

ENVIRONMENTAL MORAL REASONING PATTERNS OF PRE-SERVICE
SCIENCE TEACHERS AND THEIR RELATIONSHIPS TO
EPISTEMOLOGICAL BELIEFS AND VALUES

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ABSTRACT

ENVIRONMENTAL MORAL REASONING PATTERNS OF PRE-SERVICE SCIENCE TEACHERS AND THEIR RELATIONSHIPS TO EPISTEMOLOGICAL BELIEFS AND VALUES

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The overarching purpose of this study was to examine environmental moral reasoning patterns of pre-service science teachers in relation to epistemological beliefs and values. To serve for this purpose, four scenarios that reflect different environmental moral dilemma situations taking place in four outdoor recreation contexts (i.e., hiking, picnicking, fishing, camping) were used. By its design, the study was a correlational research and data on environmental moral reasoning, epistemological beliefs, and values were collected quantitatively. 1524 pre-service science teachers enrolled in six public universities located in Central Anatolia Region of Turkey constituted the sample of the study. Path analysis was the data analysis technique used for examining the research questions. AMOS statistical package program was utilized for conducting the path analyses. Separate path models were specified for testing the predictability of environmental moral

reasoning patterns that the participants expressed for each environmental moral dilemma scenario. Model fit indices indicated good fit between the specified path models and the study data. Nevertheless, proportions of the explained variances in the endogenous variables of the models could not reach large practical significance. Significance, direction, and magnitude of the relationships of environmental moral reasoning to epistemological beliefs and values showed changes depending on the dilemma context and the focus of environmental moral consideration, suggesting a dynamic nature with regard to the hypothesized relationships. All in all, findings of the study showed that environmental moral reasoning is a complex construct that is related to both personal characteristics of individuals and the issues that are under consideration.

Keywords: Environmental Moral Reasoning, Epistemological Beliefs, Values, Path Analysis, Teacher Education

ÖZ

FEN BİLGİSİ ÖĞRETMEN ADAYLARININ ÇEVRESEL AHLAKİ MUHAKEME ÖRÜNTÜLERİ VE BU ÖRÜNTÜLERİN EPİSTEMOLOJİK İNANÇLAR VE DEĞERLER İLE İLİŞKİSİ

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Bu çalışmada, temel olarak, fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerini epistemolojik inançlar ve değerler ile ilişkili olarak incelemek amaçlanmıştır. Bunun için, yürüyüş, piknik, balık tutmak ve kamp yapmak etkinlikleri çerçevesinde kurgulanmış çeşitli ahlaki ikilem durumlarının sunulduğu dört farklı çevresel durum hikâyesi kullanılmıştır. Çalışma, araştırma deseni bakımından bir korelasyon araştırması olup, çevresel ahlaki muhakeme örüntüleri, epistemolojik inançlar ve değerler ile ilgili veriler nicel yollarla toplanmıştır. Çalışmanın örneklemini İç Anadolu Bölgesi'ndeki altı devlet üniversitesinde öğrenim görmekte olan 1524 fen bilgisi öğretmen adayı oluşturmuştur. Araştırma sorularını cevaplandırmak için istatistik analiz yöntemi olarak yol analizi kullanılmıştır. Yol analizlerinin uygulanmasında AMOS istatistik

paket programından faydalanılmıştır. Yol analizleri, katılımcıların her bir çevresel durum hikâyesi karşısında sergiledikleri çevresel ahlaki muhakeme örüntülerinin tahmini için ayrı ayrı uygulanmıştır. Analizlerden elde edilen model uyum indeksleri test edilen yol modellerinin çalışmanın verileri ile uygunluğunu desteklerken, modeller tarafından açıklanabilen varyansların etki büyüklüğü yüksek değerlere ulaşamamıştır. Çevresel ahlaki muhakeme örüntülerinin epistemolojik inanç ve değer boyutları ile ilişkilerinin istatistiksel anlamlılık, yön ve büyüklük bakımından yol modellerinin test edildiği çevresel durum hikâyelerine ve çevresel ahlaki kaygıların odak noktalarına bağlı olarak değişiklik gösterdiği gözlemlenmiştir. Bu durum, öngörülen ilişkilerin dinamik bir yapıya sahip olduğu şeklinde yorumlanmıştır. Bir bütün olarak ele alındığında, çalışmanın bulguları çevresel ahlaki muhakeme kavramının hem kişilerin bireysel özellikleri hem de üzerinde düşünülen konular ile ilişkili olan, çok boyutlu bir kavram olduğunu ortaya koymuştur.

Anahtar Kelimeler: Çevresel Ahlaki Muhakeme, Epistemolojik İnançlar, Değerler, Yol Analizi, Öğretmen Eğitimi

To Life ...

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love, sometimes like my child and sometimes like my father...In summary, “you are everything for me” ;) I hope we will be happy together until the end of our lives...

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LIST OF ABBREVIATIONS

PST	Pre-service Science Teachers
EE	Environmental Education
ESD	Education for Sustainable Development
SSI	Socioscientific Issues
NOS	Nature of Science
STSE	Science-Technology-Society-Environment
SEM	Structural Equation Modeling
PA	Path Analysis
EFA	Exploratory Factor Analysis
CFA	Confirmatory Factor Analysis
SK	Simple Knowledge
CK	Certain Knowledge
OA	Omniscient Authority
QL	Quick Learning
IA	Innate Ability
ST	Self-transcendence
SE	Self-enhancement
OC	Openness to Change
T	Tradition
ST_T	Self-transcendence – Tradition

CHAPTER I

INTRODUCTION

This chapter starts with an introduction to environmental education and place of environmental ethics in it. Then, readers are presented with sections devoted to the main constructs of the study: environmental moral reasoning, epistemological beliefs, and values. Following these sections, proposed model of the study and justifications of the relationships existing in the proposed model are explained. Then, research questions, their rationale, and significance of the study are presented. The chapter concludes with a summary section that gives an overview of the whole chapter.

1.1 Environmental Education

Nature Study, Outdoor Education, and Conservation Education constitute the early twentieth century predecessors of environmental education (EE) (Kopnina, 2012; Marcinchowski, 2009). Issues addressed in these educational movements carry the *zeitgeist* (spirit of the age) and reflect the needs of their times. For example, nature study, which dominated the late 19th century and early 20th century, had a romantic approach and used fables and moral lessons as a way of promoting appreciation to nature (Cronon, 2015). Outdoor education mainly aimed to help learners to explore the environment from an ecological perspective and see the interdependence of all living things, which would, hopefully, result in cultivation of a land ethic (Passmore, 1972). In the late 1960s and early 1970s, as a response to concerns about high levels of pollution and land abuse, conservation of natural resources gained importance and

frequently addressed within conservation education (Marcinkowski, 2009). In the following years, with increasing levels of environmental degradation and associated problems, protection of the natural environment and reducing human impacts on it became the main focus in the early understandings of environmental education (Kopnina, 2012; McKeown & Hopkins, 2003). International and intergovernmental agendas (e.g., Conference on ‘Environmental Education and the School Curriculum’ (International Union for Conservation of Nature [IUCN], 1970), International Workshop on Environmental Education and the Belgrade Charter found in its final report (United Nations Environment Programme/ United Nations Educational, Scientific and Cultural Organization [UNEP/UNESCO], 1975), Tbilisi Conference on Environmental Education (UNESCO, 1977)) were declared to emphasize the importance of environmental education for overcoming environmental challenges. Then, in 1987 the concept of sustainable development was introduced in Brundtland report (World Commission on Environment and Development [WCED], 1987) to highlight human-environment-development interrelationships. In this report, sustainable development was defined as: “development that meets the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987). This definition was accepted by many scholars and became the most frequently cited definition of sustainable development (Marcinkowski, 2009). As observed in Agenda 21 (also called as Earth Summit) of United Nations Conference on Environment and Development (UN-UNCED), which was held in Rio de Janeiro in 1992, a balance was tried to be achieved between the needs of the environment and those of humans (Kopnina, 2012; McKeown & Hopkins, 2003). Accordingly, more emphasis was put on sustainability and sustainable development with signals of integrating Education for Sustainable Development (ESD) into school curricula. This emphasis was also evident in Chapter 36 of the conference report, which was devoted to “promoting education, public awareness, and training” (UN, 1992). The emphasis on sustainability, sustainable development, and education for sustainable development continued to exist in the reports of the succeeding conferences and commissions such as United Nations Commission on Sustainable Development [UNCSD] (2001), Earth Summit 2012 (Rio + 20) (UNCSD, 2012),

and World Conference on Education for Sustainable Development (UNESCO, 2014). In fact, United Nations Educational, Scientific and Cultural Organization (UNESCO) declared 2005-2014 as *Decade of Education for Sustainable Development* to integrate SD and its economic, social, and environmental dimensions into all aspects of education and learning (UNESCO, 2014).

Although specific objectives of these educational movements may change, they have a common aim of contributing to the solutions of environmental problems (McKeown & Hopkins, 2003). In 1960s, the route for achieving this aim was seen as producing a citizenry that is knowledgeable about the biophysical environment and its problems, and aware and motivated to solve environmental problems (Stapp et al., 1969). In the 21st century, raising social awareness was added to the objectives of education and participatory citizenry and action competence was suggested as the goals to be achieved through ESD (Kopnina, 2012). This approach was also adopted in the reports of UNESCO (Mula & Tilbury, 2011; UNESCO, 2012). In UNESCO's final report on the UN Decade of Education for Sustainable Development (*Shaping the Future We Want*), basics of ESD are summarized with its themes (i.e., climate change, disaster risk reduction, sustainable livelihoods, sustainable consumption and production, biodiversity and poverty reduction) (UNESCO, 2014). Moreover, guidelines are presented to the educators regarding the dynamics of ESD and its requirements. For instance, owing to the complex nature of sustainable development and the problems it deals with, educators are suggested to utilize teaching methods that improve critical thinking, systems thinking (i.e., understanding systematic interconnections), value clarification, and collaborative decision making in order to achieve environmental integrity, economic viability, and a just society.

As a more contemporary example regarding the response of educational programs to the environmental problems of their times, we can talk about climate change education. As revealed in intergovernmental documents (e.g., Intergovernmental Panel on Climate Change [IPCC], 2007, 2014), creating changes in individuals' lifestyles and behavior patterns (e.g., consumption behaviors) are accepted as one of

the most promising ways of mitigating climate change. In a parallel manner, climate change started to shape educational programs both methodologically and pedagogically (Marcinkowski, 2009). Innovative teaching approaches (e.g., interdisciplinary practice, whole school approaches, non-formal education programs) that help learners to increase their understanding and awareness about climate change, adapt to its impacts, and promote changes in their environmental attitudes and behaviors are called for by international agenda and implemented in a number of projects and initiatives (UNESCO, 2010). Finally, it should be stated that, similar to international responses to the problems and needs of their times, specific problems and the needs of the countries are reflected in their national educational programs related to the environment (Blum, Nazir, Breiting, Goh, & Pedretti, 2013). Depending on the urgent needs of their countries, governments reorient and reframe educational programs related to environment by giving more focus to health education, peace education, HIV and AIDS education, multicultural education, etc. (Mula & Tilbury, 2011).

Orr (1992) stated that regardless of their content and areas of emphasis, all educational programs share the common aim of teaching learners to be a part of the natural world and called all of the environment-related education as environmental education. In a similar manner, in the present study environmental education is used as a general term to refer to educational practices related with environment, its conservation and protection, problems associated with environmental degradation and their solutions. Regardless of the specific characteristics of the programs applied, ultimate goal of environment-related education is to promote pro-environmental behaviors in individuals and society, and by this way, contribute to the solution of environmental problems (Eilam & Trop, 2010; Gurevitz, 2000; Hungerford & Volk, 1990, Littledyke, 2008; Palmer, 1998; Postma, 2006; Potter, 2009; Simmons, 1991; York & Becker, 2012). Nevertheless, an examination of the outcomes of environmental education programs reveals that these educational efforts have not reached their ultimate goal of educating citizens who demonstrate pro-environmental behaviors in their daily lives (Potter, 2009; York & Becker, 2012).

Researchers have proposed several reasons for this situation. For instance, Uzzell, Rutland, and Whistance (1995) stated that the way environmental problems are presented and environmental issues are addressed in environmental education often leads to an action paralysis rather than responsible environmental behaviors in learners. According to the authors, an emphasis on scientific, especially chemo-biological, investigations such as measuring levels of pollution in streams caused by agricultural runoff cause learners to feel a sense of powerlessness and helplessness which in turn results in decrease in their feelings of responsibility for the environmental problems. Potter (2009) considered the problem from a different perspective and pointed to the insufficiency of funding and educator training as the main reasons for the inefficacy of environmental education for educating citizens who demonstrate environmental awareness in their daily life behaviors. Blumstein and Saylan (2007) attributed this ‘failure’ of environmental education mainly to environmental education curricula which do not target personal environmental responsibility and individual behavior change such as consumption control. Finally, Littledyke (2008) highlighted the insufficiency of environmental education in integrating cognitive and affective domains which is vital to help learners develop positive relationships with the environment and motivate them to exhibit pro-environmental behaviors.

In fact, putting more attention on human-environment relationships may be a key for the success of environmental education in achieving its goals and contributing to environmental conservation and protection (Duan & Fortner, 2005). Individuals’ perceptions regarding their relationships with the environment and their roles in the causes of and solutions for environmental degradation are found to be influential for personal decisions about environmental behaviors (Gurevitz, 2000). Therefore, developing a sense of relationship and interconnectedness with the environment through environmental education appears to be vital for promoting love, respect, and care for the environment and responsibility for its related problems and solutions, which in turn will foster pro-environmental behaviors (Littledyke, 2008). There is a branch of environmental philosophy which has long been examining human-

environment relationships: environmental ethics. Next section is devoted to the construct of environmental ethics and how it was utilized in the present study.

1.2 Environmental Ethics

Environmental ethics mainly uncovers and questions the ways in which humans can and should interact with the non-human natural world (Palmer, 2012). Moreover, it is the very early social psychological basis of environmentalism that debates for the necessity of extending ethics to human-environment relationships (Kortenkamp & Moore, 2001; Stern & Dietz, 1994). The importance of having a sense of ethics with regard to the environment and human-environment relationships for exhibition of pro-environmental attitudes and behaviors (Palmer, 1997; Tilbury, 1995) as well as for the larger framework of environmental movement (Horwitz, 1996) was also revealed by empirical research. Moreover, theories were proposed to explain the influence of values and moral norms on pro-environmental attitudes and behaviors. For instance, based on Schwartz's (1977) norm-activation theory, Stern, Dietz, Abel, Guagnano, and Kalof (1999) proposed value-belief-norm (VBN) theory to explain social movements including environmental movement. In their theory, the researchers highlighted the importance of personal values for pro-environmental behaviors and generalized awareness of adverse consequences (AC) and ascription of responsibility (AR) elements of Schwartz's theory from other people to non-human species and the biosphere. Accordingly, the researchers proposed that if people with particular personal values are aware of the adverse consequences of their behaviors to the environment and believe that they have contributed to the environmental problems or they could alleviate those consequences, they experience a moral obligation (personal norm) to act pro-environmentally and support pro-environmental movements.

