reward make people exhibit less environmental behaviour. However, as stated by Schultz and Oskamp (1999), anthropocentric orientation toward nature may encourage environmental behaviour if the person perceives that being aware of these actions will provide him/her personal gains such as money, reward and so forth. In the scope of Nordlund and Garvill's (2002) study the effects of general values, environmental values, problem awareness, and personal norms on environmental behaviour were tested with a hierarchical model with 1400 Swedish people. The results revealed that an ecocentric orientation toward the environment had indirect positive effect on environmental behaviours whereas an anthropocentric orientation had indirect negative effect through personal norms. It is also revealed by the results that individuals who appreciated nature were more aware of the threats to the environment and had much stronger moral obligations in themselves than those whose priorities were their own benefits. Investigating the relationship between environmental attitudes and pro-environmental behaviours within six countries, Schultz et al. (2005) indicated that there was a negative link between anthropocentric attitude and pro-environmental behaviours and positive link between ecocentric attitude and pro-environmental. Authors attribute the negative relationship between human-based motives and environmental behaviour to the nature of environmental behaviours perceived as challenging and demanding with a little award in turn which is mostly intangible. Another explanation provided by the same researchers is the perception of participants as that the global problems are more critical than the local ones. If local environmental problems are perceived seriously enough to activate the anthropocentric attitude, this pattern will lead to pro-environmental behaviour.

Contrary to our findings, some researchers have argued that there is a positive relationship between self-interested orientation (anthropocentric motive) and environmental behaviour (Barr, 2003; Barr, 2007; Schultz & Zelezny, 2003; Stern, Dietz, & Kalof, 1993; Stern, Dietz, Kalof, & Guagnano, 1995). For example, Barr (2003) studying with citizens of south-west England found that both attitudinal motives valuing the nature for itself (ecocentric motives) and valuing for human priority (anthropocentric motives) positively correlated to waste reduction behaviour. Authors have suggested that anthropocentric and ecocentric motives are not inconsistent with each other due to the fact that the common aim is environmental protection. In addition, Schultz and Zelenzy (2003) in their study tried to synthesize the past research on the relationship between attitudinal motives and environmental behaviour. They stated that when a person worries about the harmful effects of a damaged environment on all the living creatures, this worry includes people, future generations and also him/herself. This positive relation between anthropocentric motive and pro-environmental behaviour is explained through the idea that people as a whole is a component of the biosphere and each individual is a component of the people. Nonetheless, they argued that there is little evidence for the supportive role of self-interested motives on pro-environmental behaviours.

In this dissertation, *knowledge of environmental issues* is the second important factor explaining the pre-service science teachers' friendly behaviours toward environment. Contrary to direct effect of attitudinal motives environmental knowledge, in all tested models, influenced pre-service science teachers' behaviours positively but indirectly, through its effect on both attitudinal motives and internal locus of control (β ranging from .34 to .35). If pre-service science teachers were knowledgeable about environmental issues, they would possibly understand the human and environment relationship better and would realize the power of his/her actions on the solution of environmental problems, in turn behave in an environmentally friendly manner. Indeed, pre-service science teachers' environmental knowledge level in this study was found insufficient. A relatively low mean score of 5.92 ($SD=2.02$) over 12 was achieved by the participants. They seemed to be unaware of many environmental

issues including the amount of World's fresh and available water, the biggest contributor of carbon monoxide is in the air, ozone layer depletion, and global warming.

As far as the results of the related literature are considered, findings of the indirect relationship between knowledge and behaviour are not surprising (e.g. Alp et al., 2006; Barr, 2003; Fielding & Head, 2012; Hines et al., 1986/87; Hsu & Roth, 1999). In the current study, knowledge of environmental issues found to be indirectly related to environmentally friendly behaviour which is parallel to study of Alp et al. (2006). In their study, Alp and her colleagues found that Turkish young students' environmental knowledge related to environmental problems and general environmental topics do not influence environmental behaviour directly; behavioural intention and attitude mediates the relationship between knowledge and responsible behaviour.

In their paper, Kaiser and Fuhrer (2003) tried to explain the reason of finding different relations between knowledge and behaviour. They stated that; since there were different types of knowledge used in environmental assessment, various magnitudes of relationship were observed in different studies. They also claimed that in the case that the relationship is strong between behaviour and knowledge, what knowledge represents is the knowledge of what and how something could be done, rather than the knowledge related to general environmental issues which is also used in the current study. Parallel to this explanation, Barr (2003) examined the relationship between recycling behaviour and knowledge about what and where to recycle. Individuals' knowledge about what and where to recycle is found to be directly and positively correlated with recycling behaviour. On the other hand, his results also indicate that there is not significant relation between general knowledge about local and global environmental issues about the waste problem and the behaviour.

As pre-service science teachers' environmentally friendly behaviours are affected by knowledge through attitude and internal locus of control, knowledge is found to have strong and diverse effect on attitudinal motives and relatively weak effect on internal locus of control. Knowledge has strong and positive effect on ecocentric attitude ($\beta=.40$) whereas it has strong but negative effect on anthropocentric attitude ($\beta=-.36$). Relationship between pre-service science teachers' knowledge and attitudinal views can be explained in this way; if pre-service science teachers have adequate knowledge on environmental issues, they will understand and try to maintain the sensitive balance of nature which is very important for all living creatures and thus they will give value nature for its own sake and adopt an ecocentric attitude. On the other hand, if pre-service science teachers who fail to comprehend the interconnected relationship between human and nature have some shallow knowledge on environmental issues, they will focus only on their own needs and develop an anthropocentric attitude. However, this strong association is not the case with the study conducted by Hunter and Rinner (2004) who investigated the influence of attitudinal motives on biological diversity. In their study, people with more ecocentric motives found to concern more about the biological diversity in their local area. However, there was not a statistically significant relation between knowledge of these species and attitudinal motives. Researchers suggested that public knowledge of local species is not a precursor of the support that public is supposed to give for the preservation of nature in local land management but ecocentric motives are important to support local biological diversity.

Regarding the relationship between knowledge and internal locus of control, current study revealed that there is a positive but relatively low association between knowledge and internal locus of control ($\beta=.18$). That is, pre-service science teachers who have adequate knowledge about environmental issues are likely to feel the power of their individual actions and will play role on the solution of environmental problems. In harmony with those findings, Gambro and Switzkt (1992), in their early study, revealed a positive relation between locus of control and knowledge with 12th grade high school students. Authors stated internal locus of control as an important

motivational variable in the context of environmental knowledge due to the fact that students realize power of their knowledge and behaviour on environmental issues through their high internal locus of control. More recently Fielding and Head (2012) have also found similar results. In their study they examined the young Australian's pro-environmental behaviours. In this regard, they used knowledge and locus of control as determinants of this behaviour. Correlation results indicated that there is a positive relation between perceived knowledge and locus of control. Examined the littering behaviour of the visitors of forests, Hwang et al. (2000) found weak correlation between the visitors' internal locus of control and perceived and actual knowledge of general environmental issues. Authors attributed this weak relation to knowledge measurement. They suggested that using knowledge of action strategies and action skills rather than general knowledge may strengthen the link between locus of control and knowledge.

Considering the *internal locus of control* as another predictor of pre-service science teachers' environmentally friendly behaviours, there is a positive and relatively low association between LOC and EFBs (β ranging from .14 to .16). Results showed that if pre-service science teachers realize the influence of their individual actions toward the solution of environmental problems, they have a tendency to develop more environmentally friendly behaviours. In fact, as the descriptive results put forward, pre-service teachers believe that they have an impact on the solution of environmental problems ($M=3.96$, $SD=.82$). For instance, great majority of the pre-service science teachers agreed upon the effect of "buying products packaged in containers with reused or recycled materials" and "reducing the amount of their household trash" in the solution process of environmental problems. On the other hand, a quarter of pre-service science teachers did not agree that "attending a community meeting about local environmental issue" would be beneficial for the solution of environmental problems. Parallel with these results, behaviour items revealed that more than half of the pre-service science teachers claimed that they never participated in political meetings or hearings concerning environmental

policies or plans. So it can be said that Turkish pre-service science teachers have confidence for their own individual actions but not for the collective ones.

Consistent with these results, Boubonari et al. (2013) reported that Greek pre-service primary teachers' exhibit higher participation to individual action such as reading articles or/and watching TV programs related to marine issue, recycling paper but exhibit lower participation to collective action such as collecting things from beach, attending in a community meeting. Researcher attributed these results to inefficient implementation of environmental policies, combined with significantly low levels of trust toward governmental institutions and the perception that the state should be responsible for environmental management. As environmental behaviours generally require collective actions rather than individual action (Hatfield & Job, 2001), models proposed in the current study revealed that internal locus of control have relatively low contribution on environmentally friendly behaviours compared to other psychological variable (attitudinal motives). In parallel with these findings of the current study, Oluyinka (2011) found that locus of control levels of Nigerian people weakly predicted their littering behaviour indicating that whoever has internal locus of control, she/he tends to exhibit less littering behaviour. Researcher attributed this result to self-determination nature of internally oriented individuals. Individuals with high internal locus of control are likely to judge outcomes of events such as conscious actions that prevent throwing of litters controllable. Research explained the weak association between LOC and littering behaviour as due to insufficient infrastructure or social impossibilities. For instance, even if people on the streets are really determined to engage in conscious actions and not to throw their litters away, the lack of litter bins or containers and so on around will increase the possibility of putting aside the determination and finally littering.

In harmony with the present study, Alp et al. (2008) found that elementary school students' locus of control is positively associated with environmentally friendly behaviours. Results indicated that: the higher the internal locus of control the higher the tendency to act in a friendly way toward the environment. Researchers explained

this positive association between LOC and behaviour as that the literature generally supports the theory that individuals who believe that they have the power of control the threats and risks are more likely to handle a hazardous situation than those who do not. Thus, they suggested that teachers should underline how much important to take necessary precautions and also to act whether individually or collectively. They should also explain and discuss how involving in an environmental project might help an individual bring solution to environmental problems.

Different from the studies presented above, the current study used environmentally specific locus of control measures while investigating the relationship between locus of control and environmentally friendly behaviour (Fielding & Head, 2012; Hsu & Roth, 1999; Hwang, et al., 2000; Smith-Sebasto & Fortner, 1994). Smith-Sebasto and Fortner (1994), in his early attempt, developed a locus of control measurement which was specific to environmental behaviour of undergraduate students. They found moderate and positive correlation between internal locus of control and environmental behaviour and suggested that environmental educators should improve, change and alter the curricula to include a strengthened locus of control. As in the current study, Fielding and Head (2012) showed that young individuals with more environmentally specific internal locus of control engage more with environmental responsible behaviour.

Spatial optimism (either current or future) and *temporal pessimism* (either local or global) were found to be another important constructs explaining environmentally friendly behaviour in each model. Current spatial optimism found to have negative effect on behaviour (β ranging from -.18 to -.19) whereas future spatial optimism had positive impact (β ranging from .06 to .13). Considering current spatial optimism, pre-service science teachers, who believe that their local area is in better situation when compared with Wold's situation in terms of environmental problems, will not behave in environmentally friendly manner. In other words, we can say that when pre-service science teachers have an unrealistic optimism towards the environmental problems, they feel like they do not need to take any steps since everything is already

fine. For example, since they have an unrealistic optimism toward management of radiation and nuclear waste and climate change, they do not likely to use public transportation which was expected to mitigate the effects of climate change by reducing carbon dioxide emission or participate in political meetings or hearings concerning environmental policies or plans to raise awareness for the nuclear power plant program in Turkey or support “pro” environmental laws, regulations, or programs to have voice on the construction of nuclear power plants in our county.

In terms of future spatial optimism, on the other hand, if pre-service teachers serve for the environment, then they will naturally be hopeful about the future of the environmental problems for which they make efforts. For example, the belief of pre-service science teachers that the water source and quality will be in a better condition in their local area is stemmed from their exhibiting behaviours accordingly such as taking steps to reduce water use. Findings of the current study are consistent with Tuncer et al. (2005). Researchers reported that Turkish young students are optimistic in terms of the conditions of the future and they also stated that they believed in that individuals have responsibility for preventing the environmental problems such as ozone layer depletion, the effects of overpopulation. Moreover, results also indicated that students feel the responsibility of their actions because they expressed that they did not trust on science and technology. Similarly, Cavas et al. (2009) revealed that Turkish young students who are actually willing to find solutions to the environmental problems, such as endangered species, air and safe drinking water, ozone layer depletion tend to develop optimistic point of view towards the future.