Current research efforts continue to reveal the importance of taking moral/ethical perspective while reasoning about environmental issues and, accordingly, cultivation

of this perspective in environmental education is suggested for promotion of pro-environmental attitudes and behaviors (Almeida, Vasconcelos, Strecht-Ribeiro, & Torres, 2011; Bonnett, 2002; Eilam & Trop, 2010; Kronlid & Ohman, 2013; Postma, 2006; York & Becker, 2012). For instance, Eilam and Trop (2010) explain the influence of ethical and value clarification on pro-environmental behaviors by referring to their role in activation of cognitive and affective (emotional) processes and learning. While concluding their discussion, the researchers propose environmental ethics as one of the fundamental elements of environmental education. Similarly, York and Becker (2012) benefit from cognitive development theory to describe the ways of employing environmental ethics in cultivation of pro-environmental behaviors. Some other scholars (e.g., Bonnett, 2002, 2007; Postma, 2006) focus on the importance of cultivating environmental ethics in developing a right relationship with nature. As have been very beautifully explained by Aldo Leopold (1949), this right relationship means, or at least can be summarized as perceiving ourselves as a plain member and citizen of land-community, rather than a conqueror of it.

In the literature on environmental ethics, many researchers tried to differentiate various ways that individuals extend ethics to human-environment relationships. In this context, environmental moral reasoning is defined as a term that is utilized while explaining the variations in individuals' perceptions of morality and ethics with regard to the environment and human-environment relationships (Kortenkamp & Moore, 2001). In the previous paragraphs, the importance of having a sense of ethics for exhibition of pro-environmental attitudes and behaviors was described. Likewise, differences in the ways of extending ethics to the environment and human-environment relationships are shown to be influential for environmental attitudes and behaviors (Bjerke & Kaltenborn, 1999; Thompson & Barton, 1994) as well as for moral judgments and decision making regarding environmental issues (Seligman, Syme, & Gilchrist, 1994). Correspondingly, among these factors, environmental moral reasoning constituted the main focal point of the present study and is explained in the following section.

1.3 Environmental Moral Reasoning

Moral reasoning is, basically, a thinking process that individuals go through with the objective of determining whether an idea or an action is right or wrong (Littledyke, 2004). Moreover, previous research reveals that moral reasoning plays an essential role while making and justifying decisions about complex and ill-defined issues such as environmental problems (Sadler & Zeidler, 2004; Zeidler & Sadler, 2008a, Zeidler & Sadler, 2008b). These findings imply that environmental moral reasoning is closely related to perceptions of environmental issues and positions in human-environment relationships. Furthermore, since moral reasoning has both cognitive and affective components (Greely, 2008; Persing, 2006; Zeidler & Schafer, 1984), studying environmental moral reasoning patterns of individuals has the potential to provide holistic explanations to the factors that influence perceptions and interpretations of environmental issues. Hence, the cognitive domain is equated with representational knowledge dimensions and mental skills, and affective domain is interpreted as emotional responses to the ethical issues or tasks undertaken in their resolution (Tuncay, Yılmaz-Tüzün, & Tuncer Teksöz, 2012).

“All approaches to ethics rest on some understanding of value” (Palmer, 1997, p.10) and differences in individuals’ motives, or reasons, for valuing nature are very important and sometimes deterministic for their approaches toward environmental issues and human-environment relationships (Bjerke & Kalternborn, 1999). Review of literature on environmental ethics and environmental moral reasoning reveals basically two categories for identifying these differences. In the first categorization, individuals’ considerations with regard to their perceptions of the environment and human-environment relationships are categorized into two: human-centered (i.e., homocentric/anthropocentric) or nature-centered (i.e., ecocentric/biocentric). Kahn and his colleagues (Kahn, 1996, 1997; Kahn & Lourenço, 2002; Severson & Kahn, 2010) are among the researchers who utilize this binary categorization in their studies. Based on the interviews conducted with children, the researchers categorized reasoning patterns and justifications about the

morality of environmental problems (i.e., oil spill, water pollution, air pollution, forest fires, logging, and pesticide exposure) as reflections of anthropocentric (e.g., personal interests, aesthetics, effects on human welfare) and biocentric considerations (e.g., intrinsic value of nature, justice for nature, living in harmony with nature). Similarly, Kortenkamp and Moore (2001, 2009) used ecocentrism-anthropocentrism distinction to understand whether participants' moral reasoning and moral judgments regarding environmental dilemmas were reflections of their propositions to protect nature for its own sake (i.e., ecocentric/biocentric), or for the benefit of humans (i.e., anthropocentric).

The second categorization proposed to understand individuals' extension of ethics to environment and environmental issues takes on a tripartite distinction. Researchers suggesting this categorization propose that in addition to human-centered (homocentric/anthropocentric) and nature-centered (ecocentric/biocentric) orientations, individuals' self-oriented (i.e., egocentric) considerations constitute a distinct type of environmental moral orientation. Merchant (1992) is one of the researchers who supports this categorization and distinguishes among these three ethical perspectives (at least as involved in land and natural resource dilemmas), revealing an egocentric, homocentric, and ecocentric ethic. More specifically, according to Merchant, when individuals possess egocentric moral orientations they tend to believe that people have right to extract and use natural resources to enhance their own lives. On the other hand, individuals who are more homocentric tend to argue that the ultimate purpose should be to maximize social good and minimize human evil while resolving environmental dilemmas. Finally, when individuals with an ecocentric moral orientation come across with environmental dilemmas they reason in line with the belief that all the things in the ecosystem have intrinsic value, thus deserve moral considerations. A number of other researchers (e.g., De Groot & Steg, 2007; Stern & Dietz, 1994; Stern, Dietz, & Kalof, 1993; Stern, Dietz, Guagnano, 1995) also supported the presence of three distinct classes of valued objects (i.e., self, other people, ecosystems/biosphere including non-human objects)

which are influential in individuals' moral reasoning and judgments regarding environmental issues.

In the present study, a tripartite (i.e., egocentric, anthropocentric, ecocentric) categorization was utilized to examine environmental moral reasoning patterns. The rationale for choosing tripartite categorization over binary categorization is twofold. First, three way vision of environmental moral reasoning provides a clear picture of individuals' extension of ethics/morality to environmental issues (Stern & Dietz, 1994). Second, as explained in more detail in the following paragraphs, tripartite categorization of environmental moral reasoning corresponds better with the theories and models proposed on moral development and moral reasoning than a binary categorization (i.e., human centered vs. nature centered) does. In this study, responses that reflected moral concerns about the harms of environmentally damaging actions to the self or desires for the benefits of a healthy environment to the individual were examined under egocentric moral reasoning. Moral considerations that concentrated on the wellbeing of all human beings were categorized as anthropocentric moral reasoning. Finally, giving a moral standing to the environment as a whole including all non-human species and the biosphere were categorized as a reflection of ecocentric moral reasoning.

Since environmental moral reasoning reflects the ways individuals extend ethics/morality to the environment and human-environment relationships (Kortenkamp & Moore, 2001), expecting a close relationship between moral development levels and environmental moral reasoning patterns is unavoidable (Karpiak & Baril, 2008). Especially, when environmental moral reasoning patterns of individuals are examined by a three way vision (i.e., egocentric, anthropocentric, ecocentric) the existence of this association becomes clearer. For instance, egocentric, anthropocentric, and ecocentric moral reasoning show parallelism with Kohlberg's (1976, 1986) pre-conventional, conventional, and post-conventional/principled moral developmental levels, respectively. That is to say, individuals who are in pre-conventional moral development level are concerned with

and focus upon their own needs and desires, which is also the case for individuals who display egocentric moral reasoning. These people tend to behave egoistically without considering others, display a trouble-avoiding mindset, and focus on rewards and punishments given to them by the authority without considering the underlying reasons for the authority's behavior. People in conventional moral developmental level may perform "good" or "right" roles in order to help and please a limited group to whose approval they give importance. Moreover, these people evaluate morality of actions and ideas by considering their influence on society. For example, support for the use of auto emissions devices with a justification of "we all need clean air to breathe" can be given an example of conventional level of moral development (Kohlberg, 1976, 1986), which is also a reflection of anthropocentric moral reasoning. On the other hand, people at the post-conventional moral development level have an understanding of shared or sharable standards, rights, and duties. Such people are inclined to avoid violating others' rights, and act according to the fundamental life goals such as freedom, love, justice, etc. Moreover, similar to people with an ecocentric moral orientation, their concerns apply to a larger reference group including biotic communities.

To distinguish between "different phenomena and different levels of abstraction in analysis" Rest and his colleagues make a distinction between micro-morality and macro-morality (Rest, Narvaez, Thoma, Bebeau, 1999b, p.645). Micro-morality focuses on individuals (Dean & Beggs, 2006), their everyday face-to-face interactions and personal relationships (de Graaf, 2007; Rest et al., 1999b; Rest, Narvaez, Thoma, Bebeau, 2000). On the other hand, macro-morality has a higher level of abstraction (de Graaf, 2007). Accordingly, macro-morality considers formal structures of the society (Dean & Beggs, 2006), rules and role systems (Rest, Narvaez, Thoma, Bebeau, 1999a), and in its broadest sense it emphasizes universality in morality (de Graaf, 2007).

When considered from this perspective, tripartite categorization of environmental moral reasoning (i.e., egocentric, anthropocentric, ecocentric) also show parallelism

with models proposed on moral development. For instance, one can observe a transition of moral reasoning from micro-moral level to macro-moral level in Kohlberg's (1976, 1986) moral development stages and Rest et al.'s (2000) moral thinking schemas. A similar transition is also observed in environmental moral reasoning patterns. More specifically, similar to people at stages of *pre-conventional* moral development level and the ones who put *personal interest* schema (which is derived from Kohlberg's moral development stages two and three – stage two belongs to *pre-conventional* level and stage 3 belongs to *conventional* level in Kohlberg's moral development theory) at the center of their moral thinking, individuals who exhibit egocentric moral reasoning mostly focus on micro-moral aspects of morality (e.g., personal gain or loss). On the other hand, as individuals progress through anthropocentric to ecocentric moral reasoning, they start to have higher levels of abstraction, consider wider societal issues, and finally universalize morality to include all living-beings, ecosystems, and the biosphere.

Allen's (1975) theoretical framework proposed on moral development may be considered as another indication for the parallelism between environmental moral reasoning patterns and levels of moral development. In his model, Allen proposed three dimensions (i.e., differentiation, empathy, reference group) which are indicators of one's moral development level. The differentiation dimension is a reflection of one's awareness about the morality of the consequences and implications of a situation. The empathy dimension is regarded as the ability to consider others' points of view, feelings, and interests, which brings out moral sensitivity. Finally, the reference group dimension is the size of the group that an individual feels a sense of moral responsibility and obligation. Based on one's moral development level, these dimensions may include only self or may expand to broader communities such as all humankind or the biosphere as individuals proceed to higher levels of moral development. The same situation is also valid for the three categories of environmental moral reasoning (i.e., egocentric, anthropocentric, ecocentric). That is, individuals who exhibit egocentric moral reasoning tend to be less aware of the moral consequences and implications of environmental issues for

other people or ecosystems including non-human species. Similarly, they are generally less empathetic and less sensitive to the feelings of others. Moreover, they are inclined to feel a sense of moral responsibility and obligation just for themselves. On the other hand, individuals with anthropocentric moral orientations are expected to extend their moral awareness (i.e., differentiation dimension), moral sensitivity (i.e., empathy dimension), and moral responsibility and obligation (i.e., reference group dimension) from self to all other people. Finally, individuals who exhibit ecocentric moral reasoning include ecosystems and non-human species in their moral dimensions regarding environmental issues.

However, it would be an unrealistic assumption to expect an individual to exhibit the same developmental level or pattern of moral reasoning across all contexts (Zeidler, Sadler, Simmons, & Howes, 2005). As put forth by Rest et al. (1999a) and Rest, et al. (2000), content and context of moral dilemmas are highly influential on one's moral reasoning. Hierarchical ordering of values (i.e., relative priority of some values over others) that an individual hold may change from one context to another (Garrison, Östman, & Håkansson, 2015). As a result, it may be possible for a person to exhibit contradictory moral positions (Kronlid & Öhman, 2013). When interpreted from environmental moral reasoning perspective, it means that an individual may apply and justify an ecocentric moral position to one situation and argue for the necessity of considering all living beings/ecosystems/biosphere while making a moral judgment. On the other hand, the same individual may disregard these higher-level moral considerations and exhibit an anthropocentric or totally egocentric position to another situation by focusing on concerns related to other people or the self. It may also be possible for him/her to develop a moral approach that cannot exactly be named as egocentric, anthropocentric or ecocentric. As Kronlid and Öhman (2013) put it, an individual's environmental moral reasoning and position is not likely to be divided into separate moral spheres because "morality acts in mysterious and sometimes inconsistent ways" (p. 37). This 'plurality in environmental ethics' (Kronlid & Öhman, 2013) requires researchers and teachers to be open to formation of new values and moral reasoning patterns (Garrison et al,

2015). Garrison and his colleagues explained how values and value spheres interpenetrate each other and result in creation of new values in educational settings related with environment and sustainable development. The researchers point to the context of moral situations and culture of the individual as the two important factors influential in these creation processes.

In the present study, four environmental moral scenarios developed by Persing (2006) were adapted and used to examine environmental moral reasoning patterns of pre-service science teachers. The scenarios represent moral dilemmas taking place in four different outdoor recreation contexts: hiking, picnicking, fishing, and camping. It was indicated that context of dilemmas influence individuals' moral reasoning patterns (York & Becker, 2012). Use of multiple scenarios in different context lets participants reason about each moral scenario separately and gives the researcher the opportunity to make comparisons among moral reasoning patterns exhibited for each environmental scenario. By this way, more information becomes available to the researcher regarding the dynamics of environmental moral reasoning and its complex, ambiguous, and contradictory character (Kronlid & Öhman, 2013). Moreover, exploring environmental moral reasoning exhibited in different contexts provides the opportunity to explore a variety of moral perspectives and positions that individuals may hold regarding moral aspects of environmental issues. This is realized by avoiding the 'trap' of identifying environmental moral reasoning as a linear unidimensional continuum (e.g., self-centrism in one end, nature-centrism in the other end), which would likely happen with use of a "simple linear scale" (Kronlid & Öhman, 2013).

As suggested by Kortenkamp and Moore (2001), the scenarios used in the study (i.e., hiking, picnicking, fishing, and camping) provided respondents moral dilemma contexts with which they were familiar with and/or likely to encounter. For instance, picnicking is an outdoor recreation activity that is very popular among Turkish citizens (te Kloetze, 2001; Ozguner, 2011; Peters, Elands, & Buijs, 2010). In fact, it would not be wrong to say that every Turkish citizen experience this activity many

times in his/her life because it is a part of Turkish culture to come together with family members and/or friends and have food and drinks in urban parks and natural areas (Ozguner, 2011). Therefore, the moral dilemma explained in the picnicking scenario (i.e., leaving or not leaving garbage after picnicking when there is no room in the trash cans) was a kind of real-life situation for the participants of the study. Moreover, it is very likely that participants of the study were also familiar with the other three outdoor recreation contexts (hiking, fishing, and camping) described in the scenarios. This is mainly owing to demographic characteristics of the study sample. That is to say, sample of the study was selected among pre-service science teachers (PSTs) who were enrolled in elementary science education departments of universities. Although not equal in all, universities provide outdoor recreation activity opportunities for their students. These activities are generally organized by student clubs and are announced in many ways in the campuses (e.g., web pages, social media, flyers, leaflets, etc.). Therefore, many university students become familiar with outdoor recreation activities. Accordingly, researchers in Turkey frequently prefer to study with university students when they examine outdoor recreation participation and its relationships with other variables (e.g., Kahyaoglu, 2011; Sahin, 2008). Moreover, research shows that for many years, hiking, picnicking, fishing, and camping have been listed by many individuals among their most popular outdoor recreation activities (Hendee, 1969; Thapa, 2010). Correspondingly, they have long been utilized in research as exemplary outdoor recreation activities and contexts for examining individuals' preferences, attitudes, behaviors, and reasoning about environmental issues (Jackson, 1986; Kelly, 1980; Greely, 2008; Persing, 2006; Tangeland, Aas, & Odden, 2013).

Research also shows that culture of individuals is influential on their perceptions about outdoor recreation activities and contexts (Ozguner, 2011). That is, meaning-making of individuals about environmental issues is influenced by the culture they belong to (Garrison et al., 2015). Although environmental moral scenarios used in the present study were adapted from Persing's (2006) study and are very similar to the ones used in Greely's (2008) research, differences may be observed in

participants' environmental moral reasoning patterns as well as factorizations and organizations of environmental moral concerns. More specifically, for this study it was hypothesized that participants' centers of moral concern (i.e, egocentric, anthropocentric, ecocentric) may show differences when compared to those of Persing (2006) and Greely's (2008) research. Moreover, as proposed by Garrison et al. (2015), our participants may frame the morality of the environmental scenarios in different ways than participants of other studies.

In addition to context of environmental dilemmas and culture, the researcher proposes that epistemological beliefs and values are among the factors that are related with environmental moral reasoning. In the following sections, operationalization of epistemological beliefs and values are given. Then, relationships of epistemological beliefs and values with environmental moral reasoning are explained.

1.4 Epistemological Beliefs

Individuals' beliefs about knowledge and knowing are defined as epistemological beliefs (Hofer & Pintrich, 1997, 2002). More specifically, epistemological beliefs are "what individuals believe about the source, certainty, and organization of knowledge, as well as the control and speed of learning" (Schommer, 1994, p. 293). Some researchers adopt a unidimensional approach to describe epistemological beliefs and propose stage like patterns to explain their development (e.g., King & Kitchener, 1994; Perry, 1970, 1981). However, in the present study epistemological beliefs are conceptualized as a more or less independent belief system which is multidimensional in nature and does not have strict stage like developmental levels (Hofer & Pintrich, 1997; Schommer, 1990, 1994). This multidimensional approach seems to be more favorable to study epistemological beliefs since the construct of epistemological beliefs is fluid and dynamic in its nature (Zeidler et al., 2013). Moreover, using a multidimensional approach is more likely to capture the

complexity of epistemological beliefs and the potential links between epistemological beliefs and other constructs (Schommer, 1994). Accordingly, in the present study, epistemological beliefs of pre-service science teachers (PSTs) were studied by utilizing Schommer's (1990) multidimensional epistemological beliefs model. In this model epistemological beliefs are explained using five major dimensions: simple knowledge, certain knowledge, omniscient authority, quick learning, and innate ability. *Simple knowledge* reflects individuals' beliefs about the complexity of knowledge. People who have naïve beliefs in this dimension believe that knowledge is simple and consists of discrete facts. *Certain knowledge* is related with individuals' beliefs about the certainty of knowledge and this dimension ranges from the beliefs that knowledge is certain to knowledge is tentative. *Omniscient authority* reflects epistemological beliefs about the source of knowledge; that is, whether knowledge is handed down by the authority or generated from reason. *Quick learning* is thought of as a continuum that ranges from learning swiftly to gradually (or not at all). Finally, *innate ability* describes beliefs about the control of knowledge. Individuals, who recognize their own capacity, as well as the capacity of others to enhance learning ability, are viewed as having more sophisticated epistemological beliefs than those who believe that learning ability is fixed at birth.

Participants' beliefs about the five dimensions of epistemological beliefs (i.e., simple knowledge, certain knowledge, omniscient authority, quick learning, and innate ability) were measured by using Epistemic Beliefs Inventory (EBI) developed by Bendixen, Schraw, and Dunkle (1998) and Schraw, Dunkle, and Bendixen (1995). The scores obtained through this five-point Likert type scale were used to examine the structure of respondents' epistemological beliefs and the relationships between epistemological beliefs and environmental moral reasoning.

1.5 Values

Values are, basically, reflections of individuals' beliefs about the relative worth of things such as community, equity, justice, nature, environment, etc. (Hart, 2003). Operationalization of values in the present study is mainly based on Schwartz's (1992, 1994) value theory. In this theory, values are conceptualized as criteria that we use to judge events, actions, other people, and ourselves (Schwartz, 1992). Therefore, values and the order of their importance act as guiding principles in our lives (Schwartz, 1994).

Schwartz's (1992, 1994) value theory is regarded as the most comprehensive and useful theoretical framework that is derived from empirical data obtained from numerous countries and cultures (de Groot & Steg, 2007; Corraliza & Berenguer, 2000; Schultz, Gouveia, Cameron, Tankha, Schmuck, & Franek, 2005). Accordingly, it is utilized in many research studies, including environmental research. In his framework Schwartz identifies a total of 56 values that form 10 motivational types: power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security. These motivational types are grouped into four value categories (i.e., openness to change, tradition (conservatism), self-transcendence, and self-enhancement) which are grouped into two dimensions. First dimension is composed of two poles: values that stress independence and favor individuals' enhancing their intellectual and emotional interests (i.e., openness to change) versus values that stress tradition and conformity (i.e., conservatism/tradition). In the second dimension, values concerning welfare of others compose the first pole (i.e., self-transcendent) and values related to personal interests compose the second pole (i.e. self-enhancement). Value items composing the value types (motivational types) and value categories identified by Schwartz are presented in the Table 1.1.

Table 1.1

Value Items, Value Types, and Value Categories Identified by Schwartz

Self-transcendence	Self-enhancement	Openness to change	Tradition/Conservatism
<u>Universalism</u>	<u>Power</u>	<u>Self-direction</u>	<u>Tradition</u>
Protecting the environment	Social power	Creativity	Devout
A world of beauty	Authority	Curious	Respect for tradition
Unity with nature	Wealth	Freedom	Humble
Broad-minded	Preserving my public Image	Choosing own goals	Moderate
Social justice	Social recognition	Independent	Accepting portion in Life
Wisdom			Detachment
Equality	<u>Achievement</u>	<u>Stimulation</u>	<u>Conformity</u>
A world at peace	Successful	Daring	Politeness
Inner harmony	Capable	A varied life	Honoring parents and elders
	Ambitious	An exciting life	Obedient
<u>Benevolence</u>	Influential		Self-discipline
Helpful	Intelligent	<u>Hedonism</u>	
Honest	Self-respect	Pleasure	<u>Security</u>
Forgiving		Enjoying life	Clean
Royal			National security
Responsible			Social order
True-friendship			Family security
A spiritual life			Sense of belonging
Mature love			Reciprocation of favors
Meaning in life			Healthy

Note. Adapted from “Values as Predictors of Environmental Attitudes: Evidence for Consistency Across 14 Countries”, by P. W. Schultz and L. Zelezny, *Journal of Environmental Psychology*, 19, p. 256.

As explained previously, in Schwartz value theory values are conceptualized as criteria or principles that guide individuals’ lives. Accordingly, researchers who utilize this theory present a list of value items to their participants and ask them to rate the importance of each value as a guiding principle in their lives. In a similar way, in the present study a selection of 37 items (Schultz & Zelezny, 1998, 1999) identified in Schwartz value theory were used to examine values of pre-service science teachers (PSTs) and their relationships with environmental moral reasoning.

PSTs' responses were evaluated on a 9-point Likert type scale ranging from "opposed to my values" (-1) to "of supreme importance" (7).

1.6 Relationships of Epistemological Beliefs and Values to Environmental Moral Reasoning

In line with research revealing the importance of environmental moral reasoning for environmental attitudes, behaviors, and decision-making regarding the environmental issues (Bjerke & Kaltenborn, 1999; Kortenkamp & Moore, 2009; Seligman et al., 1994; Stern et al., 1993; Thompson & Barton, 1994), researchers have attempted to provide explanations for the differences in the ways individuals extend ethics to the environment and human-environment relationships. Some of the researchers concentrated on demographic factors such as gender, age and grade level. For instance, Stern and his colleagues (Stern et al., 1993; Stern et al., 1995) and Zelezny et al. (2000) investigated whether males and females differed in their moral orientations toward the environment. Littledyke (2004), Kahn (1997), and Kahn and Lourenço (2002) studied the influence of age and grade level on environmental moral reasoning patterns. Some other researchers such as Kortenkamp and Moore (2001, 2009) examined the influence of information presented in environmental dilemmas (i.e., harmful effects on the environment/humans, type of land (pristine/agricultural), presence of social conflict, and intentions of the environmentally damaging actions) as a reflection of the effects of situational factors on individuals' environmental moral reasoning. In a similar way, Berenguer (2010) examined whether empathy conditions (high/low) and objects of empathy affected participants' moral reasoning about the environment or not.

Some researchers included cognitive and affective characteristics of individuals in their studies and examined the relationships between expression of environmental moral reasoning and these variables. As an example, Nevers et al. (1997) studied whether biological knowledge and aesthetic values, in addition to gender and

familiarity with the environment, had an influence on environmental moral reasoning. Zeidler and Schafer (1984) investigated the extent science content knowledge (ecology comprehension), general moral reasoning abilities, environmental attitudes (in terms of verbal commitment, actual commitment, and affect), past experiences and science orientations (science major/non-science major) mediated the formation of moral judgments on environmental moral dilemmas. Their result showed that all of the variables other than two subcomponents of environmental attitude (i.e., verbal commitment and actual commitment) were influential for environmental moral reasoning. Findings of Tuncay et al.'s (2012) study also revealed the relationships between cognitive (e.g., knowledge) and affective factors (e.g., moral emotions) and patterns of moral reasoning regarding environmental issues.

The present study shares the same motivation of contributing to knowledge about environmental moral reasoning and the factors that may be related with it. Accordingly, overarching purpose of this study was to provide explanations about how epistemological beliefs and values of PSTs were related to their moral reasoning regarding environmental issues. In the following subsections, these hypothesized relationships are explained in more detail.

1.6.1 Epistemological Beliefs and Environmental Moral Reasoning

Owing to their complex and ill-structured nature, many environmental issues are regarded as socioscientific issues (SSI) (Lee, Chang, Choi, Kim, & Zeidler, 2012; Lee, Yoo, Choi, Kim, Krajcik, Herman, & Zeidler, 2013; Sadler, 2004; Zeidler, 2003, 2014). Similar to other SSI, their resolution requires considering many facets of the issues including ethical and moral concerns (Lee et al., 2012; Zeidler & Nichols, 2009). At this point, based on the reasons explained below, finding relationships between environmental moral reasoning and epistemological beliefs becomes intuitively obvious.

Epistemological beliefs are reflections of how individuals conceptualize issues and justify their decisions related to them (Zeidler, Herman, Ruzek, Linder, & Lin, 2013). Moreover, research shows that epistemological beliefs of individuals influence their approaches to new information as well as the meaning they make about the information they encounter (Hofer, 2002). Therefore, epistemological beliefs of individuals influence their understanding of and reasoning about issues surrounding them, especially the ones which are ill-structured and lack definite solutions (Schraw et al., 1995). Furthermore, as also revealed in Zeidler et al.'s (2013) study, epistemological beliefs are embedded in emotive reasoning which includes application of moral emotions such as care, empathy, sympathy, and concern.

These features of epistemological beliefs imply close relationships among epistemological beliefs and moral reasoning because critical analysis of available and relevant information embedded in issues is a prerequisite for informed moral reasoning and subsequent moral judgments (Simmons & Zeidler, 2003). Accordingly, in the present study it was hypothesized that there are relationships among PSTs' epistemological beliefs and environmental moral reasoning. More specifically, PSTs' beliefs about the structure, certainty, and source of knowledge as well as control and speed of learning were hypothesized to be related to how they approach and interpret information regarding environmental issues (in this study, information presented in environmental moral reasoning scenarios). Similarly, sophistication of PSTs' epistemological beliefs was hypothesized to be related to the effort they devoted for the resolution of moral issues embedded in the environmental dilemma scenarios, which would result in differences in their environmental moral reasoning patterns. For instance, in the picnicking scenario there was not any explicit information about the possible outcomes of the action that the character in the scenario might choose to perform (i.e., leaving garbage after picnicking) and their moral implications. Only some specific individual facts were given about the context of the dilemma (e.g., picnic area is in a state park, all trash cans in the picnic area are full, there is no one else at the picnic area, etc.). Therefore, PSTs needed to

integrate and interpret the available information in order to comprehensively reason about the scenario's moral aspects. At this point, it was hypothesized that respondents' epistemological beliefs would be related to the efforts they devoted to carry out these processes or their achievement in performing them. For example, it was hypothesized that PSTs' who had naïve beliefs in *quick learning* epistemological belief dimensions would not devote enough time or concentrated effort while reasoning about the various moral aspects embedded in the scenario. Conversely, they were anticipated to show a tendency to arrive at solutions or decision making quickly by considering only the explicitly available information. As another example, it was hypothesized that PSTs who had naïve beliefs in *simple knowledge* epistemological belief dimension would be less successful in inferring that leaving garbage in the picnic area (which is in a state park) would give harm to the non-human species living there even they knew the meaning of state park. Therefore, these PSTs were anticipated to exhibit less ecocentric (i.e., nature-centered) moral considerations when compared to their counterparts who had more sophisticated epistemological beliefs in this dimension.

1.6.2 Values and Environmental Moral Reasoning

Similar to epistemological beliefs, values were hypothesized to be related to moral reasoning of PSTs that they exhibited towards environmental moral dilemmas. Justification for this hypothesis comes from the related literature. To begin with, values are found to influence the way how individuals perceive and interpret information about the issues they come across (Stern et al., 1995). Therefore, values play vital roles in individuals' conceptualizations of and reasoning about issues and accompanying problems as well as the analysis and construction of their related solutions (Simonneaux & Simonneaux, 2009). By this way, values act as guiding principles in individuals' lives and influence their judgments about various situations including environmental ones (Garrison et al., 2015).