In fact, it was found that pre-service science teachers had spatial optimism for both today ($M=.57$, $SD=.82$) and future conditions ($M=.31$, $SD=.70$) of environmental problems. Optimism profiles of the participants revealed that they perceive the environmental quality is and will be acceptable at local level and worsening at global level and future conditions. For example, current situation of local soil quality was perceived as better. This is possibly emerged from widely known reputation of Turkey as the ‘country of agriculture’ and those problems such as irrigation and

desertification hasn't been revealed to attract attention yet. Likewise, future condition of water resource and quality will thought to be better in pre-service science teachers' local are when compared to global conditions. The reason of this could be that our country hasn't confronted with a serious water shortage yet. Small provinces could still benefit from the water that they are provided by their own supply of fresh water. In big cities, water is so easy and cheap to get. Moreover, pre-service science teachers have an optimistic perspective for their location both for today and in the future which maybe because of the lack of a nuclear plant in Turkey or that any nuclear disaster hasn't occurred in Turkey yet. They feel confident because they know about the notoriety of the Chernobyl and they are aware of the presence of 200 nuclear power plants in 31 countries around the world.

Spatially optimistic perceptions of Turkish pre-service science teachers can be also explained by "proximity effect". According to the proximity effect people are more likely to believe that things that are near to them spatially and temporally are better than things in further cases. Weinstein (1989) stated that people have optimistic perceptions about bad events such as automobile accidents, crimes, and disease as well as environmental problems. According to the author, optimism can occur in bad events due to three underlying reasons. First suggestion is that optimism is seen as a shield that protects people from being harmed. Another reason is the wish of being better than others. Last explanation is derived from simple cognitive failures. If conditions of high-risk individual determined, individuals are likely to use this conditions as a criteria and see their risks under the average. He also argued that people tend to have unrealistic optimism as that they are less likely to be subject to the negative events (like environmental degradation) than other people and more likely to be subject to the positive ones. These results are consistent with Gifford et al. (2009). According to the results of their study, spatial optimism bias exists in citizens of eighteen countries participating to the study. They explained this global trend due to the motivation that the citizens carry to keep a favourable self-image that is a component of one's identity of a place. They also claimed that optimistic spatial bias might be because of media which raised awareness and also the concerns

for global environment issues. These reports might lead to the perception that global problems are much more serious than the local ones

Another finding of the study is that while ecocentric attitude and internal locus of control are negatively associated with pre-service science teachers' current spatial optimism level, they are positively related to their future spatial optimism; implying that pre-service science teachers who have an optimistic expectation about the future of local environmental problems tend to value nature for its own sake and they also feel the power of their individual actions on environmental problems. Thus, this pattern supports developing environmentally friendly behaviour. For instance, pre-service science teachers who thought that destruction of natural areas is the bad side of overpopulation tended to feel the power of his/her waste reduction behaviour on the protection of natural areas and he/she also tended to be spatially optimistic about the future of the human population because he/she had already taken steps to improve wildlife habitat by planting trees and flowers, building bird houses, and feeders or reporting littering and dumping violations to authorities. Such a link between the internal locus of control, attitudinal motives and optimism is supposed to be based on the early study of Weinstein (1980). Weinstein (1980) found that college students have unrealistic optimism about both negative and positive events when they feel the controllability of the event. These results indicated that motivational sources (i.e. internal locus of control) affected the construction process of optimism. On the other hand, if pre-service science teachers have anthropocentric attitude and less internal locus of control, they are likely to think that their local area is in better condition and this pattern inhibits them from expressing environmentally friendly behaviour. Pre-service science teachers who thought that resources should be preserved to maintain a high quality of life were less likely to feel the power of his/her actions (i.e. setting his/her home appliances to energy saver levels) on energy saving and he/she were also likely to be spatially optimistic about the current situation of the energy scarcity. And thus, he/she thought that there is no need to take an action to reduce water use.

In terms of *temporal pessimism* of pre-service science teachers pessimism, global temporal pessimism (β ranging from -.04 to -.10) were found to have negative effect on behaviour whereas local temporal pessimism (β ranging from .12 to .14) had positive impact. Considering global temporal pessimism, pre-service science teachers who believe that future of global environmental problems will become worsen, will not behave in environmentally friendly manner. Turkish pre-service science teachers were temporally pessimistic about local and global environmental problems. In particular, they were found to have pessimistic perception toward the future of global condition of the quality of soil for agricultural purposes and water resource and quality. The reason of this could be that the mass media is constantly talking about the famine and drought in African countries which leads the pre-service teachers to think that their local area will be is in a truly good condition in terms of agriculture and water resources.

Pessimistic perception was also found among young Australians in the study of Connell, Fien, Lee, Sykes, and Yencken (1999). They also found out through the focus group interview that young Australians have enough knowledge about the environment and they concern on local and global problems. Due to the fact that young people were generally pessimistic about the future, they felt helpless in acting for environment. Moreover, they trusted to the government and industry to save the environment. They also hoped that education could encourage people to save the environment. Authors argued that these confronting emotions, anger and action paralysis are highly important. They suggested that immediately the media, schools and families at home should work to create awareness for the possibility of optimism for there are already people endeavouring for solving the environmental problems and that we can join them. Here schools bear too much responsibility in terms of increasing hope with the curricula. Nagel (2005) also drew attention to the negative statements making in schools. He also added that education programs in schools give messages to students in a way that supporting “learned hopelessness”. As stated by McKinley (2008), the reason of the disbelief that people will have an impact over the solution of the environmental issues might be this message mostly given

unintentionally by the environmental organizations and mass media: “For the environment we are already too late and there is nothing to do”. Moreover, researcher also emphasize the effects of popular fictions on pessimistic perception such as 12 Monkeys, Matrix, I Robot, The Day After Tomorrow, 2012 which are based on negative image in terms of the condition of the environment in the long haul shouldn't be underestimated.

Current study also revealed that pre-service science teachers' temporal pessimism regarding global environmental problems is positively associated with ecocentric attitude whereas negatively associated with internal locus of control. Interestingly, although people having global temporal pessimism developed ecocentric attitude, their pessimism toward future of global environmental problems prevent them from exhibiting friendly behaviours. In other words, the reluctance for exhibiting EFB could be explained by having pessimistic perception of world's future and deficiency of internal locus of control. This maybe because of the fact that people mostly agree that the environment is constantly being deteriorated and soon all sources will be exhausted and natural values will be annihilated.

Regarding local temporal pessimism, models revealed that a person who has a pessimist perception towards his/her location may have a chance to exhibit EFB. In fact, the highest local temporal pessimism level was observed in Region of Aegean, Mediterranean, and Marmara as expected. Coastal cities in Turkey, for example, have naturally developed to the industrial, commercial and tourism activities in particular, Region of Aegean and Mediterranean. New demands such as tourism development, secondary housing project for holiday, have been added to the classical uses of urbanization since 1980s (Burak, Dogan, & Gazioglu, 2004). Pre-service science teachers living in these regions tended to feel the negative impact of tourism and industrialization more closely compared to others. Marmara region, on the other hand, is the most industrialised region so the student teachers living in this region confront lots of environmental problems such as, air and water pollution, the harmful waste of industries, slum and crowded cities all which affect the human beings more

than elsewhere in the country (Ozden, 2008). Parallel to these studies, Teksoz, Tekkaya and Erbas (2009) found that young Turkish students living in Marmara have high awareness, concern, and responsibility of environmental issues but they have low optimism toward environmental problems. Similarly, students from Region of Mediterranean which is an important trading and tourism centre tended to have high awareness and concern level with a lowest optimism.

Proposed models also indicated that pre-service science teachers' local temporal pessimism level is positively associated with anthropocentric attitude and internal locus of control. Therefore, these findings revealed that self-interest is positively related to environmental behaviour only when there is a direct threat from an environmental problem. In this regard, pre-service science teachers who have local temporal pessimism exhibited environmentally friendly behaviour reason of human-based motives rather than nature-based. Consistent with these results, Teksoz et al. (2010) found that pre-service chemistry teachers are pessimistic about the consequences of human activities on the resource management. They also thought that humans were meant to rule over the rest of nature. The pre-service chemistry teachers' pessimistic attitudes about the consequences of human activities and the resource management were attributed to the nature of self-interest. That is, it might be implied that they think of their benefits on the first basis because they perceived themselves as the owner of the nature. Moreover, they feel responsible for the protection of the environment. These results were not surprising considering the study of Uzzel (2000). Uzzell (2000) conducted a study investigating the concern levels of participants from Australia, England, Ireland and Slovakia regarding local and global environmental issues. Results indicated that problems at the global level perceived more serious than problems at local level. As an interesting result, participants feel the responsibility of their actions on local environmental problems which are underestimated. Thus, people with that kind of attitude were more likely to take action when they face local environmental problems. According to the researcher, people may find it easy to understand local environmental problems and they might easily be involved in those; thus, could see how their actions result and so

they could separate their actions as the ones beneficial for the environment and the ones not. In a similar way, Schultz, et al. (2005) in their cross-cultural study found that individuals perceived that serious environmental problems have not been apparent yet in their local area. In terms of self-interest, the emphasis is necessarily on local issues. They thought that self-interest have a positive connection with environmental behaviours in the in such cases that the local environmental problems were perceived in more seriously and correspondingly the individual felt responsibility regarding local environment problems. In other words pre-service science teachers start engaging in environmentally friendly behaviours only when environmental problems bother them. These results indicated that the motto of “act locally, think globally” seems to be refuted because unfortunately we act locally for our own interest and we do not have any global concern.

In this regard, only focusing on adopting either ecocentric or anthropocentric attitude is not necessary to enhance a sustainable future (Crompton & Kasser, 2009). Sustainability could be explained in such a simple way: the maintenance of humankind is related to the sustainability of the environment whether directly or indirectly. It is only possible with the sustainability that humans and nature can exist in harmony implying both ecocentric and anthropocentric views. At this point, we must first question the reality of either pure anthropocentrism or ecocentrism. Today, we live in a progressively industrial society where, in the words of Grumbine (1994), “people cannot be separated from nature”. Due to the fact that an anthropocentric viewpoint is not sustainable and an ecocentric viewpoint is not realistic with the structure of human society today, the best motivation of our environmentally friendly behaviour would be one that balances these two polar viewpoints.

5.2 Implications of the Study

The present study highlights some cognitive and psychological variables influencing pre-service science teachers’ environmentally friendly behaviours in a developing country, Turkey. Since the adoption of environmental behaviour is regarded as the

main target of the environmental education (Disinger & Roth, 1992; Hungerford & Volk, 1990), these variables shouldn't be missed out during the theory and practice. The results of the current study revealed that giving optimistic or pessimistic messages to pre-service science teachers regarding environmental issues play a role on the development process of environmentally friendly behaviour. In this regard, the suggestion is that; the curriculum should include a focus on the development of a realistic sense of hope and optimism with actions like working collaboratively for increasing the quality of environment. In other words, "solution oriented" rather than "problem oriented" environmental education in schools can encourage individuals to exhibit environmentally friendly behaviour.

This study provides great contributions to the education system in Turkey since it proposes suggestions to educators, teachers, curriculum developers, textbook authors and social politicians. Pre-service science teachers in the current study found to have inadequate knowledge of environmental issues. As the research put forward, nearly all of the junior and senior pre-service science teachers have taken at least one course on the environmental issues. However, their knowledge of environmental issues was still very limited and they had some misconceptions about the reason and effect of environmental problems. Curriculum developers and academic staff should pay more attention to the teaching of local and global environmental issues, as well as basic ecological concepts. Moreover, the number of courses related to the environmental issues should be increased. In addition, in the context of the environmental courses appropriate pedagogies should be benefited from in order to help students develop environmentally friendly behaviours through addressing environmental knowledge, attitude and locus of control of the student teachers. While pre-service teachers are still undergraduate and the intended behavioural change is tried to being reached with the help of courses abovementioned, the university should also provide the necessary equipment with the students so that they could meet their needs and be motivated to perform some activities in nature.