In fact, values and value conflicts are embedded in most of the environmental issues. For example, what is deterministic on approaches to and preferences of public and private transport may, to a large extent, be the relative value given to protecting the environment or pursuing comfort in everyday life (Karp, 1996). Number of these examples can be increased (e.g., buying organic product, which are healthier and more environment-friendly but more expensive). Findings of empirical research which reveal relationships of values with environmental orientations, decision-making processes, concerns, attitudes, and behaviors (Corraliza & Berenguer, 2000; de Groot & Steg, 2007; Karp, 1996; Kollmus & Agyeman, 2002; Nordlund & Garvill, 2002; Schultz et al., 2005; Schultz & Zelezny, 1999; Stern & Dietz, 1994; Stern et al., 1999; Stern et al., 1995) also support the contention that environmental issues involve value conflicts in them. When we consider these conflicts as dilemmas which encompass varying levels of morality (Karp, 1996), it seems reasonable to expect relationships between values and moral reasoning of individuals about environmental issues, as realized in the present study. Moreover, although researchers of these studies did not explain the relationships they found within the framework of moral reasoning, they adopted a similar approach with the present study by using categorizations of self-centrism (egocentrism), human-centrism (focusing on other people/altruism/anthropocentrism), and nature-centrism (ecocentrism/biocentrism). Therefore, findings of these research studies can also be regarded as evidences for the existence of relationships between values and environmental moral reasoning. Studies which reveal the influence of values on environmental moral norms (i.e., feelings of obligation to act more pro-environmentally) (e.g., Dietz, Fitzgerald, & Shwom, 2005) and the ones which explain how values inform environmental ethics (Kronlid & Öhman, 2013; Palmer, 1997; York & Becker, 2012) provide comprehensive justifications for the rationale of value-environmental moral reasoning relationships. For example, Kronlid and Öhman (2013) proposed value-oriented environmental ethics as a dimension of their environmental ethical conceptual framework. The researchers benefited from a variety of discourses (e.g., moral philosophy and ethics, intrinsic value discourse, etc.) to explain this dimension and its two categories (value-oriented anthropocentric

environmental ethics and value-oriented non-anthropocentric environmental ethics). For instance, different viewpoints about the identity of the term *moral object* (an object of moral relevance) were discussed from an instrumental value versus intrinsic value perspective. According to this perspective, ethical orientations that consider humans as the only holder of intrinsic value were categorized as anthropocentric. On the other hand, acceptance of non-human entities as holders of intrinsic value was regarded as an indication of a non-anthropocentric orientation to environmental ethics. Similarly, in their discussions the researchers stated that different viewpoints about the relative value of one's well-being, interests, functions, etc. are influential on individuals' moral reasoning about the environment. In here, the one can be anything including humans, non-human species, ecosystems, landscapes, and so on.

1.6.3 Proposed Model

Based on the above mentioned issues, epistemological beliefs and values are perceived to be among the factors that are related with the ways how individuals extend ethics to environmental issues. Accordingly, in the present study it was expected to find relationships among PSTs' patterns of moral reasoning about the moral dilemmas presented in the four environmental scenarios (i.e., hiking, picnicking, fishing, camping) and their epistemological beliefs and values. As explained in the previous subsections (subsections 1.6.1 and 1.6.2), literature provides supporting evidence for the existence of these hypothesized relationships. In the study, a model was proposed to examine the nature of the relationships among the constructs of the study. As seen in Figure 1.1, in this model it was proposed that epistemological beliefs and values are related to environmental moral reasoning and explain differences in environmental moral reasoning patterns. With this model it was aimed to test the possible relationships of epistemological beliefs and values with environmental moral reasoning patterns of PSTs in a more holistic way. This

would make it possible to provide more comprehensive explanations about individuals’ reasoning about the moral aspects of environmental issues and the dilemmas that may be embedded in them. To test the proposed model, path analysis – a special case of structural equation modeling (SEM) – was used. Path analysis is a quantitative analysis method which enables researchers to test the interrelatedness of multiple variables simultaneously. At the same time, it provides information about the relative importance of each variable for the model (Tabachnick & Fidell, 2007).

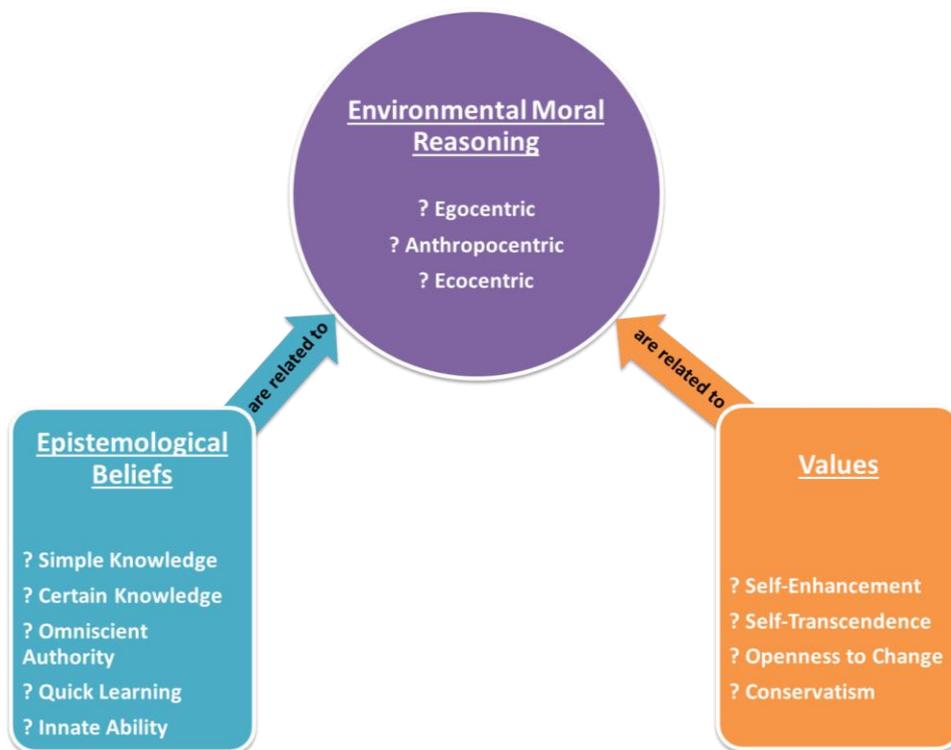


Figure 1.1 Graphical representation of the study constructs and hypothesized relationships

Question marks used in Figure 1.1 indicate that dimensions of environmental moral reasoning, epistemological beliefs, and values, which constituted the variables of the path analysis, were not pre-determined. That is to say, environmental moral scenarios and related questions developed by Persing (2006) which were used to collect data on PSTs’ environmental moral reasoning utilizes a tripartite

classification (egocentric, anthropocentric, ecocentric). Epistemic Beliefs Inventory (EBI) (Bendixen et al., 1998; Schraw et al., 1995) that was used to investigate participants' epistemological beliefs is based on Schommer's (1990) epistemological beliefs model, which proposes five epistemological belief dimensions (simple knowledge, certain knowledge, omniscient authority, quick learning, innate ability). Similarly, the four value categories (openness to change, conservatism, self-transcendence, self-enhancement) are the value categories identified in Schwartz's (1992, 1994) value theory and Schultz and Zelezny' (1998, 1999) instrument which were used to investigate values of the participant PSTs. However, although related theories, models, and literature provide a general picture about the categorizations (dimensions) of environmental moral reasoning, epistemological beliefs, and values, empirical data may reveal differences. Accordingly, depending on the characteristics of the study sample (e.g., culture, age) different categorizations may emerge. Literature also supports the assumption that structures of epistemological beliefs, values, and moral reasoning, as well as their relationships, may change depending on the culture that individuals belong to (Garrison et al., 2015). In this respect, it was especially reasonable to be open to new categorizations in environmental moral reasoning and values in the present study because instruments used for collecting data on these constructs had not been used in Turkey's context before. As a result, decisions of the variables to be entered to the proposed path model, which constituted the dimensions of epistemological beliefs, values, and environmental moral reasoning patterns, were based on factor analyses of the data.

1.7 Research Questions

Main purpose of the study was to examine relationships of PSTs' epistemological beliefs and values to their environmental moral reasoning patterns. To investigate the hypothesized relationships within the contexts of the four environmental moral dilemmas (i.e., hiking, picnicking, fishing, camping) path analyses were conducted. Path analysis is a special case of structural equation modeling (SEM) technique

which considers simultaneous interrelatedness among the variables and reveals their relative importance for the model, thus allows for complete and simultaneous tests of all the relationships (Tabachnick & Fidell, 2007). Therefore, use of path analysis in the present study made it possible to simultaneously investigate the relationships of PSTs' epistemological beliefs and values to their environmental moral reasoning patterns. Analyses served for answering the following research question, which was tailored as the overarching research question of the study:

Overarching Research Question: To what extent, if any, are environmental moral reasoning patterns of pre-service science teachers predicted by their epistemological beliefs and values?

Rationale: Environmental moral reasoning is a comprehensive construct that includes both affective and cognitive elements in it (Greely, 2008; Persing, 2006; Tuncay et al., 2012, Tuncay-Yüksel, Yilmaz-Tuzun, & Teksoz, 2015; Zeidler & Schafer, 1984). Correspondingly, with an attempt to explain environmental moral reasoning in a holistic way, a path model was proposed to be tested throughout the study. Epistemological beliefs and values were included in the proposed model since they are regarded among the basic components of cognitive (Bendixen et al., 1998) and affective (Corraliza & Berenguer, 2000) domains, respectively. Moreover, these two constructs play important roles in individuals' perceptions and evaluations of issues, which are related to their reasoning about the morality of the issues including environmental ones (Littledyke, 2008). Nevertheless, investigation of their relationships with environmental moral reasoning explicitly remains to be an empirical question. Accordingly, in the present study relationships of PSTs' epistemological beliefs and values with their environmental moral reasoning patterns were simultaneously tested.

The following sub-research questions were also tailored to address key facets of this research:

Sub-Research Question 1: How are epistemological beliefs of pre-service science teachers related to their environmental moral reasoning?

Rationale: Previous research findings propose epistemological beliefs as indicators of individuals' awareness about the various aspects of the issues, interpretations of information, approaches for understanding and solving issues as well as their related solutions, and tendencies for constructing their own moral standards (Bendixen, Schrwaw, Dunkle, 1998; Schommer, 1990, 1998; Walker, Rowland, Boyes, 1991). These findings also imply existence of relationships among epistemological beliefs and moral reasoning (Bendixen et al., 1998; Mintchik & Farmer, 2009; Topcu, 2011; Walker et al., 1991). Nevertheless, despite the vital role of moral reasoning for decision-making, attitudes, and behaviors related to the environment (Palmer, 1997; Tilbury, 1995), in the literature there is not any research that specifically examines the relationships of epistemological beliefs to moral reasoning about environmental issues. Accordingly, findings of the study related to this research question were expected to fill the gap in the literature by empirically testing the relationships of PSTs' epistemological beliefs with their environmental moral reasoning.

Sub-Research Question 2: How are values of pre-service science teachers related to their environmental moral reasoning?

Rationale: Most of the environmental issues involve conflicts such as conflicts between collective and individual interests (e.g., desire for protecting the environment but unwillingness to pay the associated costs which usually mean less comfort in everyday life) (Karp, 1996). Therefore, many of the environmental decisions can be regarded as indicators of priority preferences among values (Nordlund & Garvill, 2002), which are basically defined as relative worth of things for individuals (Hart, 2003). Correspondingly, values are regarded among the most important variables that are correlated with environmental attitudes, concerns, decision-making processes, and behaviors (Corraliza & Berenguer, 2000; Karp, 1996; Stern et al., 1999; Stern et al., 1995). Moreover, values are proposed to be

central to many kinds of moral analyses, including analysis of moral aspects of environmental issues, since they are related to moral norms and beliefs (Dietz, Fitzgerald, & Shwom, 2005). Therefore, expecting relationships between values and individuals' ways of extending ethics to the environmental issues is reasonable. In fact, based on the vital role of values on morality and moral reasoning, any attempt to explain environmental moral reasoning without taking values into consideration may be deficient. Correspondingly, in the present study relationships of PSTs' values with their environmental moral reasoning were empirically examined.

1.8 Significance of the Study

Although the importance of morality for studying and developing human-environment relationships seems intuitively obvious, the actual number of studies that utilize theories of moral reasoning and development as applied to environmental conservation and sustainability research fields is relatively few (Karpiak & Baril, 2008). Nonetheless, research findings suggest empirical evidence for further exploration of individual's moral orientations toward environmental issues. To this end, some classifications are proposed to help identify and explain different environmental moral orientations.

Possible variables that are related to individuals' environmental moral orientations and subsequent environmental moral reasoning patterns still remain to be explored. For instance, what may be the possible reasons that some of the undergraduate students in Kortenkamp and Moore's (2001) study exhibited more ecocentric considerations toward the environmental moral dilemmas than others? Likewise, why did other undergraduate students give more importance to the human related aspects of those environmental moral dilemmas? In their study, Tuncay et al. (2012) provided some explanations regarding the possible variables that are associated with differences in environmental moral reasoning patterns. The researchers conducted interviews with pre-service science teachers. Their analyses of the interviews

revealed a number of variables such as moral emotions, popular culture, experiences, knowledge, and locality. However, it is clear that literature requires more comprehensive and generalizable explanations to clarify the variables that may explain variances in individuals' environmental moral reasoning patterns. In this respect, the present study aimed to contribute to the literature by empirically examining relationships of PSTs' epistemological beliefs and values with their environmental moral reasoning.

In addition to its potential in providing important explanations that add to the literature on the issue of predictors of environmental moral reasoning patterns, the present study bears additional importance owing to its participants who were pre-service science teachers (PSTs). Similar to some other countries such as Singapore and Denmark (Blum et al., 2013), in Turkey there is not a particular environmental education course but environment related issues are incorporated mostly in science education curricula. Hence, findings obtained from the investigation of PSTs' environmental moral reasoning and its relationships to epistemological beliefs and values may have important implications and contributions for the country's science and environmental education. That is to say, findings of the study will serve for the common aims that are implicitly or explicitly present in science and environmental education such as teaching/learning about the world surrounding us and how to live in it (Carter & Simmons, 2010) and cultivating ethical sensitivity and awareness regarding human-environment relationships (Bodzin, Klein, & Weaver, 2010).

As explained previously, in the study relationships of PSTs' environmental moral reasoning with their epistemological beliefs and values were studied. Related findings have potential to have significant implications for teacher education programs. For instance, providing empirical evidence for the relationships among sophisticated epistemological beliefs and higher levels of moral reasoning about environmental issues would have important implications for the necessity of developing PSTs' epistemological beliefs in teacher education programs. In the same way, particular values found to be more related to higher levels of

environmental moral reasoning would imply the requirement of their cultivation through teacher education programs. Nevertheless, studying these variables and their relationships with a sample of PSTs is not only important for developing pre-service science teacher education programs. Literature shows that pre-service teacher education has multiplier effects on society because its scope not only includes future teachers but also reaches to a far greater number of students they will teach when they start their profession (Powers, 2004). Accordingly, education of environmental educators is regarded to be very important for the overall success of environmental education (May, 2000) and solutions of environmental problems (Palmer, 1998). In this respect, educating PSTs through more developed educational programs would carry its effects to their future students and the whole society. By this way, it is hoped to contribute to the cultivation of environmental ethics in the society which is constituted of individuals who exhibit higher levels of moral reasoning toward environmental issues.