Since teachers will raise students who are environmentally literate, enhancing pre-service science teachers' environmentally friendly behaviour does not guarantee the transmission of these acquired features into act of teaching. However, this is highly possible when teachers use suitable content and have good pedagogical knowledge (Summers, Corney, & Childs, 2003). In this regard, environmental issues and appropriate pedagogies should be integrated to the context of courses in teacher education programmes such as Science Teaching Method course which included the practices of educational techniques and methods.

Considering pre-service science teachers' lifestyle change to enhance the environmental protection, light green actions such as reduction in household energy use, recycling, and protecting natural areas were found to be moderately engaged on an individual level. On the other hand, pre-service science teachers very frequently engaged in dark green actions such as political and legal actions supporting environmentally friendly policies.

There is a strong need to investigate the relationships and understandings of researcher on environmentally friendly behaviours and the potential barriers that hinder the effective exposition of environmentally friendly curriculum. A further research study is significantly required to decide the barriers which hamper conversion of Faculty of Education students' knowledge, attitude, optimism and pessimism, and locus of control into more friendly behaviours toward environmental.

5.3 Limitations and Recommendation for Further Research

There are some limitations associated with the current study. For example in the study, about 45% of the variance in EFB accounted for a linear combination of the selected cognitive and psychological variables. It must be acknowledged that further research is needed to explore other determinants that may play an important role in pre-service science teachers' environmental actions. Further research should examine the effects of socio-demographic attributes, such as gender, socioeconomic status and

situational factors including economic constraints, social pressure, advantages and disadvantages of the actions should be carefully investigated in the future research.

This is a nation-wide study and involved 1497 pre-service science teachers across seven regions of Turkey. However, the influence of geographical region on environmentally friendly behaviours and its associated variables was not explored. On the basis of different environmentally friendly patterns with different regions of Turkey, it is suggested that future research should look more thoroughly considering regional differences. This will enable a deep search of the parameters in order to examine the parameters that inhibit or encourage environmentally friendly behaviours of the young from different regions of Turkey, and thus different EE strategies for each region might be required.

The study also comprises some limitations because of its method. The correlational nature of the data raises questions about the causal links between variables. As proposed models of environmentally friendly behaviours suggest, such cognitive and psychological factors promote the environmental behaviour; yet, the only way to examine it is the experimental research. Moreover, it is possible for feedback loops to appear when exhibiting environmental behaviour is supported or inhibited by attitudes, locus of control and optimism/pessimism. Finally, the environmentally friendly behaviour model we used doesn't include the multifaceted and complex nature of this endeavour. It may be handled in the future research that whether the relationship of this study's focal variables depend on the aspect of the environmental behaviour that they are related to. Another methodological limitation is that path analysis is a special case of Structural Equation Modelling (SEM). It includes only observed variables and has a more limited set of assumptions than SEM. On the other hand, SEM uses latent variables for explaining the measurement error. In this regard, testing the proposed models using SEM approach will strengthen the relationships founded in the scope of this study.

Considering the limitation related to measurement, the study was limited by its reliance on self-reported data. Although there have been taken precautions for promoting honest responding, the self-report measures of behaviour hasn't reached the intended level yet. Further research might benefit the actual behaviour as an indicator of environmentally friendly behaviour. Moreover, it is not effective to measure the cognitive factors with the help of only 12 multiple choice items; thus, further research should enable a more comprehensive scale including different forms of knowledge (knowledge of environmental action strategies, skills of using environmental action strategies, knowledge of ecology and environmental science, knowledge of environmental problems and issues) and different measuring methods.

Lastly, the study was limited by its reliance on quantitative data. The current present study was exploratory in nature and "Why" question was not addressed in the study. The use of extra qualitative data strategy in the further studies is highly recommended to form a comprehensive perception for the responses of pre-service teachers in terms of environmental behaviour and its associated variables.

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APPENDICES

Appendix A

BÖLÜM 1. Kişisel Bilgiler

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

1. Cinsiyetiniz: Kız Erkek
2. Büyüdüğünüz çevreyi nasıl tanımlarsınız?
 - a. Kırsal alan (köy, kasaba, belde, çiftlik)
 - b. İlçe
 - c. İl
3. Çevre ile ilgili bir derneğe veya kulübe üye misiniz?
 - a. Evet
 - b. Hayır
4. Üniversitede çevre konularını içeren kaç ders aldınız?
 - a. Hiç
 - b. 1
 - c. 2
 - d. 3
 - e. Daha fazla

BÖLÜM 2. Çevre Dostu Davranış

Verilen davranışları 1 yıl içinde ne sıklıkla yaptığınızı lütfen belirtiniz	Hiçbir Zaman	Neredeyse Hiç	Bazen	Sıklıkla	Her Zaman
Özel araç yerine çevre koruması için alternatif ulaşım araçları kullandım (örn; toplu taşıma, bisiklet)					
Çevre koruma gruplarına üye oldum veya bağışta bulundum (TEMA, ÇEVKO, TÜÇEV, DOĞADER vb.)					
Bir topluluğa çevre konusuyla ilgili bilgi verdim veya böyle bir ortamda bulundum					
Çevre yanlısı görüşlere sahip politikacıları desteklemek konusunda bir veya birden fazla kişiyi teşvik ettim					
Su kullanımını azaltmak için somut adımlar attım					
Çevre yasalarını ihlal edenleri uyardım ve onları bu yasaları ihlal etmemeleri konusunda ikna ettim					
Park ve koruma alanlarındaki bitkileri koparanları, bu alanlardaki hayvanları çalan veya satanları yetkililere bildirdim.					

Seçilmiş yetkililere (milletvekilleri, belediye başkanı, rektör vb.), çevre korumasını desteklemelerini teşvik eden mektuplar yazdım					
Kâğıt, cam, plastik, metal ve organik atık gibi malzemeleri geri dönüştürdüm					
Çevre sorunlarına çözümler öneren yayınlar hazırladım, dağıttım veya paylaştım (bültenler, afişler, sosyal paylaşım sitelerinde videolar/mesajlar gibi)					
Doğal hayata doğrudan zarar veren ürünler almaktan kaçındım (örn; hayvanlar üzerinde test edilen ürünler, kürkten yapılan ürünleri)					
Balıkçılık ve avcılık yasalarındaki ihlalleri yetkililere bildirdim					
Doğal ortamı desteklemek için somut adımlar attım (örn; ağaç ve çiçek dikmek, kuş evleri ve yemlikleri yapmak)					
Bir kişinin/grubun/şirketin/kurumun, çevrenin iyileştirilmesi konusunda önlem almasını talep eden bir dilekçe imzaladım veya bildiri dağıttım					
Çevre yanlısı politikaların veya kanunların desteklenmesi konusunda mesaj içeren materyaller dağıttım veya imza topladım (el ilanları, dilekçeler vb.)					
Çevre yanlısı kanunları, düzenlemeleri ve programları destekledim					
Geri dönüşümü mümkün olmayan, biyolojik olarak parçalanamayan veya aşırı paketlenmiş ürünler almaktan kaçındım					
Sokakta gördüğüm çöpleri topladım					
Çevreye zarar veren davranışta bulunan kişi veya grupları, bu davranışlarından vazgeçmesi için uyardım (örn; çöp atmak, sprej satın almak, böcek ilaçları kullanmak)					
Çevre politikaları ve planlarını konu alan siyasi toplantılara veya oturumlara katıldım					
Çevreye zarar veren ürünler almadım (spreyler, strafor, toksik kimyasallar, böcek ilaçları vb.)					
Çevreyi kirletenleri yetkililere bildirdim					
Isıtma, soğutma ve/veya aydınlatmada kullanılan enerjiyi düşürmek için somut adımlar attım					
İnsanları çevre dostu davranışlarda bulunması yönünde teşvik ettim (örn; geri dönüşüm yapmak, su ve enerji tasarrufu yapmak)					
Amacı çevreyi desteklemek olan bir pozisyonda görev aldım veya bu pozisyon için aday oldum (örn; öğrenci meclisi, gençlik örgütü)					
Tamamen veya kısmen geri dönüştürülmüş malzemelerden yapılan ürünleri aldım (örn; bazı kâğıt ve plastik ürünler)					

Çevre korumaya yönelik yasaları uygulamak amacıyla görevlilere yardım ettim					
Seçimlerde çevre yanlısı kimliği ile bilinen bir adayı destekledim					
Çevreci mesajlar hazırladım veya kamu önünde sergiledim (örn; posterler, rozet, tişört, araba çıkartmaları)					
Yeniden doldurulabilir, iade edilebilir veya geri dönüştürülebilir kaplardaki ürünleri aldım (örn; alüminyum kaplar, depozitolu şişeler)					
Çevre dostu kampanyalara/faaliyetlere katıldım (örn; pil toplama, plastik kapak toplama)					

BÖLÜM 3. Çevreye Yönelik Tutum

Aşağıdaki ifadelere ne derece katıldığınızı lütfen belirtiniz.	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
İnsanlar da, diğer hayvanlar kadar ekosistemin bir parçasıdır					
İnsanların petrol kaynaklarını tüketiyor olması beni rahatsız ediyor					
Bazen, hayvanlar bana adeta insanmış gibi geliyor					
Doğada zaman geçirmek stresimi büyük oranda azaltır					
Ormanların yok olması hakkında beni en çok endişelendiren şey, gelecek nesiller için yeterli kereste bulunmayacak olmasıdır					
Geri dönüşüm yapmanın en iyi yollarından biri para tasarrufu sağlamasıdır					
Doğanın kendi içinde bir değeri vardır					
Doğa, insanların refah ve keyfine sağlayabileceği katkılardan dolayı önemlidir					
Çevreye zarar verildiğini görmek beni üzer					
Doğal kaynakları, yüksek bir yaşam kalitesi sürdürmek için korumalıyız					
Bazen mutsuz olduğumda doğada huzur bulurum					
Doğal kaynakları korumanın en önemli nedenlerinden birisi, insanların yüksek yaşam standardının devamını sağlamaktır					

Mutlu olmak için doğada zaman geçirmeye ihtiyaç duyarım					
Doğal alanların insan kullanımına açılması insanlara yüksek yaşam kalitesi sunduğu sürece iyi bir fikirdir					
Tarım alanları yaratmak için ormanların tahrip edilmesi beni üzer					
Yaban hayatı, hayvanat bahçelerine tercih ederim					
Doğal kaynakları korumanın en önemli nedenlerinden biri, doğal yaşam alanlarını korumaktır					
Sırf doğada olmak adına, doğal ortamda vakit geçirmekten zevk alırım					
Sadece ekonomik önemi olan bitki ve hayvanlar korunmalıdır					
Aşırı nüfus artışının en kötü yanı doğal alanların yok ediliyor olmasıdır					
Yağmur ormanlarının kaybının en kötü yanı, yeni ilaçların geliştirilmesinin sınırlanacak olmasıdır					

BÖLÜM 4. Çevre Geleceği Anketi

Aşağıda size çeşitli çevre problemleri verilmiştir. Bu problemlerin günümüzde ve gelecekteki durumunu değerlendirmeniz istenmektedir. Bu değerlendirmeyi lütfen büyüdüğünüz yer, Türkiye ve Dünyamız için ayrı ayrı yapınız.