1.9 Summary

In the previous sections of the chapter, the important role of morality in individuals' reasoning about environmental issues and the necessity of cultivating moral perspectives through environmental education were explained. In this context, environmental moral reasoning was proposed as a promising construct to be studied to understand moral orientations of individuals regarding environmental issues and human-environment relationships. Since environmental moral reasoning includes both cognitive and affective elements in its nature (Greely, 2008; Persing, 2006; Tuncay et al., 2012; Zeidler & Schafer, 1984), and since perceptions and understanding about the issues and emotional motivation for their solutions are regarded as the bases of extending ethics to the environment (Littledyke, 2008), epistemological beliefs and values were hypothesized to be significant predictors of environmental moral reasoning patterns. Accordingly, a model was proposed to

explain environmental moral reasoning patterns of PSTs in relation to their epistemological beliefs and values.

For investigation of PSTs' environmental moral reasoning patterns, tripartite categorization of egocentric, anthropocentric, and ecocentric moral reasoning was utilized. The rationale for the preference of this tripartite categorization over a binary categorization (i.e., anthropocentric vs. ecocentric/biocentric) was its power to provide a clear picture of individuals' extension of ethics/morality to environmental issues and correspondence with the theories and models proposed on moral development and moral reasoning. This tripartite classification (i.e., egocentric, anthropocentric, ecocentric) constituted the first dimension of the analytical framework that was used for examining PSTs' responses to the environmental moral reasoning scenarios. In addition to this dimension, which can be named as center of moral concern, reference group or circle of moral relevance, a second dimension that focused on underlying reasons of environmental moral considerations was used. With the help of this two-dimensional analytical framework, it was aimed to examine the complex structure of environmental moral reasoning in a more effective way (Kronlid & Öhman, 2013; Wiseman & Bogner, 2003).

For investigation of PSTs' epistemological beliefs, Schommer's (1990) multidimensional epistemological beliefs model, which conceptualizes epistemological beliefs as a more or less independent belief system was adopted. The reason of selecting this multidimensional model was its appropriateness for studying the construct of epistemological beliefs, which is fluid and dynamic in its nature (Zeidler et al., 2013). Moreover, literature proposes use of this multidimensional approach as a promising way to capture the complexity of epistemological beliefs and the potential links between epistemological beliefs and other constructs (Schommer, 1994). In Schommer's model, epistemological beliefs are categorized as simple knowledge, certain knowledge, omniscient authority, quick learning, and innate ability epistemological belief dimensions. Finally, for

investigating PSTs' values, Schwartz's (1992, 1994) value theory was used since this theory is regarded as the most comprehensive and useful theoretical framework proposed on values (de Groot & Steg, 2007; Corraliza & Berenguer, 2000; Schultz et al., 2005). In the study, Schwartz's four value categories (i.e., openness to change, conservatism, self-transcendence, and self-enhancement) were regarded as *potential* categories (dimensions) that might be obtained as the variables of the data analyses (e.g., path analysis). More specifically, value dimensions held by PSTs' were investigated through factor analyses of the related data first. The resulting factor solutions revealed the actual variables of the data analyses. The same approach was also applied to data on PSTs' environmental moral reasoning and epistemological beliefs. Therefore, as explained in more detail in section 1.6.3, dimensions of the study constructs (i.e., environmental moral reasoning, epistemological beliefs, and values) were not pre-determined but were decided according to factor analyses of empirical data.

In order to simultaneously test the relationships of PSTs' epistemological beliefs and values with their environmental moral reasoning, a model was proposed (Figure 1.1). Specific research questions of the study and their rationale were given in Section 1.7. Findings of the study are believed to have important contributions to the literature on environmental moral reasoning. Moreover, implications derived from the research have potential to provide important educational insights.

CHAPTER II

LITERATURE REVIEW

The overarching purpose of this study was to examine relationships of environmental moral reasoning with epistemological beliefs and values. Correspondingly, literature on environmental ethics, moral reasoning and development, epistemological beliefs, and values were reviewed. Moreover, since the study was carried out with pre-service science teachers and findings of the study and their implications were interpreted within environmental education context, literature on environmental education and the role of (pre-service) teacher education in it was reviewed and presented in the chapter. Since review of this literature contributed to the rationale and theoretical background of the study as well as insight about methodological choices, information about the designs and methodologies of key studies are also provided. The chapter evolves around five main themes: environmental education (EE), environmental ethics, environmental moral reasoning, epistemological beliefs, values, and (pre-service) teacher education within the context of EE. Identification of the studies for review was based on their relevance to these themes. Nevertheless, based on their contribution to the related literature some of the research that did not name their study constructs under these headings was also reviewed. For instance, research studies that examined differences in environmental orientations from an environmental attitude, rather than environmental moral reasoning, perspective were also selected for the review. For the review of the literature, the researcher extensively utilized library facilities of Middle East Technical University and University of South Florida for electronic and printed resources including journal articles, books, and dissertations.

Organization of this literature review chapter flows in a systematic way that is aligned with the rationale and research questions of the study. First, a conceptual framework of environmental education and environmental ethics as well as place of environmental ethics in environmental education is presented to clarify the starting point and the rationale of the study. Then, research on environmental moral reasoning together with its place in and connection with the broader construct of moral reasoning is explained. After presenting the overall picture, in line with the research questions of the study, analyses of research studies conducted on epistemological beliefs and values and their relationships with environmental moral reasoning are provided. Then, importance of (pre-service) teacher education for environmental education is presented with supporting evidences from the landmark documents and research studies published on environmental education. Finally, a summary that tied the main themes of the reviewed research is given at the end of the chapter.

2.1 A Conceptual Framework for Environmental Education

It has long been accepted that humans lie at the core of the environmental crisis both as the main contributors for its emergence and the most promising agents for its solution (Kopnina, 2012; Marcinkowski, 2009; Stapp et al., 1969; Winter, 2000). For instance, in 1973 Maloney and Ward described environmental (ecological) crisis as “a crisis of maladaptive behavior” (p.583), which dictated a solution in terms of creating changes in individuals. The researchers conceptualized the issue (environmental crisis) as an outcome of increases in population, consumption, and demand. What they proposed for an effective solution was population-wide changes in the society which could be achieved through education. The call for education as a fundamental means for creating desired changes in the society and contributing to the solution of environment related problems has been repeated by many other scholars during the history (Sauve, 2005; Stapp et al., 1969; Tilbury, 1995). Responses to these calls emerged as applications of environmental education, which

showed some variances in terms of their conceptualization of the environment, specific aims, and approaches and strategies they utilized for achieving those aims (Sauve, 2005).

Among these, Nature Study, Outdoor Education, and Conservation Education can be regarded as the early forerunners of environment-related education (Kopnina, 2012; Marcinchowski, 2009; Tilbury, 1995). Nature Study conceptualized the environment mostly as nature and mainly focused on reconstructing links between humans and nature (Sauve, 2005). This educational movement, which dominated late 19th and early 20th century, had a romantic and spiritual approach. Educators used fables and moral lessons for exploration of human values in order to reach their aim of fostering appreciation towards nature in their learners and in the society at large (Cronon, 2015). Outdoor education had a similar motivation. Exploring interdependence of all living beings, cultivating respect and admiration for life, and forming land ethics were the fundamentals of this educational movement (Passmore, 1972). As a teaching approach, an ecological perspective was adopted and out-of-door direct experiences with nature (e.g., field trips, nature camps) were encouraged (Johnson, 1977). On the other hand, with the influences of high levels of pollution, land abuse, and subsequent signs of resource depletion, Conservation Education had a relatively utilitarian perspective regarding the environment. Within Conservation Education the environment was mostly conceptualized as a resource (Sauve, 2005). Correspondingly, conservation of natural resources constituted the primary objectives of related educational programs (Johnson, 1977; Marcinkowski, 2009; Stapp et al., 1969). A variety of educational approaches (e.g., learning by doing, integrated and interdisciplinary education) were used to promote behaviors and skills that are compatible with environmental conservation (McCrea, 2006). Nevertheless, by some scholars, restricting environment-related education to conserving resources was found to be insufficient and ineffective for solving environmental problems (Stapp et al., 1969). Maybe with an additional influence of the “Earthrise” (the phenomenon emerged after the first picture of earth taken from space was published), definitions of environment was broadened to include humans,

their surroundings, community, planet, and even the universe (Johnson, 1977). Conceptualization of the environment within this broader outlook contributed to the foundation of Environmental Education. The main focus of this “new” educational movement was to protect the natural environment and biosphere by reducing human impacts (McCrea, 2006). In 1969, Stapp and his colleagues provided one of the first definitions of Environmental Education. In their definition, the emphasis on the role and responsibilities of individuals for solving environment related problems was clearly evident. The researchers defined Environmental Education as: “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” (Stapp et al., 1969, p. 31).

For a complete and comprehensive conceptual framework for environment-related education and its evolution in time, intergovernmental and international agendas and their related documents should also be examined. The United Nations Conference on The Human Environment held in 1972 in Stockholm, Sweden (UN, 1972) can be regarded as one of the first attempts to envision environmental issues from a common (worldwide) outlook and establish an international programme in environmental education. In the conference report (also named as *Stockholm Declaration*), environmental education was suggested to include all levels of education and was recommended to be implemented in out-of-school and in-school contexts with an interdisciplinary approach (UN, 1972; Recommendation 96). In addition to outlining basic principles of environmental education (EE) with the Stockholm Declaration, the conference contributed to the development, promotion, and funding of EE with the creation of UNESCO/UNEP International Environmental Education Program (IEPP) (McKeown & Hopkins, 2003). IEPP organized International Workshop on Environmental Education in Belgrade-Yugoslavia in 1975 and Intergovernmental Conference on Environmental Education in Tbilisi-Georgia in 1977, which were very important for the foundation of EE. *Belgrade Charter* documented after 1975 workshop (UNEP/UNESCO, 1975) was

an historic document that outlined the fundamental ideologies, principles, and strategies of EE. In the goal statement of EE and in the specific EE objectives listed in the Charter, awareness, knowledge, attitude, skills, evaluation ability, participation ability were proposed as the agents that are required for fostering human-environment relationships and solutions of environmental problems. At the beginning of the document an introduction was presented to describe environmental situation of the time. In this introduction, an urgent call for ‘a new global ethic’ was proposed with the words of:

We need nothing short of a new global ethic – an ethic which espouses attitudes and behaviour for individuals and societies which are consonant with humanity’s place within the biosphere; which recognizes and sensitively responds to the complex and ever-changing relationships between humanity and nature and between people.

The *Tbilisi Declaration* documented after the first intergovernmental conference on environmental education (UNESCO, 1977) was another milestone for EE and still continues to guide goals, objectives, and principles of EE applications of today (McCrea, 2006). In the declaration, EE was conceptualized as a lifelong education that should be provided for all ages and at all levels in formal and non-formal educational contexts. The report started with information about the situation of environmental problems and the crucial role of education for solving them. References were made to ethics (e.g., ethical dimension of development) to explain interrelationships between natural and man-made environment and the place of individuals in these interrelationships. Similarly, “improving life and protecting the environment with due regard given to ethical values” (UNESCO, 1977, p.24) was among the overarching goals of EE described in the declaration. A holistic and interdisciplinary approach aimed at promoting awareness, sensitivity, knowledge, attitudes, values, concerns, motivation, skills (e.g., critical thinking, problem solving), and active participation were suggested with regard to the implementation of EE practices.

In the following years, with the increasing need of balancing economic development and environmental conservation (Tilbury, 1995), the terms sustainability and sustainable development were introduced to the overall intent and goals of environment-related education (McKeown & Hopkins, 2003). In the *Brundtland Report* (also known as *Our Common Future*) (WCED, 1987), necessity of combining environmental concerns with concerns related with development in a socioeconomic and political context was highlighted (Tilbury, 1995). This change in the conceptualization of environmental problems and their solutions was also reflected in the report of United Nations Conference on Environment and Development which was held in Rio de Janeiro-Brazil in 1992 (UN, 1992). In the conference report (named as *Agenda 21* or *Earth Summit*) a call was made to reorient education towards sustainable development. Chapter 6 of the *Agenda 21* was devoted to “promoting education, public awareness, and training”. Explanations in the related paragraphs pointed to the importance of education for fostering the capacity of humans and societies through “achieving environmental and ethical awareness, values and attitudes, skills and behaviour consistent with sustainable development and for effective public participation in decision-making” (UN, 1992). A multidisciplinary approach applied through formal and non-formal education methods was adopted as an educational strategy. This educational movement was then termed as Education for Sustainable Development (ESD) and took place in the documents of the subsequent conferences and commissions (McKeown & Hopkins, 2003). In some reports such as *Shaping the Future* (final report of UNESCO on UN Decade of Education for Sustainable Development) a number of themes (i.e., climate change, disaster risk reduction, sustainable livelihoods, sustainable consumption) were proposed to be reflected in the programs of this educational movement (UNESCO, 2014). Today we can also see that some of the educational programs may take specific names depending on the emphasis they place on the specific themes of ESD. For example, programs which specifically focus on the issue of climate change and aim to educate learners who are more aware about the reasons and impacts of it and who have the necessary attributes to adopt it (e.g.,

critical thinking, systems thinking, collaborative decision making) are named as Climate Change Education (UNESCO, 2010).

As explained in the above paragraphs, the history of environment-related education dates back to many years. During this long history an array of educational movements and related educational programs have arisen (e.g., Nature Study, Outdoor Education, Conservation Education, Environmental Education, Education for Sustainable Development). Writings in the related literature show us the efforts of some scholars to distinguish between these educational programs. Sometimes these efforts were based on concerns of losing place in curriculum applications and limited resources (McKeown & Hopkins, 2003). In 1970s and 1980s, these discussions revolved around comparisons between emerging field of EE with established fields of outdoor education, nature study, and conservation education (e.g., Passmore, 1972). Today, similar debates are conducted over EE and ESD relationship (Kopnina, 2012). As also stated by Marcinkowski (2009), there is not a single way to frame this relationship. Conversely, there are a variety of viewpoints regarding EE-ESD relationship (Blum et al., 2013, Eilam & Trop, 2011; McKeown & Hopkins, 2003). For instance, Marcinkowski (2009) see ESD as a separate educational movement and states that the relationship between EE and ESD resembles the relationships between EE and its forerunners (i.e., outdoor education, nature study, and conservation education). In his view, the latter ones built upon the former ones but have developed their own purposes and practices as well as infrastructures and program sites. Some other scholars perceive ESD as one of the goals (McKeown & Hopkins, 2003) or perspectives (Sauve, 2005) of EE. On the other hand, Blum et al. (2013) perceive EE (and climate change education) as a term that is related with and included in ESD. Writings also include discussions that compare contradictory claims proposed on EE-ESD relationship (e.g., EE is a subset of ESD vs. ESD is a subset of EE, EE and ESD are the same thing vs. EE and ESD are two separate things), which generally revolve around debates about the degree and nature of overlap between the two fields of education (Eilam & Trop, 2011).

Some other scholars used the term environmental education in a generic way. For instance, in her study Sauve (2005) presented a typology of pedagogical approaches related to environment (e.g., Outdoor Education, Education for Sustainable Development). For her typology she used environmental education as a general term and entitled her study as “Currents in environmental education: Mapping a complex and evolving pedagogical field”. Similarly, Orr (1992) called all types of environment-related education as environmental education regardless of the differences in their content, practices or areas of emphasis. In the present study, a similar approach is adopted and environmental education (EE) is used as a broad term that includes environment-related educational practices in general.

2.2 Ethics in Environmental Education

Ethics is “the ability to adequately define and realize *correct* or *good* action based upon some set of values or belief structure” (York & Becker, 2012, p.2). Therefore, it includes and shapes human relationships with and approaches towards other humans and nature (Garrison et al., 2015; York & Becker, 2012). Accordingly, since at the heart of environmental education lays the issue of human-environment relationships (Bonnett, 2002, 2007), ethics has revealed itself as an important part of educational movements and programs related to the environment. For instance, moral lessons were used in Nature Study to foster admiration towards nature in their learners and promote human-environment relationships (Cronon, 2015). Similarly, establishing land ethics and educating individuals who love and respect nature were stated to be among the overarching goals of Outdoor Education (Passmore, 1972).

The trace of the vital place of ethics in environmental education can also be found in the landmark documents related to environment and environmental education. In *Belgrade Charter* (UNESCO, 1975) and the *Tbilisi Declaration* (UNESCO, 1977) the issue of ethics and its importance were explicitly declared in the forms of an urgent call for “a new global ethic” and recommendations on the necessity of a new

ethic that includes respect for nature, respectively. In the *Tbilisi Declaration*, a mistaken ethical conception about human-environment relationships was proposed among the causes of ecological crisis and necessity of restoring educational systems on ethical values and developing environmental education programs accordingly were stated. In the reports of the United Nations Conference on Environment and Development (*Agenda 21*; UN, 1992) and World Summit on Sustainable Development (UN, 2002), which aimed to strengthen and improve implementation of *Agenda 21*, the issue of ethics and its importance was also stated. In these reports, references were made to the necessity of considering ethical issues in decision making processes (e.g., political, organizational) and integrating ethics into education curricula and research.

When we look at the most recent writings published on environmental education, we can see that the importance of ethics has been acknowledged by many scholars. This acknowledgement is generally based on the fact that many of the environmental issues we face today are ethical issues at the same time and include moral dilemmas in them (Kronlid & Ohman, 2013). For instance, Kronlid and Ohman argued that ethics should be an integral part of environmental education research and practice because most of the problems faced /will be faced by disadvantaged people, future generations, and many non-human species are, to a large degree, due to non-environmental lifestyles (e.g., high-consumerism) of some privileged groups. The example given by Marcinkowski (2009) may also be a very striking example for this: United States is the largest emitter of greenhouse gases which are among the main contributors of anthropogenic climate change although its population represents only about 5% of the world's population.

The famous saying of Elbert Einstein “The significant problems we face cannot be solved at the same level of thinking that we used when we created them” is very inspiring as a foundational rationale for integrating ethics in environmental education. It seems that Garrison et al. (2015) followed a very similar rationale. In their article the researchers argued that in order to deal with environmental problems

in an effective way we should first change our thinking patterns which created them. The change they proposed included critical thinking and creation of new ethical, epistemological, and aesthetical values. They pointed to educative moments as invaluable moments where it becomes possible to change old values through some processes (i.e., value conflict, value criticism, value creativity, and value judgement) to new ones which are more pro-environmental. In a similar way, Kronlid and Ohman (2013) explained the moral issues (e.g., economic, social, psychological, etc.) embedded in environmental issues and accompanying environmental problems and stated the need for continuous reflection on values in environmental education. According to the researchers, continuous reflection on values is very vital in EE research and practice because it enables to better see the morality in environmental issues and human-environment relationships. Moreover, Kronlid and Ohman stated the importance of studying the processes of moral meaning-making that teachers and learners experience in environmental education contexts as well as the nature and the content of those moral meaning-making.

The crucial role of personal ethics for motivation to act more pro-environmentally (York & Becker, 2012) strengthens the validity of the scholars' calls for integrating ethics into environmental education. By cultivating ethics in individuals it may be possible to promote long term pro-environmental behaviors in the society, which has been called for by national and international environmental education agendas but has not been fully achieved so far (Potter, 2009). York and Becker brought a comprehensive explanation to this situation. According to the researchers, failure of the adaption of pro-environmental behaviors in the society cannot simply explained by insufficiency of environmental knowledge, awareness or concern. The researchers drew attention to the increasing amount and availability of information about environmental issues, educational programs which continuously contribute to the awareness of society about environmental issues as well as the precautions and treatments of the related problems, and research findings revealing the widely held environmental concerns. Therefore, the answer lies, the researchers argued, in

environmental ethics and its cultivation in research, policies, and educational practices.

2.3 Environmental Ethics

History of environmental ethics dates back to many years ago. Aldo Leopold, who is known as the father of environmental ethics, is accepted as the first to put forth 'land ethics'. With his words of "A thing is right when it tends to preserve the integrity, stability and beauty of the biotic community. It is wrong when it tends otherwise" (Leopold, 1949, p.262) Leopold urged love and respect for nature. Similarly, Rachel Carson's 1962 book *Silent Spring* in which she examined the effects of pesticide and herbicide use on human health and wildlife is very important for the development of ideas about environmental ethics and is often accepted as the trigger of the modern environmental movement.

Environmental ethics is a branch of environmental philosophy and is grounded in the oldest and youngest academic traditions, namely philosophy and post-industrial environmental thinking, respectively (Pojman & Pojman, 2012). In this context, the topic of environmental ethics has two sides like a coin where the discipline of ethics and environmental crisis (which is the strongest driving force for post-industrial environmental thinking) constitute its two sides (Traer, 2009). Both of these 'sides' reveal the close relationship between environmental ethics and humans. That is to say, Environmental ethics primarily studies human-environment relationships (Palmer, 2012) and humans lay at the heart of environmental crisis both as the primary reason for its existence and as the only solution for it (Traer, 2009). In fact, years ago, Maloney and Ward (1973) pointed out that maladaptive human behaviors are the primary causes of the environmental crisis. Accordingly, the researchers proposed sciences that study human behavior as our best hope for correcting undesirable practices.

When we look at the origin of the word *crisis*, the relationship between environmental crisis and humans becomes more obvious. The noun crisis comes from the from the Greek word *krisis*, which has meanings of decision, choice, and judgment. Correspondingly, most environmental crises represent the sum total of our choices and decisions that have caused many of the issues we face today. This is where the “ethics side” of environmental ethics becomes an essential prerequisite for change in human attitudes and behaviors toward the environment (Palmer, 1997). As a study of ‘goodness’ and ‘rightness’, ethics examines “our reasons for acting one way rather than another, or our reasons for trying to be one kind of person rather than another” (Schmidtz & Willott, 2002, p. xii). More specifically, environmental ethics compels us to think about ethical *shoulds* and *oughts* regarding our interactions with the environment (Palmer, 1997), and thus plays a vital role in identifying what is right and good in terms of human-environment relationships (Traer, 2009).

While reading about the literature on environmental ethics, one will notice that ‘morality’ and ‘ethics’, and their derivatives, are frequently used interchangeably. The terms moral and ethics come from Latin and Greek words of *mores* and *ethos*, respectively, and they both derive their meaning from custom. Nevertheless, there are subtle differences between the meanings of these two terms. While moral refers to “customs, principles, and practices of people or culture”, ethics is the name of the branch of philosophy that refers to the “whole domain of morality and moral philosophy” (Pojman & Pojman, 2012, p. 4). Nonetheless, choice of their usage in most of the modern contexts such as education is based on linguistic conventions and decisions rather than ontological differences of these two terms (Zeidler & Sadler, 2008).

Environmental ethics is a discipline that explores environmental issues and their possible solutions from an ethical perspective (Palmer, 1997). Some terms such as duty, character, relationships, and rights act as ‘paths’ and lead to different approaches in the field of environmental ethics (Traer, 2009). For instance,

approaches to ethical thinking may differ in whether they are individualistic (i.e., individual living beings are given consideration), holistic (i.e., species and ecosystems are considered as a whole while extending ethics to the environment), rights-based (e.g., nature have right to be protected), responsibility-based (e.g., humans have a responsibility to protect nature), human-centered or nature-centered (Kortenkamp & Moore, 2001).

Nevertheless, as also stated by Kortenkamp and Moore (2001), it would not be wrong to say that most of the debates on environmental ethics are based on discussions among human-centered and nature-centered environmental ethicists. These debates rest on some central questions such as “What is considered to be valuable?” and “Where does value come from?” For instance human-centered environmental ethicists (also called *value subjectivists*) believe in *instrumental value*, which is value assigned to something because of its usefulness. Similarly, with regard to the origin of value, they argue that humans create values, and thus we cannot talk about existence of any value in absence of humans. On the other hand, supporters of nature-centered environmental ethics (also called *value objectivists*) believe in *non-instrumental/intrinsic* value and argue that nature is valuable regardless of its usefulness to humans. In contrast, they argue that humans do not create values; rather values are built into the world; humans simply recognize a value that is already present (Palmer, 2012).

In fact, human-centered (anthropocentric) positions in environmental ethics receive criticisms by many environmental ethicists and environmentalists. Environmental ethicists claim that anthropocentric approaches cannot provide a comprehensive view of environmental ethics because they take human life rather than some independent moral reality as the starting point of ethical reasoning and they unjustifiably deny giving full moral standing to all aspects of the environment other than humans. Additionally, environmentalists criticize human-centered approaches for giving little respect and protection to the natural world and put the environment at risk (O’Neill, 2013), and some even accuse anthropocentrism of being one of the

roots of environmental crises (Dias, 2002). In this context, the term sustainable development is also criticized for advocating a human-centered approach for environmental protection and conservation (Palmer, 2012). To support their arguments, opponents of sustainable development generally use the most commonly cited definition of sustainable development: “meeting the needs of current generations without compromising the ability of future generations to meet their own needs” (World Commission on Environment and Development [WCED], 1987, p.45).

On the other hand, some others perceive sustainable development as a key for achieving a realistic balance of environmental protection and human development. That is to say, sustainable development is proposed as an approach that aims to protect the environment but, at the same time, acknowledges the need of human development (McKeown & Hopkins, 2003). When interpreted from the tripartite classification of environmental moral reasoning (i.e., egocentrism, anthropocentrism, ecocentrism), this perspective leads to the conceptualization of sustainability as a mixture of self-centered, human-centered, and nature-centered considerations.

2.4 Environmental Moral Reasoning

Environmental moral reasoning is closely related to the theories and approaches that bring out explanations about individuals’ reasoning about morality of environmental issues as well as developmental aspects of that reasoning. In the subsequent sections of this chapter, a review of fundamental approaches connected to moral reasoning and moral development is presented first. Then, a review of research that examines the ways individuals extend morality to environmental issues and problems is provided. The former section serves as a basis for a better understanding of moral reasoning in general and environmental moral reasoning in particular. Furthermore, it helps the reader to better interpret findings and implications of the studies

reviewed in the latter section which presents findings of research on environmental moral reasoning.

2.4.1 Approaches to moral reasoning and moral development

Kohlberg's (1976, 1986) theory of moral development, which is inspired by Kant's "perfect duties" moral philosophical discourse and Piaget's works on moral judgment, is regarded as the most influential work on moral reasoning and development (Langford, 1995). Kohlberg argued for a universal view of morality against moral relativism and claimed that application of moral principles and moral development reflects a universal pattern, which does not differ from culture to culture. Moreover, according to Kohlberg, morality, which is reflected in terms of moral reasoning, is independent of the content and situational contexts. Based on philosophical prepositions and supported by empirical observation, Kohlberg (1986) proposed that an individual progresses through hierarchical stages and levels as his/her level of moral reasoning develops. These stages were described as reflections of different qualitative features in one's cognitive structure. According to Kohlberg, individuals' thoughts and interpretations of moral rules, norms, and principles were the primary determinants of their moral judgments, which reflected different stages and levels of moral development (Kohlberg, 1984). Although moral reasoning was perceived as a reflection of mental moral structures, with particular cognitive structures regarded to be a necessary but not sufficient condition for moral development, the proposed developmental stages were not seen just simply a result of maturation. Instead, the development of moral reasoning was also seen as a result of the interaction between the physical and social environment (Walker, 1984).

In Kohlberg's (1986) theory of moral development a total of three hierarchical levels (each of which includes two stages) were proposed. At the pre-conventional level, the main concern for an individual is avoidance from punishment from an authority and the primary motivators for doing the right things are fulfilling his/her own interests, desires, and needs. Individuals in this level have an egocentric view and do

not consider other perspectives while making moral judgments. The conventional level of moral development is the one in which individuals are aware of the feelings, agreements, and expectations found in social structures ranging from friends and family to important authority figures and societal norms. They show concern for other people, especially close ones such as parents and friends. The main motivators for doing morally right actions are fulfilling expectations of such people, and keeping mutual relationships, and fulfilling duties with the desire to maintain social order. The post-conventional level is where an individual begins to attain a more principled level of moral reasoning. At this level, individuals become aware that there are variety of opinions and values held by people. Moreover, while making moral judgments, individuals in this level strive toward a universal perspective and consider welfare of all others with a concern for an overall utility. In addition, they base their moral decisions on self-chosen universal moral principles after considered reflection, rather than unreflectively following rules or laws that are imposed by the authorities. In summary, Kohlberg based moral reasoning and moral development on precepts of justice and fairness, where the application of rules and principles (i.e., justice) and moral norms (i.e., life, law, conscience, punishment, contract, and authority) determine one's level of moral reasoning and development (Zeidler & Keefer, 2003).

In course of time Kohlberg's conceptualization of moral reasoning as a context free endeavor dominated by cognitive processes has received considerable challenges. One of the most radical challenges to this cognitive-developmental model of moral reasoning was Gilligan's (1982) "ethics of care" approach. Gilligan stated that Kohlberg's theory was biased against women and did not consider feminine concerns of welfare, caring, and responsibility for others (Walker, 1984). Although Gilligan did not totally exclude cognitively based rules and principles from her framework (since they were required for understanding conflicts in moral dilemmas), she argued that a more narrative contextual approach was necessary to understand individuals' moral reasoning and development in a more complete way (Zeidler & Keefer, 2003). Based on interviews she conducted with women, Gilligan

stated that while reasoning about the morality of issues, individuals, especially women, do not only use rules or moral principles but issues of care and interpersonal relationships are also influential in their moral reasoning and development. Moreover, according to Gilligan, strategies of using either principles or issues of care and interpersonal relationships for resolving moral dilemmas was neither superior or in competition with the other; instead, they were different moral orientations that individuals utilize in their moral reasoning and behavior.