GÜNÜMÜZDE					GELECEKTE				
Çok İyi	İyi	Kabul Edilebilir	Kötü	Çok Kötü	Daha İyi	İyi	Aynı	Kötü	Daha Kötü
1	2	3	4	5	1	2	3	4	5
					Büyüdüğüm Yer				
					Türkiye				
					Dünya				
					Büyüdüğüm Yer				
					Türkiye				
					Dünya				

					Büyüdüğüm Yer	Ekilebilir Toprağın Kalitesi	Büyüdüğüm Yer							
					Türkiye		Türkiye							
					Dünya		Dünya							
					Büyüdüğüm Yer	Küresel Isınma	Büyüdüğüm Yer							
					Türkiye		Türkiye							
					Dünya		Dünya							
					Büyüdüğüm Yer	Enerji Kıtılığı	Büyüdüğüm Yer							
					Türkiye		Türkiye							
					Dünya		Dünya							

BÖLÜM 5. Kişisel Kontrol Odağı

Aşağıda verilen cümleleri "...çevreye yönelik tehditleri azaltmış olurum" ifadesi ile tamamlayarak oluşan ifadeye ne derece katıldığınızı lütfen belirtiniz.	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
Çevremdeki geri dönüşüm etkinlikleri hakkında bilgi sahibi olarak					
Yerel bir çevre sorunu ile ilgili bir halk mitingine katılarak					
Doğal kaynakların korunmasını destekleyen aletleri (yavaş akışlı duş başlıkları, sensorlu musluklar vb.) kullanarak					
Tekrar kullanılabilir, geri dönüştürülebilir ya da geri dönüştürülmüş tüketim malzemelerini satın alarak					
Doğal kaynakların korunmasını ile ilgili düzenlemeleri ve yasaları (yasak avlanma, yasal olmayan ağaç kesimi vb.) ihlal eden kişileri yetkililere bildirerek					
Malzemeleri mümkün olduğunca tekrar kullanma ve geri dönüştürme ile atık miktarını azaltarak					
Enerji tasarruflu ev eşyalarını (buzdolabı, çamaşır makinesi, bulaşık makinesi, su ısıtıcısı vb.) tercih ederek					
Evde kullanılmış olan sıvı yağları tekrar kullanılabilmesi için yetkililere teslim ederek					
Benzinli yerine LPG'li ya da dizel araba kullanarak					

Araba ile yalnız seyahat etmek yerine ortak araç kullanımına yönelerek (örn; birbirine yakın mesafede oturan kişilerin bir araya gelerek kampüse tek özel araçla gelme)					
Havalandırma için vantilatör ya da klima kullanmak yerine pencereyi açarak					

BÖLÜM 6. Çevre Bilgisi

- Küresel ısınma Dünya'mızın sıcaklığını arttırmaktadır. Aşağıdakilerden hangisi bu durumun nedenlerinden birisi değildir?**
 - Ozon tabakasının incilmesi
 - Fosil yakıt tüketimi
 - Ormansızlaşma
 - Karbondioksit (CO₂) salınımı
 - Bilmiyorum
- Aşağıdakilerden hangisi hayvan türlerinin nesillerinin tükenmesinin en yaygın sebebidir?**
 - Pestisitlerin hayvanların ölümüne neden olmaları
 - Yaşam alanlarının insanlar tarafından yok edilmesi
 - Avcılığın çok artması
 - İklim değişikliğinin hayvanları etkilemesi
 - Bilmiyorum
- Aşağıdakilerden hangisi "zararlı atık" olarak adlandırılabilir?**
 - Plastik ambalajlar
 - Cam şişeler
 - Piller
 - Bozulmuş yiyecekler
 - Bilmiyorum
- Geri dönüşümü sağlanamayan ve tekrar kullanılamayan madde aşağıdakilerden hangisidir?**
 - Çocuk bezleri
 - Gazeteler
 - Alüminyum kaplar
 - Plastik şişeler
 - Bilmiyorum
- Geri dönüşümün başlıca nedeni aşağıdakilerden hangisidir?**
 - Daha dayanıklı plastik maddeler üretebilmek
 - Ormanları korumak
 - Atık miktarını azaltmak
 - Hava kirliliğini azaltmak
 - Bilmiyorum
- Aşağıdakilerden hangisi yenilenebilir bir enerji kaynağıdır?**
 - Petrol
 - Ağaçlar
 - Demir madeni
 - Kömür
 - Bilmiyorum

7. Türkiye’de elektrik üretimi büyük ölçüde nasıl gerçekleştirilmektedir?
a. Fosil yakıtlar ile c. Güneş enerjisi ile
b. Rüzgar enerjisi ile d. Hidroelektrik santraller ile
e. Bilmiyorum
8. Dünya’daki suyun yüzde kaçını insan kullanımı için uygun niteliktedir?
a. %1 b. %5 c. %10 d.%33 e. Bilmiyorum
9. Aşağıdakilerden hangisi asit yağmurlarının başlıca nedenlerindedir?
a. Kükürtdioksit b. Karbondioksit
c. Ozon d. Azot
e. Bilmiyorum
10. Karbon monoksit hava kirliliği yaratan önemli bir kirleticidir. Aşağıdakilerden hangisi en önemli karbon monoksit kaynağıdır?
a. Fabrikalar ve işyerleri b. İnsanların nefes alması
c. Motorlu araçlar d. Ağaçlar
e. Bilmiyorum
11. Ozon, atmosferin üst katmanlarında koruyucu bir tabaka oluşturur. Ozon bizi aşağıdakilerden hangisinden korur?
a. Asit yağmurlarından
b. Küresel ısınmadan
c. Sıcaklıktaki ani değişimlerden
d. Zararlı, kansere neden olan güneş ışığından
e. Bilmiyorum
12. Türkiye’de çöplerin büyük bir kısmı nasıl bertaraf edilir?
a. Denizlere atılarak
b. Yakma tesislerinde yakılarak
c. Geri dönüşüm merkezlerine gönderilerek
d. Çöp depolama alanlarında depolanarak
e. Bilmiyorum

Appendix B

EXTENDED TURKISH SUMMARY

(Geniřletilmiř Trke zet)

1.Giriř

evre konusunu ele alan ilk Birleřmiř Milletler konferansı olmasının yanı sıra, ilk byk uluslararası toplantı niteliğinde de olmasıyla nem tařıyan Stockholm Konferansı (1972) insanların evreyle alakalı eylemleri zerine eęilmiř ve uluslararası dzeyle evresel hareketin temellerini oluřturmuřtur. Konferans sonucunda, insanoęlunun evre zerindeki etkisinin azaltılması iin uluslararası iřbirlięinin ne denli nemli olduęu vurgulanmıř ve evre problemlerini doęuran sebeplerin byk bir oęunluęunun kresel sebepler olduęu belirtilmiřtir. 60lı yıllardan bu yana evre problemlerine karřı gittike artan ilgi gz nnde bulundurulduęunda, evre eęitimi; hem daha iyi bir evre hem de doęal kaynakların korunması iin en mmkn zm olarak kendisini gstermektedir. Nitekim evre eęitiminin nihai amacı da, evre dostu davranıřlara sahip bireyler yetiřtirmektir. (Hines, Hungerford, & Tomera, 1986-87; Hungerford & Volk, 1990). Bu baęlamda geliřtirilen evre eęitimi programları, evreye karřı duyarlı bireyler yetiřtirmeyi hedeflemiřtir. (Jurin & Fernet, 2002). Peki, evresel eęitim bu hedeflerine ulařıyor mu? Bu sorunun cevabı ‘evet’tir. (Coyle, 2005). NEEFT’e gre, evresel eęitim yaygınlık kazanmadan nce, insanlar evreyi kendi kullanım ve faydaları doęrultusunda tketelebilecek bir kaynak olarak gryor ve evre iin herhangi bir endiře duymuyorlardı. Fakat evre eęitiminden sonra, insanların evre konusundaki farkındalıklarının eęitim yoluyla arttırılabileceęi sylenebilir. Bununla beraber, artan farkındalık ve duyarlılıęa raęmen, insanoęlunun hala daha evre problemlerine en fazla sebep olan canlı olduęu dřnlmektedir (Gardner & Stern, 2002). Konuyla alakalı yapılan alıřmalarda hala evre dostu davranıř otuřturulamadıęı grlmektedir (Kollmus & Agyman, 2002; Lee, 2008).

Bireylerin hem genel davranışlarını (Ajzen & Fishbein, 1980; Ajzen 1991) hem de özel olarak çevresel davranışlarını (e.g. Ramsey & Rickson, 1977; Hines et al., 1986/87; Hungerford & Volk, 1990) etkileyen faktörlerin neler olduğunu belirlemek adına, birkaç model öne sürülmüştür. Ramsey ve Rickson (1977) ilk çalışmalarında, bilgi, tutum ve davranış arasında doğrudan ilişki bulunduğunu öne sürmüştür. Buna göre, bilgi çevresel davranışın iyileştirilmesini sağlayacak ve dolayısıyla bireyin çevre dostu davranışlarını geliştirecektir. Hines et al.(1986/ 87), Ajzen ve Fishbein'in Planlanmış Davranış Teorisini baz alarak, "Sorumlu Çevresel Davranış Modeli" geliştirmişlerdir. 128 çalışmanın ışığında kapsamlı bir meta-analiz yapmışlar ve modellerinde dört ana değişkenin çevresel davranışı etkileyen yordayıcılar olduğu tespit etmişlerdir. Bu değişkenlerden ilki bilişsel değişkenlerdir ve bileşenleri; çevre problemleri/sorunları hakkında bilgi, eylem stratejileri ve eylem becerileridir. İkincisi yaş, cinsiyet, gelir gibi unsurları kapsayan demografik değişkenlerdir. Psiko-sosyal değişkenlerin ise alt başlıkları, tutum, kontrol odağı ve kişisel sorumluluk şeklinde verilebilir. Hines et al (1986/87) bu çalışmasıyla eş zamanlı ve hemen ardından yürütülen pek çok çalışma, ilgili alan yazına oldukça katkıda bulunmuştur (Sia, Hungerford, & Tomera, 1985/86; Marchinkowski, 1988; Ramsey, 1989; Sivek, 1989). Tüm bu çalışmalar, davranışı etkileyen değişkenlerin muhtemelen üç başlıkta incelenebileceğini ortaya çıkarmıştır (Hungerford & Volk, 1990). Giriş düzeyi değişkenleri; çevresel duyarlılık, androcini, çevrebilim bilgisi ve kirlilik/teknoloji/ekonomi hakkındaki tutumlar gibi önkoşul değişkenlerini kapsar. Bu değişkenlerin kişilerin karar verme süreçlerinin iyileştirilmesini sağlaması beklenmektedir. Kişisel değişkenler çevre meselelerinin derin bilgisini ve kişisel yatırımı kapsar. Güçlendirici değişkenler ise şunlardır; çevresel eylem stratejilerinin bilgisi, kontrol odağı ve harekete geçme niyeti. Yüksek oranda güçlendirici değişkene sahip kişiler, bir değişim meydana getirebileceklerine ve çevresel problem ve meselelerin çözümüne katkıda bulunabileceklerine inanırlar. Sosyal ve psikolojik değişkenler çevre dostu davranış gelişimini etkilediğinden, sosyal-psikolojik araştırmalar da davranış ve ilgili ve değişkenlerini incelemek için yapılmıştır.

Yukarıda bahsedilen model ve teorilerde her ne kadar yapılan çalışmaya göre çevre dostu davranışa olan etkisinin büyüklüğü değişkenlik gösteriyor olsa da, çevre bilgisi, tutum ve içsel kontrol odağı gibi değişkenlerin çevre dostu davranışın önemli yordayıcıları olduğu konusunda bir uzlaşmaya varıldığı söylenebilir. Bu doğrultuda, önceki çalışmalarda sıklıkla ele alınan değişkenlerin yanı sıra, çevre dostu davranışa etki edebilecek yeni değişkenler de saptanıp incelenmelidir. İyimserlik ve kötümserlik algıları bu noktada çevre dostu davranışı etkileyebilecek araştırılması beklenen yeni unsurlar olarak ortaya çıkmaktadır. Örneğin, O'Brien (2007) iyimserlik ve kötümserlik seviyelerini psikolojik değişkenler kapsamına dahil etmiştir ve katılımcıların genel anlamda çevresel kalitenin son on yılda büyük bir düşüş yaşadığı şeklinde küresel bağlamda çevre meselelerine karşı kötümser bir bakış açısına sahip olduklarını ortaya çıkarmıştır. Benzer şekilde McKinley (2008) de, kişinin kendisini geleceğinin gittikçe kötü bir hal alacağına ikna ederse daha iyi bir gelecek için uğraşmayabileceğini belirtmiştir. Ayrıca Gifford et al. (2009) insanların küresel çevre sorunlarına karşı tutumlarıyla kıyaslandığında yerel sorunlara karşı daha iyimser bir bakış açısına sahip olduklarını yani bir diğer deyişle, mekânsal iyimserlik algısına sahip olduklarını ifade etmiştir. Çevre problemlerine karşı iyimser bir algının çevre dostu davranış gelişimini engelleyeceğini çünkü insanların bu iyimserlikleri yüzünden yerel sorunları küçümseyebileceğini söylemişlerdir. Bu sonuçlarla paralel olarak, Hatfield ve Job (2001) da bireylerin gelecekları hakkında kaygılanmamaları ve iyimser olmaları durumunda, herhangi bir önlem alma gereği hissetmeyeceklerinin altını çizmişlerdir. Bireylerin psikolojik birer değişken olan iyimserlik ve kötümserlik düzeylerinin aynı zamanda çevre dostu davranışın bir diğer önemli yordayıcısı olan kontrol odağı ve tutumla da yakından ilişkili oldukları ortaya konmuştur.