Through course of time further criticisms about Kohlberg's cognitive and content-free conceptualization of morality have arisen. These criticisms included the inadequacy of Kohlberg's theory in explaining all forms of morality such as the relation between moral reasoning about hypothetical dilemmas and moral behaviors, which was also admitted in his own later writings (e.g., Kohlberg, 1985). Among the researchers who criticized Kohlberg's assumptions about morality were Rest and his colleagues (Rest, Narvaez, Bebeau, & Thoma, 1999; Rest, Narvaez, Thoma, & Bebeau, 2000), who proposed a modified framework for moral development and reasoning. They named their approach to moral reasoning and development as "Neo-Kohlbergian" so as to honor the influences and contributions of Kohlberg's theory to their approach (King & Mayhew, 2005). This Neo-Kohlbergian approach was based on many years of study and synthesis of review of previous research in the literature (Rest et al., 1999). In this framework, individuals progress through moral schemas that can cut across stages, meaning that stages are not as rigid and can overlap. Moreover, content and context of moral dilemmas as well as culture were proposed to be influential factors in one's moral reasoning. In addition, the researchers argued that simply having higher moral reasoning competence does not guarantee the implementation of that reasoning level because moral reasoning is highly dependent on the contexts of the issues under consideration. In other words, since there is rarely a *ceteris paribus* (all things are equal) condition in real life, and competing interests obfuscate principled rules and facts, it is unreasonable to expect an individual to perform at their optimal level of moral reasoning across all contexts (Zeidler, Sadler, Simmons, & Howes, 2005).

While conceptualizing morality as a construct that is composed of only cognitive elements cannot explain all aspects of morality, a vision of morality as a totally affective construct would also be a poor description (Sadler, 2003). Rest and his colleagues (Rest, 1984; Rest et al., 1999) support this position. Their “Four-Component Model” of morality includes both cognitive and affective domains as necessary elements for moral behavior. More specifically, in their “Four-Component Model” the researchers proposed four psychological processes (i.e., moral sensitivity, moral judgment, moral motivation, and moral character) that impact moral behavior. These components operate in a highly interactive way rather than a sequential fashion (Bailey, Scott, & Thoma, 2010). In each of the four components one can notice the intersection of cognitive and affective elements and their interactions. The *moral sensitivity* component is a kind of empathetic awareness about the morality of the situations. It includes interpreting situations by evoking role taking perspectives as to how various actions may affect the parties involved and imagining related cause-effect chains. Inference drawing abilities and feelings for others such as compassion are also important necessities for this component. The *moral judgment* component is regarded as the ability to identify the morally ideal course of action for a specific situation, achievement of which requires the individual to be able to evaluate various actions in terms of their justifiability in a moral sense. The third component, *moral motivation*, characterizes the degree of commitment an individual employs in taking actions related to a moral issue and accepting responsibility for their outcomes. The calculation of relative utilities of various goals, feelings of empathy that impel decisions, and social understanding that motivates the choice of goals are among the cognitive-affective elements required for this component. Finally, the *moral character* component reflects persistence in a moral task with the help of courage and characteristics necessary for overcoming fatigue and temptation of accepting less ideal decisions simply because they are easier while pursuing a moral goal. Similar to other components, both cognitive and affective elements including inner strength, ability to mobilize oneself to action and possessing “strong character” characterize processes involved in this component.

Sadler and Zeidler's (2004) study also revealed that individuals use multiplicity of approaches, including cognitive and affective processes, while reasoning about the morality of issues and making moral judgments. In addition to utilitarian analyses of consequences and application of moral principles, affective features of moral emotion and intuition were found to be influential for their participants' moral reasoning about dilemmas on genetic engineering issues. In a similar vein, Berkowitz (1997), who had been a post-doc student of Kohlberg, highlighted the necessity of incorporating multidimensional aspects of morality into a holistic view of moral behavior. Based on his previous research, and that of other neo-Kohlbergian scholars, the author stated that in order to have a complete vision of morality we should consider moral behavior, moral character, moral values, moral reason, moral emotion, moral identity, and meta-moral characteristics as elements of complete moral person. Meta-moral characteristics are characteristics of a person that are not moral in themselves, but act as catalysts for exhibition of moral behaviors. Empathy, emotions, practical reason, and self-determination can be given as examples of such meta-moral characteristics (Zeidler & Keefer, 2003).

2.4.2 Research on environmental moral reasoning

The importance of morality and moral reasoning for individuals' perceptions of human-environment relationships, their attitudes towards the environment, environmental behaviors, and decisions regarding environmental issues has been advanced in the work of many researchers (e.g., Bjerke & Kaltenborn, 1999; Burek & Zeidler, 2015; Horwitz, 1996; Kahn, 1999; Mueller & Zeidler, 2010; Mueller, Zeidler, & Jenkins, 2011; Palmer, 1997; Seligman et al., 1994; Thompson & Barton, 1994; Tilbury, 1995). In this context, it becomes intuitively evident that morality and moral reasoning should be included in environmental education programs in order to cultivate pro-environmental attitudes and behaviors in individuals and, thus, contribute to the solution of many of the environmental problems (Postma, 2006).

Incorporating moral and ethical issues in educational programs is also very important for science education, and has been recognized by a few countries such as US, UK, Canada, and Australia (Zeidler & Keefer, 2003). When the present conditions of students' everyday lives are considered, the rationale proposing the vitality of including morality and moral reasoning in science education may be better clarified. Today, we are living in such a world that we are increasingly confronted with scientifically based personal and societal issues. These issues have moral overtones as well and are called as socioscientific issues (SSI) (Zeidler, 2014). This situation has reached such a striking level that "Even something as fundamental as the food we eat has become a socioscientific issue" (Zeidler & Lewis, 2003, p.289). Most of the decisions we make even in our daily lives have possible consequences on physical, biological, and social world (Zeidler, 2014). Therefore, science educators should cultivate students, who will be the citizens of the future, in such a way that they are able to make sound, rational, and informed decisions by being aware of the possible consequences of them. As proposed by Zeidler and his colleagues (Zeidler, 2014; Zeidler & Keefer, 2003; Zeidler & Lewis, 2003; Zeidler & Sadler, 2011; Zeidler et al., 2005), the *functional scientific literacy* framework is a promising approach to achieve this aim. In this framework moral reasoning is regarded as the focal point for a complete vision of scientific literacy. Moreover, moral and ethical issues are included in an interdisciplinary science curriculum and discourses on socioscientific issues are handled in a way that they enable psychological, social, and emotive growth of the students. This framework situates SSI in a sociocultural perspective and includes, but is not limited to, cognitive and moral development, emotive reasoning, character education, socio-moral discourse, and NOS issues (Zeidler, 2014). More specifically, there are four broad educational themes proposed in this framework: moral reasoning/development, cognitive reasoning/development, emotive beliefs systems, and moral education/character education. In addition, issues of nature of science (NOS), classroom discourse, cultural issues, and case-based and science-technology-society-environment (STSE) issues constitute the four pedagogical elements of functional scientific literacy framework. In order to successfully apply this framework in science classrooms and

help students achieve functional scientific literacy, it is important to keep in mind that all these elements are interrelated and interdependent.

Since environmental issues such as ozone depletion, alternative forms of energy, recycling, and consuming environmentally-friendly products accounts for a large portion of SSI (Zeidler & Lewis, 2003), the functional scientific literacy framework and its socioscientific elements also have potential to provide important insights about individuals' reasoning about environmental issues. For example, as also stated by Zeidler and Lewis, in order to be able to negotiate about competing scientific claims about global warming, one first needs to have a basic content knowledge about the issue. However, having the necessary content knowledge is not enough by itself to exhibit higher levels of reasoning about the issue at hand. In order to be able to do this, one needs to have the necessary precursors such as a well-developed understanding about NOS and inquiry. These constructs are reflections of understandings about epistemology of scientific knowledge and processes and methods that are used to develop such knowledge, respectively. Accordingly, they are vitally important for being able to evaluate competing scientific evidences and claims (e.g., presentations of global temperature data). Nevertheless, the authors argue, even an individual exhibits higher levels of understanding about NOS and inquiry, he/she will not be able to have a complete understanding of global warming and competing claims about it unless he/she considers the moral and ethical aspects of the issue such as intergenerational justice.

Therefore, as implied in the above examples, moral reasoning plays a significant role in individuals' perceptions and understanding of SSI, as well as their subsequent approaches and decisions regarding those issues. Accordingly, findings of research conducted on environmental moral reasoning and its development will have important implications for environmental education and science education. Actually, from SSI perspective, science education and environmental education are not separate scholarships. In fact, they share so much in common that constructs such as socioecological literacy, ecojustice, and environmental literacy are regarded

as key elements of science education movements (Zeidler, 2014). Zeidler and Schafer (1984) stated this relationship by identifying environmental issues such as the use of limited environmental resources as major ethical issues in science. Moreover, the researchers stated that the ability to meaningfully reason about and respond to those kinds of environmental issues should be regarded as necessary qualifications of environmentally literate citizens. Hence, science educators should provide efforts to facilitate moral reasoning of students in order to achieve this aim.

In the following paragraphs, findings of empirical research examining moral reasoning of individuals toward environmental issues are presented. In line with the purpose of the study, more space is given to research findings that examined environmental moral reasoning patterns under egocentric, anthropocentric, and ecocentric moral reasoning framework. In fact, some researchers did not name these constructs as categories of environmental moral reasoning but rather they preferred to study the egocentrism, anthropocentrism, and ecocentrism distinction under environmental attitude, concern, or value orientation frameworks (e.g., Nordlund & Garvill, 2002; Schultz, 2001; Thompson & Barton, 1994). Nonetheless, findings of these studies are also included in the literature review of the study since all these constructs and motivations underlying them have explicit or implicit foundations in moral and ethical considerations and moral reasoning (Karpiak & Baril, 2008; Lee, Chang, Choi, Kim, & Zeidler, 2012; Lee et al., 2013).

As have been introduced in the introduction chapter, egocentric moral reasoning reflects individuals' considerations about self-interests. More specifically, this moral orientation mostly includes concerns about the harms/costs of environmentally damaging actions to the self and desire for the benefits of protecting the environment to the individual (Stern et al., 1993). On the other hand, individuals whose egocentric moral considerations are dominant over other moral considerations (i.e., anthropocentric, ecocentric) may be more inclined to believe that they have right to extract and use natural resources to enhance their own lives (Merchant, 1992). As a second moral reasoning category, anthropocentric moral reasoning also has a

utilitarian approach regarding human-environment relationships and favors the belief that nature is important because it is central to human wellbeing (Karpiak & Baril, 2008). Therefore, nature's material and physical benefits that it can provide for humans (Thompson & Barton, 1994) or threats to humans that may result from the degradation of the environment (Franson & Gärling, 1999) are the main matter of concerns for individuals who exhibit anthropocentric moral reasoning.

Conversely, ecocentric moral reasoning is mainly based on the idea of establishing equivalences between human and non-human life forms, and valuing biological life and natural processes. In this moral reasoning category, valuing nature for its own sake (Gardner & Stern, 1996; Karpiak & Baril, 2008; Thompson & Barton, 1994), advocating equivalence and justice in the relationships between humans and the nature (Kahn, 1997), and having concern for nonhuman objects (e.g., animals, ecosystems, biosphere) (Stern & Dietz, 1994) are frequently emphasized. This environmental moral reasoning category extends morality to all elements of the environment including all species as well as the biosphere (Stern et al., 1993).

In the literature it is proposed that individuals' approaches toward the environment reflect a combination of a variety of motivations, concerns or moral considerations. Nonetheless, individuals tend to prioritize an environmental orientation which becomes more important than others while reasoning about an environmental issue and making judgments and decisions regarding it (Stern et al., 1993). Accordingly, researchers seek for explanations regarding the possible reasons or influential factors that may lead to differences in individuals' environmental orientations. For instance, Karpiak and Baril (2008) investigated ecocentrism, anthropocentrism, and environmental apathy, which reflects lack of interest in environmental issues (Thompson & Barton, 1994), and their relationships with moral reasoning levels and some demographic and background variables (i.e., gender, academic major). The researchers used Rest's (1993) three-scenario version of Defining Issues Test (DIT) and Thompson and Barton's (1994) scale to measure college students' ($N=158$) principled moral reasoning levels (P-scores) and environmental orientations, respectively. In DIT a list of 12 considerations is presented to the respondents for

each scenario. These considerations reflect different levels of moral reasoning. Respondents are asked to rank four of these considerations according to their perceived importance. Percentages of the considerations that reflect principled/post conventional moral reasoning level are used to calculate P-scores to be used in subsequent data analyses. Karpiak and Baril's analyses revealed that principled moral reasoning level was slightly correlated with ecocentrism ($r = .21$) and environmental apathy ($r = -.29$). On the other hand, there was not a statistically significant correlation between anthropocentrism and principled moral reasoning ($r = -.11$). Gender and academic major of the participants were also found to have some statistically significant, but slight (maximum r value was $-.21$), correlations with their environmental orientations. Females exhibited more ecocentrism and less environmental apathy when compared to their male counterparts. In addition, being a biological science major was positively correlated with ecocentrism but negatively correlated with anthropocentrism and environmental apathy. Findings of multiple regression analyses conducted to further study the influences of P-scores, gender, and being a biological science major on the participants' environmental orientations (i.e., ecocentrism, anthropocentrism, environmental apathy) supported these correlations. However, similar to the r -values, regression coefficients obtained from these analyses were relatively small (maximum β value was $-.26$).

Although Karpiak and Baril's (2008) study had some limitations such as demographically limited sample and small effect sizes of the findings, it is still valuable in terms of teasing out the relationships between individuals' environmental orientations and moral reasoning. For example, it was found that anthropocentrism had a slightly positive correlation with environmental apathy. The authors attributed this finding to the egocentric nature of anthropocentrism (Schultz & Zelezny, 1999; Thompson & Barton, 1994) which may make individuals prioritize their own needs and desires over environmental concerns leading to a lack of interest in environmental issues (i.e., environmental apathy). On the other hand, ecocentrism, which had a highly negative correlation with environmental apathy ($r = -.55$), showed a slight but statistically significant correlation with principled (post-

conventional) moral reasoning. Based on these findings, the authors concluded that ecocentrism reflects higher levels of cognitive justice-oriented morality (as measured by DIT) because it extends principles of rights and justice to nature. Furthermore, ecocentrism was also regarded to be an indication of higher emotional connection with the nature because most of the ecocentric items in Thompson and Barton's (1994) scale included affective elements of environmental concerns such as sadness, which are also indicators of higher moral reasoning levels (Karpiak & Baril, 2008). Finally, positive relationships of enrollment in biological science academic major and ecocentrism to principled moral reasoning were interpreted as a possible influence of enhanced understanding of non-human life on individuals' approaches toward the environment.