Bu doğrultuda mevcut çalışma, çevre dostu davranışın muhtemel yordayıcılarının gösterildiği kavramsal bir model sunmuş. Sunulan modelde çevre konuları hakkında bilgi, çevreye yönelik tutum, içsel kontrol odağı, mekânsal iyimserlik ve zamansal kötümserlik algıları kullanmıştır. Mekânsal iyimserlik algıları bugün ve gelecek için ve zamansal kötümserlik yerel ve küresel çevre problemleri için ayrı ayrı test

edileceği için bir ana model çerçevesinde dört farklı model test edilmiştir. Modellere göre, bireyin çevre konuları hakkında bilgisinin çevreye yönelik tutumlarına, içsel kontrol odaklarına ve çevre dostu davranışına katkı sağlayacağı öne sürülmüştür. Ayrıca, çevresel konular hakkında edinilen bilginin çevre dostu davranış üzerinde dolaylı bir etkisi olacağı öne sürülmektedir. Modeller ayrıca, bireylerin çevreye yönelik tutumları ve içsel kontrol odaklarının, çevre dostu davranışlarıyla alakalı olacağını savunmaktadır. Çevreye yönelik tutum ve içsel kontrol odağı değişkenleri ayrıca mekânsal iyimserlik ve zamansal kötümserlik üzerinde de doğrudan etkilidir. Bunlara ek olarak, çevreye yönelik tutum ve içsel kontrol odağı, mekânsal iyimserlik ve zamansal kötümserlik yoluyla çevre dostu davranış gelişimine katkıda bulunabileceği öne sürülmüştür. Son olarak, modelde mekânsal iyimserlik ve zamansal kötümserlik algılarının, çevre dostu davranış gelişiminde doğrudan etkisi olduğu öne sürülmüştür.

1.2 Çalışmanın Önemi

Yaşam kalitesini yükseltmek adına, insanların doğal kaynaklarını adeta sömürdüğü bir gerçektir. Fakat daha iyi yaşam koşulları için yapılan bu eylemlerin sonucunda hem içinde yaşadığımız kendi çevremize hem de kendimize tehdit unsurları oluşturmaktayız. Tung Huang ve Kawate (2002) bugün karşı karşıya olduğumuz çevresel problemlerin pek çoğunun insanların yaşam stillerinden kaynaklı olduğunu belirtmişlerdir. Buna göre, insanoğlunun yaşam tarzı çevre sorunlarının en büyük kaynaklarından biridir. Bu bağlamda, eğitim psikoloji ve sosyoloji alanlarında çalışan araştırmacılar, bireyin çevreye karşı davranışlarını etkileyen faktörleri tanımlamak üzere çok sayıda çalışma yaptılar (Bamberg & Möser, 2007; Hines et al. 1986/87). Fakat bireylerin iyimserlik veya kötümserlik algıları üzerine yapılan çalışma sayısı oldukça azdı. Bu iki unsur yerine genellikle, bilgi, tutum ve içsel kontrol odağı gibi değişkenlere yoğunlaşmıştır çünkü bu değişkenlerin çevre dostu davranış üzerinde en belirgin etkilere sahip oldukları düşünülmektedir. Diğer çalışmaların aksine, bu çalışmanın amacı, iyimserlik ve kötümserlik değişkenleri üzerine geniş bilgiler veren bir model ortaya koymaktır.

Öğretmenlerin çevre dostu bireyler yetiştirerek bir toplumu şekillendirmedeki önemli rolleri göz önüne alındığında, fen bilgisi öğretmen adaylarının gelecek nesilleri yetiştirmede ne denli önemli oldukları anlaşılmaktadır. Bu yüzden etkili bir çevresel eğitimin en önemli bileşeni olarak görülen fen bilgisi öğretmen adayları bu çalışmanın konusunu oluşturmuşlardır (Plevyak, Bendixen-Noe, Henderson, Roth & Wilke, 2001). Çevre dostu davranışlar sergileyen öğretmen adaylarının, derslerinde de çevre sorunları ve çözümleriyle alakalı farklı metotlar kullanmaları, kendi öğretim materyallerini geliştirmeleri ve uygulamaları ve öğrencilerine de çevre dostu davranışı, olumlu tutumu, farkındalığı ve çevreye karşı sorumlu davranışları aşılamaları beklenir. Bu yüzden öğretmenler, hem çevre eğitimi için (Loughland, Reid, & Petocz, 2002) hem de çevre dostu davranışları geliştiren veya engelleyen faktörlerin tespit edilmesinde anahtar rolü üstlenmektedir.

Bu çalışma çevre eğitimi kapsamında, öğretmen eğitim programlarının geliştirilmesine katkı sağlayabilecek bir çalışmadır. Öğretmenlerin çevresel kararlarla alakalı davranışlarını etkileyen faktörlerin yanı sıra, öğretmenlere uygun ve doğru çevre eğitiminin verilmesi de onların çevresel davranışlarının değişimi için önem taşır. Bununla birlikte, Türkiye'deki öğretmen eğitim programları incelendiğinde, çevresel eğitim derslerinin diğerlerine nazaran pek de ilgi çekici bulunmadığı anlaşılmaktadır. Her ne kadar bu çalışmanın asıl amacı bir eğitim programı modeli sunmak olmasa da, öğretmen adaylarının çevre dostu davranış yordayıcılarının incelenmesi, çevre eğitimi programlarının içeriğinin geliştirilmesine katkı sağlayacaktır. Konuyla alakalı yapılan çalışmaların, modellerin ve öne sürülen teorilerin sayısı artıyor olmasına rağmen, istenilen sonuç ve verilen çevre eğitimi arasında bir boşluk olduğu aşikârdır. (Volk, 1984). Gelişmekte olan bir ülke olarak Türkiye'de tam oturmuş bir çevre eğitimi sistemi olmadığı söylenebilir (Tuncer, Ertepinar, Tekkaya, & Sungur, 2005). Bu yüzden, bu çalışmanın sonuçlarının daha nitelikli bir çevre eğitim programı geliştirilmesine katkı sağlayacağı umulmaktadır.

2.Yöntem

Bu çalışma nicel bir çalışma olup korelasyon çalışmasıdır. Bu çalışmanın katılımcıları Türkiye'deki devlet üniversitelerinde öğrenim görmekte olan 3. ve 4. sınıf fen bilgisi öğretmen adaylarıdır. 2012-2013 akademik yılları içerisinde toplam 1497 fen bilgisi öğretmen adayıyla çalışma yürütülmüştür. (%76.79 bayan ve %23.21 erkek). En çok katılım İç Anadolu Bölgesi'nden (390 katılımcı, %25.9) olup en az katılım ise 51 katılımcıyla (%3.39) Güneydoğu Anadolu Bölgesi'nden olmuştur. Katılımcıların yaş ortalaması 21.47'dir (SS= 1.92).

2.1 Veri Toplama Aracı

Bu çalışmada kullanılan veri toplama aracının altı farklı bölümü mevcuttur. Birincisi, Demografik Anket olup, öğretmen adaylarının cinsiyet, okudukları okul, doğup büyüdüğü ortam, bir çevre derneğine/kuruluşa üyeliklerinin olup olmadığı ve çevreyle alakalı aldıkları ders sayısı gibi bilgilerin edinilmesinde kullanılmıştır. İkinci bölüm Çevresel Eylem Davranış Envanteri'nin Türkçe versiyonunu içermektedir. Üçüncü bölüm Çevre Eylemi İçsel Kontrol Endeksi'nin Türkiye versiyonundan oluşmakta ve dördüncü Çevre Geleceği Anketi kullanılarak öğretmen adaylarının mekânsal iyimserlik ve zamansal kötümserlik düzeyleri saptanmıştır. Beşinci bölümde Çevresel Tutum Anketi ile öğretmen adaylarının insan ve çevre merkezli tutumları incelenmiştir. Son bölüm ise Çevre Konuları Hakkındaki Bilgi Ölçeğinden oluşmaktadır.

Demografik Anket

Öğretmen adaylarının özgeçmişleriyle alakalı dört sorunun yer aldığı ankette amaç, katılımcıların karakteristikleriyle ilgili daha derin bir bilgiye ulaşabilmektir. Cinsiyet, okudukları üniversitelerin isimleri, doğup büyüdüğü ortam, herhangi bir çevre derneğinde/kuruluşunda üyeliklerinin bulunup bulunmadığı ve çevreyle ilgili aldıkları ders sayısı gibi bilgiler bu anket yoluyla edinilmiştir.

Çevresel Eylem Davranış Envanteri

Ölçek çevre dostu davranışın beş ana başlığını belirlemek amacı ile kullanılmıştır. Bunlar; eco-yönetim, tüketim, ikna, politik ve yasal eylemlerdir (Marchinkowski, 1988). Ölçek 30 maddelik 5li Likert tipte oluşmaktadır.

Çevresel Tutum Anketi

Çevreye yönelik değer yönelimlerini ölçmek için Thompson ve Barton'ın (1994) hazırladığı 23 maddelik 5li Likert tipi kullanılmıştır. Anket, insan merkezli ve çevre merkezli tutumlar olarak iki boyuttan oluşmaktadır.

Çevre Geleceği Anketi

Ölçek, katılımcıların mekânsal iyimserlik ve zamansal kötümserlik düzeylerinin ölçülmesinde kullanılmıştır (Gifford et al. 2009). Ölçek kapsamında yerel ve küresel olmak üzere on beş çevre sorunu belirlemiş ve katılımcıların bu sorunların günümüzdeki durumunu ve gelecekteki beklentilerini buldukları bölge, ülkeleri ve dünya için derecelendirmeleri beklenmiştir. Böylelikle katılımcıların belirtilen çevre problemleri hakkındaki iyimserlik ve kötümserlik algıları belirlenmeye çalışılmıştır.

Çevre Eylemi İçsel Kontrol Endeksi

Ölçekte katılımcılara 11 maddelik Likert tipi bir ölçek verilmiştir. Katılımcıların ölçeklendirmelerini kesinlikle katılıyorum ile kesinlikle katılmıyorum arasında yapmaları beklenmiştir. Ölçek, katılımcıların eylemlerinin çevresel problemleri çözme yetisi olup olmadığı konusundaki düşüncelerinin anlaşılmasını amaçlamaktadır.

Çevre Konuları hakkında Bilgi Ölçeği

Bu ölçek, öğretmen adaylarının yerel ve küresel çevre sorunlarıyla alakalı bilgi düzeylerini ölçmek amacı ile uygulanmıştır. Yerel ve küresel çevre sorunları seçilirken önceki çalışmalar (O'Brien, 2007; Dunlap, Van Liere, Merting, & Jones, 2000; Leeming, Dwyer, & Bracken, 1995) ve 2011 yılında çıkarılan Türkiye Çevre

Durum Raporu göz önüne alınmıştır. Çevre Durum Raporunda öncelik verilen çevre konuları göz önüne alınarak alan yazında daha önce hazırlanan sorular kullanılarak 12 adet çoktan seçmeli soru belirlenmiştir.