In a similar study, Zeidler and Schafer (1984) examined possible influences of content knowledge, moral reasoning ability, and past experiences on formation of moral judgments about environmental dilemmas. The study consisted of two subsequent phases, which were quantitative and qualitative in nature, respectively. For the first phase, two distinct groups of university students enrolled in School of Forestry of a state university in USA participated to the study. The first group of participants were 86 third and fourth grade environmental science majors. In the second group there were 105 first to fourth year non-science majors who had less than 12 credit hours of science courses. All of the participants were asked to respond to Defining Issues Test (DIT) (Rest, 1976, 1979) and Environmental Issues Test (EIT) (Iozzi, 1978) as reflections of their levels of moral reasoning towards social and environmental moral dilemmas, respectively. Moreover, the participants responded to Test of Ecology Comprehension (TEC) (Hart, 1978; Moore, 1971) and Ecology Attitudes Inventory (EAI) (Maloney & Ward, 1973). In its original form, the EAI is comprised of four subscales: verbal commitment, actual commitment, affect, and knowledge. While 'verbal commitment' subscale measures what an individual is willing to do with regard to environmental issues, 'actual commitment' subscale measures what an individual actually does. Moreover, 'affect' subscale measures the degree of individuals' emotional connection with the environment.

Finally, knowledge subscale includes items that reflect respondents' levels of ecological knowledge. Nevertheless, Zeidler and Schafer (1984) measured ecological content knowledge via TEC and used three of the four subscales of EAI (i.e., verbal commitment, actual commitment, affect) to measure participants' environmental attitudes. In addition to scores obtained from each of the subscales, a composite score obtained from all the three subscales constituted respondents' overall environmental attitude scores and was included in data analyses.

For data analysis, 2 X 2 repeated measures ANOVA was performed to investigate group differences (i.e., science major vs. non-science major) in participants' moral reasoning levels exhibited for general social issues (as measured by DIT) and environmental issues (as measured by EIT). Results revealed the influence of the contexts of the moral dilemmas on the participants' moral reasoning levels. The participants from both groups were found to exhibit higher levels of moral reasoning to the environmental dilemmas than the social dilemmas. As also stated by the researchers, this situation may have resulted from the participants' higher levels of interests in the environmental issues when compared to the social ones, which may have caused them to invest more time and effort while reasoning about the moral aspects of the dilemmas. Analyses also had implications about the effects of knowledge and experience on moral reasoning. ANOVA results suggested differences in the moral reasoning levels of the two groups and subsequent t-tests showed that this difference stemmed from the moral reasoning scores on EIT. That is to say, environmental science majors, who were more knowledgeable and experienced about environmental issues, were found to exhibit higher levels of moral reasoning than non-science majors on EIT. No statistically significant difference was detected between the moral reasoning scores of the science and non-science majors on DIT. In another ANOVA which was performed with the participants' "decision commitment" scores (i.e., number of times the participants responded as 'yes' or 'no' rather than 'not decided' for the statements presented about dilemmas in DIT and EIT), it was found that both groups (i.e., environmental

science majors and non-science majors) were more committed to thinking about and resolving environmental moral issues when compared to general social issues.

Zeidler and Schafer (1984) also conducted stepwise and hierarchical multiple regression analyses to explore the contributions of DIT, TEC, overall EAI scores and scores obtained from EAI's subcomponents (i.e., verbal commitment, actual commitment, affect) for prediction of the participants' environmental moral reasoning levels (EIT scores). In line with findings of many research (e.g., Karpiak & Baril, 2008; Littledyke, 2008; Rest, 1974), both cognitive and affective elements including moral reasoning on general social issues (DIT), emotional propensity toward the environment (affect), science orientation (group), environmental attitude, and ecology comprehension significantly contributed to the prediction of the participants' environmental moral reasoning scores (EIT). The only variables that were not found to be among the significant predictors of EIT scores were verbal commitment and actual commitment subcomponents of environmental attitudes. The remaining five variables (i.e., DIT, affect, group, EAI, TEC scores) and interaction effect of group science orientation and ecology comprehension (group X TEC scores) explained 44% of the variance in respondents' environmental moral reasoning.

In addition to examining moral reasoning of participants toward environmental dilemmas and general social dilemmas, Zeidler and Schafer (1984) also examined whether students in two groups differed in terms of their environmental attitudes and ecology comprehension. Findings revealed that environmental science majors' scores on Verbal Commitment and Actual Commitment subcomponents of environmental attitude scale as well as their composite scores on Environmental Attitude and Ecology Comprehension were significantly higher than their non-science major counterparts. Nevertheless, contrary to findings of Karpiak and Baril (2008), science majors and non-science majors did not differ in their levels of emotional connection to the environment, which was measured by 'Affect' subscale of EAI. This dissimilarity in findings of the two studies may be attributed to the

differences in their data collection instruments. That is to say, while Karpiak and Baril's instrument was a 5-point Likert type scale, items in the EAI were presented in true-false format (Maloney & Ward, 1973). Accordingly, range of available responses to the items in the two scales may have influenced participants' responses and resulted in differences in the findings of the two studies. Maybe more important than that, differences underlying the meanings of the items in the two scales may have led to such a difference in the results. More specifically, the 'affect' subscale of the EAI included some items such as "I get depressed on smoggy days." In Thompson and Barton's (1994) scale, items having similar meanings (e.g., "Nature is important because of what it can contribute to the pleasure and welfare of humans") were regarded as anthropocentric motives underlying environmental attitudes rather than ecocentric motives, which were regarded as reflections of emotional connection with the environment. Nevertheless, further research is needed in order to make more robust explanations regarding the influence of academic major (i.e., science vs. non-science) on degree of emotional connection with the environment.

For the second phase of their study, which was qualitative in nature, Zeidler and Schafer (1984) selected 11 pairs of subjects based on their environmental attitude (EAI) and moral reasoning level (DIT) scores which were measured in the first phase of the study. Each of the 11 pairs consisted students with similar environmental attitudes but different moral reasoning levels. The reason for this pairing was to stimulate conversation and reasoning of the participants during their discussions on the environmental moral dilemmas presented in EIT. Participants of this phase of the study were asked to discuss their previous responses to EIT and come to a common decision at the end. The researchers observed that individuals with higher moral reasoning levels generally convinced their counterparts who had lower reasoning levels to exhibit higher levels of environmental moral reasoning than their previous responses. Moreover, analyses of the participants' conversations about the environmental issues revealed the importance of moral developmental levels as well as educational and social experiences on individuals' environmental

moral reasoning and judgments. Therefore, in the overall, Zeidler and Schafer's study showed that individuals' levels of moral reasoning are influenced by the contexts of the issues. That is, individuals tend to exhibit higher levels of moral reasoning toward the issues for which they have more interest, knowledge, and experience. Moreover, in line with the literature, this study revealed that environmental moral reasoning and moral judgments regarding the environmental moral dilemmas were influenced by both cognitive and affective factors. These findings did not only contributed to the related literature but also had some important implications for education such as the need of offering meaningful experiences to students which may help them develop understanding, positive attitudes, and care and concern for science-oriented moral issues (e.g., environmental issues) as well as feelings of commitment to resolve them.

In another study, Kortenkamp and Moore (2001) examined when and how individuals extend ethical reasoning to nature-oriented issues. In scope of their study, the researchers regarded ecocentrism and anthropocentrism as two distinct contexts for moral reasoning about nature. Moreover, the researchers hypothesized that individuals' judgments and decisions about environmental issues may also be based on their non-environmental moral concerns such as obedience to social contracts, laws, and truthfulness. Therefore, in addition to the two environmental moral reasoning categories (i.e., ecocentric, anthropocentric), they included a third category of "non-environmental moral reasoning" in their data analyses. Different from most of the research conducted in the field, Kortenkamp and Moore used an experimental design to test their hypotheses and study their research questions. The study was realized as two subsequent experiments. Sample of the first experiment constituted 91 undergraduate university students enrolled in introductory psychology classes. For data collection, four environmental dilemma scenarios (i.e., overgrazing a common, logging old growth stands, cutting firewood in a protected forest, building a new landfill) were used as stimuli where main characters in each scenario were set in situations in which they could support or not support environmentally damaging actions. Two factors were manipulated within the dilemmas: additional

information about the action's impact on the environment, and additional information about the action's impact on humans. For each environmental dilemma, participants were asked to decide whether the main characters should or should not support environmentally damaging actions and then list the factors that influenced their decisions. Frequencies of their statements reflecting ecocentric, anthropocentric, and non-environmental moral reasoning were used as variables for data analyses. In addition to the scenarios of environmental dilemmas, Environmental Attitudes Scale (EAS) (Ebenbach, 1999), which distinguishes between internally and externally motivated pro-environmental attitudes, was also used for data collection. With this experiment, Kortenkamp and Moore aimed to examine moral orientations of participants regarding environmental issues and influences of situational variables including dilemma contents (i.e., information enhancement on harms on the environment and humans) and topics (e.g., wild land vs. agricultural land) on their reasoning. Moreover, the researchers investigated whether environmental attitudes, as a variable reflecting individual differences, were related with participants' environmental moral reasoning patterns.

Researchers conducted ANOVA, correlation, and multiple regression analyses to investigate their research questions. Firstly, results of 2 (Impact on Environment Information) X 2 (Impact on Humans Information) X 3 (Moral consideration Category) mixed ANOVA showed that there was a significant main effect for moral reasoning category. Participants' non-environmental moral reasoning ($M = 8.82$) was found to be significantly higher than their anthropocentric ($M = 3.98$) and ecocentric ($M = 3.40$) moral reasoning, respectively. There was also a significant interaction between "Impact on Environment Information" and "Moral Consideration Category" revealing that additional information about the impacts on the environment caused participants to exhibit more ecocentric and anthropocentric but less non-environmental moral reasoning. Secondly, correlation analyses revealed that there were positive correlations between internally motivated pro-environmental attitudes and ecocentric ($r = .35$) and anthropocentric ($r = .30$) moral reasoning. Conversely, the relationship between internally motivated pro-environmental

attitudes and non-environmental moral reasoning was negative ($r = -.40$). Findings of hierarchical multiple regression analysis also supported these results. More specifically, the presence of information on environmental impacts was found to have significant positive effects on the use of ecocentric and anthropocentric moral reasoning but negative effect on the use of non-environmental moral reasoning. Similarly, internally motivated pro-environmental attitudes had significant positive effects on the use of ecocentric and anthropocentric moral reasoning but negative effect on the use of non-environmental moral reasoning. Finally, effects of dilemma topic on the use of ecocentric moral reasoning were tested in a 2 (Environmental Information enhancement) X 2 (Human Information Enhancement) X 4 (Dilemma Topic) mixed ANOVA with mean number of ecocentric moral considerations as the dependent variable. A significant main effect was found for dilemma topic where participants exhibited significantly fewer ecocentric moral considerations for “overgrazing a common” environmental dilemma.

Based on their findings, the researchers concluded that information enhancement about the impacts of environmentally damaging actions on the environment as well as internally motivated pro-environmental attitudes influenced participants’ moral reasoning toward the environmental issues. Nevertheless, as also stated by the researchers, their analyses were unable to reveal a clear distinction between ecocentric and anthropocentric motivations underlying environmental attitudes. This result shows parallelism with findings of Stern and his colleagues’ (Stern & Dietz, 1994; Stern, Dietz, Kalof, & Guagnano, 1995) research in which telephone interviews were conducted with a general population of adults ($N = 199$) to examine egocentric, social-altruistic (anthropocentric), and biospheric/ecocentric value orientations underlying environmental concerns. Factor analyses conducted on their data did not differentiate between biospheric and social-altruistic value orientations and these two value orientations loaded on the same factor (i.e., *biospheric-altruistic* value orientation).

Kortenkamp and Moore's (2001) second experiment was conducted in an attempt to further investigate the influence of environmental dilemma contexts on participants' moral reasoning. In this experiment, they developed four versions of the "overgrazing a common" dilemma in which information about presence of social commitments (i.e., social conflict) and wilderness of the ecosystem (i.e., land-use conflict) were manipulated. Similar to the first experiment, participants of the second experiment were undergraduate students who were enrolled in introductory psychology courses. ANOVA analyses revealed that existence of social conflict made participants exhibit significantly less ecocentric moral reasoning. On the other hand, when the land described in the dilemma became more 'wild' and pristine they exhibited significantly more ecocentric moral reasoning. Moreover, existence of social conflicts in the dilemma was found to significantly increase non-environmental moral considerations of the participants. In conclusion, Kortenkamp and Moore's (2001) study showed that in addition to individual variables (i.e., environmental attitudes) situational variables (i.e., contexts of the dilemmas) were influential on individuals' environmental moral reasoning.

In their later study, Kortenkamp and Moore (2009) examined environmental moral reasoning of 5th, 8th and 11th grade children, as well as undergraduate college students. By broadening age range (10 to 20 years) of their sample, the researchers aimed to investigate developmental trends in ecocentric/biocentric and anthropocentric moral reasoning. Similar to their 2001 study, environmental dilemma scenarios were used as stimuli for data collection. In each of the two scenarios (i.e., nature park, cats), there were main characters that decided to perform an ecologically damaging action. The scenarios were presented to the participants in written form and they were asked to make four moral judgments (i.e., decision rightness, damage rightness, blame of decision maker, blame of agent of damage) about each of the environmental dilemmas. Responses were measured on 19-point scales (i.e., 1(very wrong) to 19 (very right); 1(not blamed at all) to 19 (blamed completely)). In each of the scenarios, information about the intentions of decision makers (biocentric vs. anthropocentric) and severity of the outcomes of their

decisions (severe vs. mild damage to nature) were manipulated. One of the scenarios was about the decision of a nature park manager who opened the trails in the nature park to bikers and dog-walkers, which caused damages in the natural areas of the park. The second scenario evolved around the decision of a pet-cat owner who decided to let her cats out of the house and caused the death of the songbirds that lived there.

To analyze the effects of behavioral intentions of the decision makers in the scenarios (i.e., behavioral intention) and severity of the outcomes of these decisions (i.e., outcome severity) on children's moral judgments, the researchers conducted ANCOVA where EAS scores were used as the covariate. Findings revealed that, in the overall, when decision makers had a biocentric intention in their decisions (i.e., aimed to manage or preserve nature for its own sake) children judged these decisions as less wrong (i.e., decision rightness) and blamed the decision makers less harshly. In addition to this, for the "nature park" scenario ecological damage was perceived to be less wrong (i.e., damage rightness) when behavioral intention of the decision maker was biocentric. Similar to behavioral intention, outcome severity was found to have significant effect on children's moral judgments about the ecological damages explained in the scenarios. When damages given to the nature became more severe, participants judged decisions of the decision makers and the ecological damage as more wrong and blamed decision makers and agents of harm more harshly.

Kortenkamp and Moore (2009) also investigated whether age of participants influenced their ability to distinguish between biocentric and anthropocentric intentions and whether this ability had an effect on their environmental