3. Bulgular

Bu bölüm, ön veri analizi, betimsel ve çıkarımsal istatistik sonuçları ortaya koymuştur. Eksik verilerin ve aykırı değer tespitinde, normallik temininde, açıklayıcı faktör analizlerinin yapılmasında, yol analizi varsayımlarında ve son olarak da değişkenlerin betimleyici istatistiklerinde SPSS programı kullanılmıştır. Çalışma kapsamında yapılan doğrulayıcı faktör analizi ve yol analizi AMOS 21 istatistik programı kullanılarak yapılmıştır.

3.1 Ön Veri Analizi

Ön veri analizi, betimsel ve çıkarımsal analizlerinden önce, verileri düzenlemek ve verileri bir sonraki analiz basamaklarına hazırlamak için yapılmıştır. Bu noktada, eksik veri analizi, etkili veri noktaları, tek değişkenli ve çok değişkenli normallik, ve doğrusallık analizleri tamamlanmış ve böylece verilerden betimleyici ve çıkarımsal analizleri sonucunda güvenilir sonuçlar elde edilmesi sağlanmış oldu.

3.2 Betimleyici Analizler

Betimleyici analiz yöntemleri, fen bilimleri öğretmen adaylarının çevre dostu davranışlarının, çevresel tutumlarının, mekânsal iyimserliklerinin ve zamansal kötümserliklerinin, içsel kontrol odaklarının, çevre konuları hakkındaki bilgi düzeylerinin incelenmesinde kullanılmıştır.

Fen Bilimleri Öğretmen Adaylarının Çevre Dostu Davranış Profilleri

Öğretmen adaylarının çevre dostu davranışlarını tespit etmek amacı ile katılımcılara son bir yıl içerisinde, verilen davranışı ne sıklıkta yaptıkları sorulmuştur. Elde edilen 2.57 ortalama puanı, katılımcıları çevre dostu davranış bazında “bazen” sekmesine yerleştirmemize neden olmuştur. Yani, Türk fen bilgisi öğretmen adayları günlük hayatlarında bazen çevre dostu davranış sergiliyorlardır.

Ölçeğin boyutları ele alındığında, her ne kadar orijinal ölçek beş davranış kategorisini (eko-yönetimi, tüketici, yasal, politik ve ikna boyutları) baz alıyor olsa da, bu çalışmada iki boyu bulunmuştur. Politik ve yasal eylemleri ve bu eylemlerin ikna davranışları bir boyutta toplanırken (koyu yeşil davranışlar), eko-yönetim ve tüketici davranışları ve bu davranışların ikna durumu başka bir boyutta (açık yeşil davranışlar) toplanmıştır. Katılımcılar çoğunlukla açık yeşil eylemler olarak isimlendirilebilecek olan davranışları daha sıklıkla yaptıklarını belirtmişlerdir ($M=3.12$, $SD= 68$). Diğer taraftan, koyu yeşil eylemler olarak isimlendirilen davranışların nispeten daha düşük oranlarda gerçekleştirildiği ortaya çıkmıştır ($M=1.90$, $SD=97$). Bu durum fen bilimleri öğretmen adaylarının politik veya siyasi eylemlerden ziyade, fiziksel faaliyetlerde veya ekonomik anlamda katkı sağlayabilecekleri faaliyetlerde bulunmayı tercih ettiklerini ortaya koymuştur.

Sonuçlar cinsiyet bazında incelendiğinde, elde edilen 2.51 ortalama puanı, kadın ve erkek fen bilimleri öğretmen adaylarının aynı oranda çevre dostu davranış sergilediklerini göstermektedir. Puanlar, kadın ve erkek düzeyinde çevre dostu davranışın boyutlarında farklılaşmıştır. Kadın katılımcılar, açık yeşil eylemlerde daha yüksek puanlar elde etmişken ($M=3.15$, $SD=67$), erkeklerin puanı daha düşük bir seviyede kalmıştır ($M=3.02$, $SD=77$). Öte yandan, koyu yeşil eylemler göz önüne alındığında ise erkeklerin ($M=2.00$, $SD=.77$) az da olsa kadınlardan ($M=1.87$, $SD=.64$) daha yüksek skorlara ulaştıkları görülmektedir. Kısacası bayan fen bilgisi öğretmen adayları açık yeşil eylemlere koyu yeşil eylemlerde daha yatkınken, erkekler için de durum tam tersidir. Aslında elde edilen bu sonuçlar, Türk halkının karakteristiği göz önünde bulundurulduğunda, şaşırtıcı değildir. Daha doğrusu, kadınlar her zaman eko-yönetimi ve tüketim faaliyetleri doğrultusunda çevreyi korumaya erkeklerden daha duyarlı yaklaşmışlardır fakat erkekler de politik veya yasal yolları tercih etmeye daha meyilli olmuşlardır.

Katılımcıların yetiştikleri yerler ele alındığında, çevre dostu davranış puanlarının birbirlerine oldukça yakın oldukları görülmektedir. İlçelerden gelen öğretmen adaylarının ortalama puanları 2. 45 ($SD=.59$) olup, kırsal kesimlerden (2.44, $SD=.60$)

ve büyük şehirlerden (2.43 SD=.60) gelen katılımcılara göre biraz daha yüksektir. Fakat bu ortalamalar, çevre dostu davranış boyutları yönünden incelendiğinde farklılık göstermektedir. Örneğin, kırsal kesimlerde yetişen öğretmen adaylarının (M=3, SD=.69), küçük illerde (M=3.12, SD=.68) ve büyük şehirlerde (M=3.11, SD=.69) yetişenlere göre, biraz daha fazla açık yeşil eylemde buldukları tespit edilmiştir. Öte yandan, büyük şehirlerde yetişen katılımcılar, küçük illerde ve kırsal kesimlerde yetişenlere nispeten daha fazla koyu yeşil eylemlerde bulunma eğilimi göstermişlerdir. Ayrıca, kırsal kesimlerde yaşayan öğretmen adayların, fiziksel ve ekonomik anlamda katkı sağlayabilecekleri faaliyetlere katılımları, ilçelerde ve büyük şehirlerde yaşayan öğretmen adaylarına göre daha fazladır. Öte yandan, büyük şehirlerde yaşayan katılımcılar, ilçelerde ve kırsal kesimde yaşayanlara göre, politika ve yasalara yönelik faaliyetlerde daha fazla bulunmuşlardır.

Fen Bilimleri Öğretmen Adaylarının Çevresel Tutum Profilleri

Öğretmen adaylarının verdikleri yanıtlar, çevre merkezli tutumlar için 4.09 (SD=.73) ve insan merkezli tutumlar için 3.39 (SD=.79) ortalama skorlarını ortaya çıkarmıştır. Başka bir deyişle, fen bilimleri öğretmen adaylarının genel olarak çevre merkezli bir bakış açısına sahip oldukları, yani doğaya sırf doğa olduğu için değer verdikleri söylenebilir. Öte yandan, insan merkezli bakış açısına sahip öğretmen adaylarının doğaya verdikleri değerlerin sebebi, doğanın insanlara sağlayacağı faydalardır. Kısacası, Türk fen bilimleri öğretmen adayları genellikle doğaya yararlanacakları faydalardan ötürü değil, doğa olduğu için değer vermektedirler.

Yanıtlar cinsiyet temelli değerlendirildiğinde, kadın katılımcıların daha büyük oranda çevre merkezli bakış açısına sahip oldukları görülmüştür. Kadın katılımcıların çevre merkezli yanıtları 4.22 (SD=.54) iken, erkeklerinki 4.09 (SD=.62) olmuştur. Paralel bir şekilde, erkek katılımcıların (M=3.37, SD=.68) kadın katılımcılara (M=3.34, SD=.68) kıyasla daha insan-merkezci bakış açısına sahip oldukları görülmüştür. Bu durum kadınların doğaya değer vermelerinin sebebinin doğanın kendisi olduğunu, erkeklerin değer verme sebebinin ise daha nitelikli hayat şartları sunabilecek olması olduğunu göstermektedir.

Doğup büyüdükleri ve/veya yaşadıkları şehirlere göz önüne alındığında ise, çevre merkezli tutumun insan merkezli tutumdan daha baskın olduğu görülmüştür. Kırsal kesimde yetişen katılımcılar ($M=4.22$, $SD=.52$) ilçelerde($M=4.18$, $SD=.54$) ve büyük şehirlerde ($M=4.18$, $SD=.59$) yetişenlere oranla biraz daha fazla çevre merkezli tutum sergiledikleri görülmüştür. Önceki sonuçlara paralel olarak, büyük şehirlerden gelen katılımcıların ($M=3.34$, $SD=.69$) ilçelerden ($M=3.38$, $SD=.64$) ve kırsal kesimlerden ($M=3.31$, $SD=.66$) gelen katılımcılara nispeten daha insan merkezci bir tutum içinde oldukları da belirlenmiştir. Bu sonuçlar doğrultusunda, kırsal kesimlerden gelen öğretmen adaylarının doğaya kendi değerinden ötürü olumlu yaklaşım sergileme eğilimleri daha yüksek bulunduğu söylenebilir. Tersine, büyük şehirlerden gelen katılımcıların doğaya verdikleri değer, doğadan kazanacaklarıyla doğru orantılı bulunmuştur. Bu veriler doğrultusunda, çevresel tutumun, kişilerin doğup büyüdüğü ve/veya yaşadıkları topraklarla yakından ilgili olduğu söylenebilir.

Fen Bilimleri Öğretmen Adaylarının Mekânsal İyimserlik ve Zamansal Kötümserlik Profilleri

Fen Bilgisi öğretmen adaylarının mekânsal iyimserlik düzeylerini belirlemek için, katılımcıların çevre problemlerini yerel ölçekte değerlendirilerek elde ettikleri skorları küresel olarak değerlendirilerek elde ettikleri skordardan çıkartarak bulunan değer kullanılmıştır. Bu değer hem günümüzdeki durum hem de gelecekte beklenen durum için yapılmıştır. Böylelikle, mevcut ve gelecek koşulları bazında iki farklı mekânsal iyimserlik puanı elde edilmiştir. Bu işlem sonucunda, öğretmen adaylarının bugünkü durum hakkındaki mekânsal iyimserlik ortalamaları 0.57 ($SD= .82$) ve geleceğe yönelik mekânsal iyimserlik ortalamaları da 0.31 ($SD= .70$) olarak hesaplanmıştır. Elde edilen bu ortalama değerlerin pozitif yönde olması, Türk fen bilgisi öğretmen adaylarının hem mevcut hem de gelecek koşullara dair mekânsal iyimserlik içinde olduklarını göstermektedir. Başka bir deyişle, öğretmen adayları yerel çevre problemlerinin dünyanın geneliyle kıyaslandığında daha iyi durumda olduğunu ve daha iyi olmaya devam edeceğini düşünmektedir.

Mevcut ve geleceğe yönelik mekânsal iyimserlik algıları, cinsiyet ve yaşanılan bölge baz alınarak da incelenmiştir. Elde edilen sonuçlar, erkek ($M_{Bugün}=.62$, $SD=.92$; $M_{Gelecek}=.41$, $SD=.80$) öğretmen adaylarının kadınlara ($M_{Bugün}=.55$, $SD=.78$; $M_{Gelecek}=.28$, $SD=.70$) kıyasla daha yüksek oranda mekânsal iyimserlik algılarının olduğuna işaret etmektedir. Yani, erkek öğretmen adayları yerel çevre problemlerinin mevcut durumunun ve gelecekteki durumunun küresel problemlerle kıyaslandığında daha ufak tefek problemler olduğunu ve öyle de kalacaklarını düşünmektedir.

Sonuçlar aynı zamanda, kırsal kesimlerden ($M_{Bugün}= 1.15$, $SD=.98$; $M_{Gelecek}= .83$ $SD=.87$) gelen öğretmen adaylarının, ilçelerden ($M_{Bugün}= .70$, $SD=.81$; $M_{Gelecek}= .40$, $SD=.71$) ve büyük şehirlerden ($M_{Bugün}= .37$, $SD=.69$; $M_{Gelecek}= .14$, $SD=.58$) gelen öğretmen adaylarına kıyasla hem bugün hem de gelecek için daha iyimser olduklarını ortaya koymuştur. Katılımcıların mekânsal iyimserlik düzeylerinin, şehirden kırsala doğru gittikçe düştüğü söylenebilir. Başka bir deyişle, yaşanılan bölge geliştikçe (kırsaldan şehre), mekânsal iyimserlik oranı düşmektedir. Bu durum bize, şehirlerde yaşayan katılımcıların daha fazla endüstrileşmeye ve günbegün artan nüfus yoğunluğuna maruz kaldığını, bu yüzden de ilçelerde ve kırsal kesimlerde yaşayan katılımcılara oranla, yerel bölgeleriyle ilgili daha az iyimser olduklarını göstermektedir. (Tikka, Kuitunen & Tynys, 2000).

Fen bilgisi öğretmen adaylarının zamansal kötümserlik derecelerinin belirlenmesi için, öğretmen adaylarının bugünkü mekânsal dereceleri, gelecekte olması beklenenden çıkartılmıştır. Böylelikle, hem yerel hem küresel şartlar için iki zamansal kötümserlik elde edilmiş oldu. Yapılan bu işlem sonucunda, fen bilimleri öğretmen adaylarının yerel çevre problemleri hakkındaki zamansal kötümserlik ortalamaları $-.75$ ($SD=.85$) olarak hesaplanırken küresel problemler hakkındaki zamansal kötümserlik ortalamaları $-.50$ ($SD=.79$) olarak hesaplanmıştır. Bulunan negatif ortalama değerleri Türk fen bilgisi öğretmen adaylarının hem yerel hem de küresel bağlamdaki çevre problemleri hakkında zamansal kötümserlikleri olduğunu göstermektedir. Daha doğrusu, öğretmen adayları, çevre problemlerinin hem kendi yaşadıkları bölgede hem de dünya genelinde gittikçe kötüleşeceğine inanmaktadırlar.

Ayrıca, araştırma sonuçları yerel zamansal kötümserliğin küresel zamansal kötümserlikten daha fazla olduğunu ortaya koymuştur. Başka bir deyişle, fen bilgisi öğretmen adayları kendi yaşadıkları çevredeki çevre problemlerinin durumuyla alakalı olarak daha kötümser bir tutum içerisindeyler.

Çalışma sonuçlarının ortaya koyduğu bir başka bulgu da hem erkek ($M_{Yerel}=-.65$, $SD=.82$; $M_{Küresel}=-.44$, $SD=.76$) hem de kadın ($M_{Yerel}=-.79$, $SD=.86$; $M_{Küresel}=-.52$, $SD=.80$) fen bilgisi öğretmen adaylarının yerel ve küresel çevre problemlerinin gelecekte kötüleşeceğini düşündükleridir. Yerel şartlar göz önünde bulundurulduğunda, kadın öğretmen adaylarının erkeklere nispeten daha kötümser oldukları tespit edilmiştir. Ufak farklılıklar da göz önünde bulundurulursa, kırsal kesimlerden ($M_{Yerel}=-.79$, $SD=.92$) ve ilçelerden ($M_{Yerel}=-.80$, $SD=.82$) gelen öğretmen adaylarının yerel zamansal kötümserliklerinin şehirden ($M_{Yerel}=-.72$, $SD=.85$) gelenlere göre daha fazla olduğu söylenebilir. Öte yandan, ilçelerden ($M_{Küresel}=-.50$, $SD=.77$) ve büyük şehirlerden ($M_{Küresel}=-.50$, $SD=.82$) gelen katılımcıların küresel zamansal kötümserlikleri kırsal kesimden ($M_{Küresel}=-.47$, $SD=.75$) gelen katılımcılara nispeten daha fazladır. Şehirler daha fazla çevre sorunuyla karşılaştığı için, büyük şehirlerden gelen katılımcılar küresel anlamda geleceğe bugünkünden daha kötümser bakarlar. Fakat ilginç bir şekilde yerel çevre problemlerine karşın daha az kötümserdirler. Bu da kendi yaşadıkları bölgelerde meydana gelen olumsuz olayları bilinçsiz reddedilerinden kaynaklanıyor olabilir.

Fen Bilimleri Öğretmen Adaylarının İçsel Kontrol Odağı Profilleri

Bu bölüm kapsamında, fen bilgisi öğretmen adaylarının davranışlarının çevre problemlerinin çözümü üzerindeki etkisine olan inançları ortaya konulmuştur. Yanıtlar, fen bilgisi öğretmen adaylarının, eylemlerinin çevre problemlerini çözebileceğine inandıklarını göstermiştir ($M=3.96$, $SD=.82$). Başka bir şekilde ifade etmek gerekirse, fen bilgisi öğretmen adaylarının büyük bir kısmı, eylemlerinin çevre problemlerinin ortaya çıkmasında olduğu kadar çözülmesinde de etkisi olduğu göstermektedirler.

Sonuçlar kadın ($M=4.11$, $SD=.65$) öğretmen adayların, erkek ($M=3.85$, $SD=.75$) adaylara kıyasla daha yüksek içsel kontrol odağına sahip olduğunu göstermiştir ki bu da kadın katılımcıların eylemlerinin çevre üzerindeki etkililiğine, erkeklere oranla daha fazla inandıklarını gösterir. Ayrıca, sonuçlar yaşanılan bölgeye göre incelendiğinde, kırsal kesimlerden ($M=3.94$, $SD=.74$) gelen adayların şehir ($M=4.07$, $SD=.67$) ve ilçelerden ($M=4.06$, $SD=.67$) gelenlere kıyasla daha zayıf içsel kontrol odaklarının olduğu tespit edilmiştir. Bu sonuç bizlere, şehir veya yerleşkelerde yetişen öğretmen adaylarının, kırsal kesimlerde yetişen öğretmen adaylarına göre, eylemlerinin çevre problemleri üzerinde yaratacağı etkinin daha çok farkında olduklarını göstermektedir.

Fen Bilimleri Öğretmen Adaylarının Çevre Konuları Hakkındaki Bilgi Profilleri

Çevre bilgisi betimleyici istatistikleri, erkek ($M=5.44$, $SD=2.02$) öğretmen adaylarının çevre bilgisi skorlarını olduğunu ve kadınlarınkinden ($M=5.23$, $SD=2.15$) daha yüksek olduğunu ortaya koymuştur ki bu da erkek fen bilimleri öğretmen adaylarının kadın adaylara göre çevre hakkında daha fazla bilgi sahibi olduklarını göstermektedir. Sonuçların ortaya koyduğu bir diğer bulgu ise, çevre bilgisi düzeylerinin yaşanılan bölge faktöründen de etkilendiğidir. Örneğin, kırsal kesimlerde ($M=5.12$, $SD=2.02$) ve büyük şehirlerde ($M=5.28$, $SD=2.04$) yetişen öğretmen adaylarının, ilçelerde ($M=5.36$, $SD=2.10$) yetişen adaylara göre daha az çevre bilgisine sahip oldukları anlaşılmıştır. Buna göre kırsal kesimlerde yetişmiş öğretmen adaylarının şehirde yetişenlere göre, çevre konusunda daha az eğitim aldığı söylenebilir.

3.3 Yol Analiz Sonuçları

Bu bölümde, yol analiz sonuçları ele alınacak ve bu doğrultuda yol analizi için gerekli olan varsayımları tartışılacaktır. Sonrasında, aşağıda verilen araştırma sorusunun cevabı bulunmaya çalışılacak ve bu süreçte sunulan model uyum katsayıları ve yol katsayıları incelenecektir.

- i. Türk fen bilimleri öğretmen adaylarının çevre dostu davranışları, çevre konuları hakkındaki bilgi düzeyleri, çevresel tutumları, içsel kontrol odakları, mekânsal iyimserlikleri ve zamansal kötümserlikleri arasındaki ilişkinin doğası nedir?

Yapılan yol analizi sonucunda çevre dostu davranışların içsel kontrol odağından, çevre merkezli ve insan merkezli çevresel tutumlardan, mekânsal iyimserlik ve zamansal kötümserlik algılarından direkt etkilendiği fakat çevre konuları hakkındaki bilgilerinden direkt olarak etkilenmediği bulunmuştur. Sunulan dört farklı modelin uyum katsayıları aşağıda ayrı ayrı incelenmiştir. Birinci modelde, çevre konuları hakkındaki bilgi düzeyleri, çevreye yönelik tutum, içsel kontrol odağı, mevcut mekânsal iyimserlik ve küresel zamansal kötümserlik değişkenlerinin doğrusal kombinasyonu, çevre dostu davranıştaki değişkenlerin % 45'ini oluşturmaktadır. Bu modelin uyum endeksleri $X^2=12.68$, $df=4$ $X^2/df=3.17$, $RMSEA=0.038$, $SRMR=0.017$, $CFI=0.99$ 'dir. İkinci modelde, çevre konuları hakkındaki bilgi düzeyleri, çevreye yönelik tutum, içsel kontrol odağı, mevcut mekânsal iyimserlik ve yerel zamansal kötümserliğin davranış değişkenlerinin % 46'sını oluşturduğu görülmüştür. Model uyum indeksleri $X^2=24.01$, $df=4$ $X^2/df=6.00$, $RMSEA=0.058$, $SRMR=0.022$, $CFI=0.99$ 'dir. Üçüncü modelde ise, çevre konuları hakkındaki bilgi düzeyleri, çevreye yönelik tutum, içsel kontrol odağı, geleceğe yönelik mekânsal iyimserlik ve küresel zamansal kötümserliğin hepsinin beraber davranış değişkenlerinin % 44'ünü oluşturmaktadır. Modelin uyum indeksleri $X^2=9.05$, $df=4$ $X^2/df=2.26$, $RMSEA=0.029$, $SRMR=0.014$, $CFI=0.99$ 'dir. Son olarak, dördüncü model, çevre konuları hakkındaki bilgi düzeyleri, çevreye yönelik tutum, içsel kontrol odağı, geleceğe yönelik mekânsal iyimserlik ve yerel zamansal kötümserliğin davranış üzerindeki etkilerini test etmiştir. Buna göre model, çevre dostu davranıştaki değişkenlerin % 43' ünü açıklamaktadır. Model uyum indeksleri $X^2=22.25$, $df=4$ $X^2/df=5.56$, $RMSEA=0.055$, $SRMR=0.020$, $CFI=0.99$ 'dir. Sonuç olarak, model için bazı uyum indeksleri kriterlere göre incelendiğinde fen bilimleri öğretmen adaylarının çevre dostu davranışlar modelinin verilerle iyi uyum gösterdiği

ve seçilen değişkenlerin öğretmen adaylarının çevre dostu davranışlarındaki varyansın % 43 ila % 46sını açıkladığı bulunmuştur.

Modeller AMOS 21 istatistik yöntemi ile test edilmiş ve değişkenler arasındaki ilişkiyi gösteren direkt ve direkt olmayan etkiler elde edilmiştir. Bu etkilerin büyüklüğü parantez içinde yer alan β değerleri ile gösterilmiştir. Bazı değişkenler birden fazla modelde test edildiğinden dolayı farklı beta değerleri elde edilmiştir. Test edilen modeller sonucu elde edilen direkt etkiler göz önüne alındığında, fen bilgisi öğretmen adaylarının çevre merkezli (.34 ila .36) ve insan merkezli (-.32 ila -.35) tutumlarının çevre dostu davranışlarını direkt olarak yordadığını ortaya çıkarmıştır. Buna göre çevre merkezli tutumlar arttıkça, çevre dostu davranışın da gelişeceği söylenebilir. Başka bir deyişle ifade etmek gerekirse, çevreyi yalnızca kendi değerinden ötürü koruyan fen bilgisi öğretmen adaylarının çevre dostu davranışlar sergilemeleri daha olasıdır. Öte yandan, içsel kontrol odağının çevre dostu davranış üzerinde nispeten daha az etkisi olduğu anlaşılmıştır (.14 ila .16) buradan yapılacak çıkarım, eylemlerinin çevre problemlerinin çözümüne etkisinin olacağını düşünen fen bilimleri öğretmen adaylarının, daha fazla çevre dostu davranış sergileyeceği yönündedir. Mekânsal iyimserlik değişkenine gelince, araştırma sonuçları fen bilgisi öğretmen adaylarının mevcut mekânsal iyimserliklerinin (-.18 ila -.19), çevre dostu davranışla olumsuz bir ilişki kurduğunu fakat tam tersine geleceğe yönelik mekânsal iyimserliklerininse (.06 ila .13) pozitif bir ilişkisi olduğunu ortaya çıkarmıştır. Fen bilgisi öğretmen adaylarının zamansal kötümserlikleri incelendiğinde, küresel çevre problemleri hakkındaki zamansal kötümserliğin (-.04 ila -.10) davranış üzerinde olumsuz etkisi olurken, yerel çevre problemleri hakkındaki zamansal kötümserliğin (.12 ila .14) olumlu etkisi olduğu görülmektedir.

Test edilen modellerde, doğrudan etkilerin yanı sıra, dolaylı etkilerin de varlığı saptanmıştır. En yüksek dolaylı etki çevre bilgisi ve davranış arasında bulunmuş ($\beta=.34$). Bu sonuç, çevre konuları hakkında sahip olunan bilginin çevreye yönelik tutum ve kontrol odağı üzerindeki doğrudan etkisinden kaynaklandığı söylenebilir.

4.Tartışma

Bu tezde dört farklı model sunulup, test edilmiş ve Türkiye'deki fen bilgisi öğretmen adaylarının çevre dostu davranış yordayıcılarının daha iyi anlaşılması amaçlanmıştır. Her ne kadar çevre konuları hakkındaki bilgi düzeyi, çevreye yönelik tutum ve içsel kontrol odağı her bir modelin ortak bileşeni olmuşsa da, bu unsurlar mekânsal iyimserlik (hem günümüz hem gelecek) ve zamansal kötümserlik (hem yerel he de küresel) bazlarında farklılık göstermişlerdir.

Denenen her bir modelde, çevreye yönelik tutum (çevre merkezli veya insan merkezli), fen bilgisi öğretmen adaylarının çevre dostu davranışlarını etkileyen en önemli unsurlar olarak ortaya çıkmıştır. Çevre merkezli tutumun davranış üzerinde güçlü ve olumlu etkisi gözlenirken, insan merkezli tutumun etkileri olumsuz olmuştur. Aslında bu sonuçlar şaşırtıcı değildir, çünkü tıpkı Thompson ve Barton (1994) ün ifade ettiği gibi, çevre merkezlilik ve insan merkezlilik iki farklı yönelimdir ve çevre dostu davranış için gerekli olan tutum çevre merkezliliktir. Örneğin, doğanın kıymetini bilen kişiler, çevreyle alakalı organizasyonlara daha katılımcıdırlar ve doğanın korunması için bizzat adımlar atarlar. Fakat insan merkezli motiflerin çevre dostu davranışı desteklemeleri beklenemez çünkü çevreye verilecek önem, insanlık yararına başka bir fayda ortaya çıktığı anda ortadan kalkabilir. Örneğin, çevre dostu davranışlar sergileyen insan merkezli tutuma sahip bir kişiyi ele alalım. Bu kişi para tasarrufu gibi kişisel faydaları doğrultusunda su ve elektrik tüketimini azaltabilir. Fakat insan merkezli tutuma sahip bu kişinin, umduğu para tasarrufunu yapamadığı anda, bu eyleminden vazgeçmesi fazlasıyla muhtemeldir. Üniversite öğrencileriyle çalışma yürüten Schultz ve Zelenzy (1998), çevreye yönelik tutum ve çevresel davranış arasındaki ilişkiyi incelemişlerdir. Ulaştıkları sonuç; çevre merkezli tutumun çevre dostu davranışın yordayıcısı olarak önemli bir rol üstlendiği olmuştur. Ayrıca, araştırma sonuçları kişisel çıkarlar ve davranış arasında olumsuz bir ilişki olduğunu ortaya koymuştur. Araştırmacılar bu olumsuz bağlantıyı, egoizmin çevre dostu davranışın önüne ket vurduğu şeklinde yorumlamışlardır. Ayrıca, büyük çaba gerektiren ve karşılığında büyük ödüller vaat

etmeyen davranışların insanlar tarafından pek tercih edilmediğini de ifade etmişlerdir.

Çevre konuları hakkındaki bilgi düzeyi, fen bilgisi öğretmen adaylarının çevre dostu davranışlarını etkileyen ikinci en önemli faktördür. Çevreye yönelik tutumun doğrudan etkilerine karşın, test edilen tüm modellerde çevre bilgisinin, fen bilgisi öğretmen adaylarının davranışlarını olumlu fakat dolaylı etkilediği görülmüştür. Bu dolaylı etkinin kaynağının çevre bilgisinin tutum ve içsel kontrol odağı üzerindeki direkt etkisi olduğu düşünülmektedir. Mevcut çalışmayla paralel olarak, Alp ve meslektaşları (2006) Türk öğrencilerin çevre bilgilerinin mevcut çevre sorunlarıyla bağlantılı olduğunu ve genel çevre konularının çevresel davranışı doğrudan etkilemediğini ortaya çıkarmışlardır. Araştırma sonuçları ayrıca davranışsal niyetlerin ve tutumların bilgi ve sorumlu davranış arasındaki ilişkiyi güçlendirdi sonucuna varmıştır.

Fen bilgisi öğretmen adaylarının çevre dostu davranışlarının bir diğer yordayıcısı olan içsel kontrol odağını ele aldığımızda, araştırma sonuçları öğretmen adaylarının, eylemlerinin çevre problemlerinin çözümü üzerindeki etkisini keşfettikleri takdirde daha çok çevre dostu davranış sergileyeceklerini göstermiştir. Betimleyici sonuçların da öne sürdüğü üzere, fen bilimleri öğretmen adayları, çevre problemlerinin çözümünde etkin olabileceklerine inanmaktadırlar. Örneğin, öğretmen adaylarının büyük bir kısmı, “geri dönüştürülmüş ve/veya dönüştürülebilir ambalajlı ürünleri satın alma” ve “daha az ev atığı” gibi maddelerde fikir birliğine varmıştır. Öte yandan, katılımcıların yüzde yirmi beşi “yerel çevre sorunları üzerine düzenlenen toplantılara katılma”nın soruların çözümüne etkisi olacağı fikrine katılmamışlardır. Bu sonuçlarla uyumlu olarak, Boubonari ve meslektaşları (2013), Yunanistan’daki ilköğretim fen bilimleri öğretmenlerinin, deniz kirliliği gibi sorunlarla alakalı televizyon programları seyretmek, makaleler okumak, geri dönüşüm yapmak gibi bireysel faaliyetlerde daha aktif olup, sahilleri temizlemek veya mitinglere katılmak gibi kolektif eylemlerde daha pasif kaldıklarını ortaya koymuşlardır.

Yaşadıkları bölgenin dünyanın geri kalanına daha iyi durumda olduğuna düşünen fen bilimleri öğretmen adaylarının mevcut mekânsal iyimserlikleri düşünüldüğünde, bu kişilerin çevre dostu davranış sergilemeyecekleri söylenebilir. Weinstein (1989) insanların gerçekçi olmayan bir iyimserliğe kapılıp kötü şeylerin (çevre felaketleri gibi) kendi başlarına gelme olasılığının başka insanların başına gelme olasılığından daha düşük olduğuna inandıklarını ve kendilerinin genelde olumlu şeylerle karşılaşacaklarını düşündüklerini öne sürmüştür. Bu bulgular, Gifford ve meslektaşlarının (2009) çalışması ile örtüşmektedir. Gifford ve arkadaşlarının araştırma sonuçlarına göre, mekânsal iyimserlik eğilimi on sekiz ülkeden çalışmaya katılan katılımcıların her birinde gözlemlenmiştir. Araştırmacılar bu yaygınlığın sebebini, kişilerin bir yere aidiyet duyma eğilimlerinin de bir parçası olan olumlu benlik imgesi olduğunu düşünmektedirler. Ayrıca çalışmada medyanın küresel çevre problemleriyle ilgili endişeleri ve farkındalığı arttırarak, mekânsal iyimserlik meylini, neden olabileceği ortaya konmuştur. Medyanın bu tutumu doğrultusunda küresel çevre problemlerinin yerel problemlerden çok daha fazla olduğu şeklinde bir algıya sebep olmakta ki bu algı da gerçekte var olan durumun oldukça uzağındadır.

Öte yandan geleceğe yönelik mekânsal iyimserlik düşünüldüğünde, fen bilgisi öğretmen adayları daha iyi bir çevre için çaba sarf ettikleri doğrultuda, doğal olarak, daha umutlu bir gelecek algısına sahip oldukları sonucuna ulaşılmıştır. Örneğin, öğretmen adaylarının yaşadıkları bölgelerdeki su kaynaklarının ve niteliğinin gittikçe iyileşeceği düşüncesi, bu alanda yaptıkları faaliyetlerle, örneğin kendi su kullanımlarını azaltmalarıyla ilgili olabilir. Bu çalışmada elde edilen bulgular, Tuncer ve meslektaşlarının (2005) çalışma sonuçlarıyla tutarlıdır. Araştırmacılar, Türk öğrencilerinin geleceğe karşı iyimser olduklarını ve aynı zamanda bireysel sorumluluklarının çevre problemleri üzerinde etkisi olduğunu da bildiklerini ifade etmişlerdir. Ayrıca araştırma sonuçları, öğrencilerin eylemlerinin sorumluluklarını bildiklerini çünkü bilim ve teknolojiye güvenmediklerini ortaya koymuştur. Benzer şekilde Cavas ve meslektaşları da (2009) nesli tükenmekte olan hayvanların korunması, hava kirliliği ve temiz içme suyu gibi çevre problemlerine karşı çözümler

üretmeyi gerçekten isteyen Türk öğrencilerinin geleceğe karşı iyimser bakış açıları geliştirdiklerini ifade etmişlerdir.

Küresel çevre problemleri hakkındaki zamansal kötümserliğe gelince, çevre problemlerinin gelecekte kötüleşeceğine fikrine sahip olmak fen bilgisi öğretmen adaylarının çevre dostu davranışlar sergilememelerine ket vuracağı sonucuna ulaşılmıştır. Bunun sebebi insanların, çevrenin günbegün kötüleştiğine, yakında tüm doğal kaynakların tükeneceğine ve bunun kaçınılmaz olacağına dair inançları olabilir. Kötümser bakış açısı aynı zamanda Connell, Fien, Lee, Sykes ve Yenchken'in (1999) Avustralyalı öğrencilerle yürüttüğü çalışmada da bulunmuştur. Gençler, geleceğe karşı genellikle kötümser bir bakış açısına sahip olduklarından dolayı, çevre için uğraşmaya da istekli değillerdir. Ayrıca, bu kişiler çevreyi koruyup kollaması için devlete ve endüstriye güvenmektedirler. Yerel çevre problemleri hakkındaki zamansal kötümserlik ele alındığında, modeller yaşadığı bölgeyle ilgili kötümser bakış açısına sahip kişilerin çevre dostu davranış sergileme eğilimleri olduğunu ortaya koymuştur.

Appendix C

CURRICULUM VITAE

PERSONAL INFORMATION

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EDUCATION

Degree	Institution	Year of Graduation
BS	Hacettepe University Elementary Science Education	2006
High School	CEAS Seyhan Anadolu Lisesi	2002

WORK EXPERIENCE

Year	Place	Enrollment
2009- Present	Atılım Universtiy	Expert

FOREIGN LANGUAGES

English

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Appendix D

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü

Sosyal Bilimler Enstitüsü

Uygulamalı Matematik Enstitüsü

Enformatik Enstitüsü

Deniz Bilimleri Enstitüsü

YAZARIN

Soyadı : Alper

Adı : Umut

Bölümü : İlköğretim

TEZİN ADI (İngilizce): Modelling Pre-Service Science Teachers' Environmentally Friendly Behaviours in Relation to Psychological and Cognitive Variables

TEZİN TÜRÜ : Yüksek Lisans

Doktora

1. Tezimin tamamından kaynak gösterilmek şartıyla fotokopi alınabilir.

2. Tezimin içindekiler sayfası, özet, indeks sayfalarından ve/veya bir bölümünden kaynak gösterilmek şartıyla fotokopi alınabilir.

3. Tezimden bir (1) yıl süreyle fotokopi alınamaz.

TEZİN KÜTÜPHANEYE TESLİM TARİHİ: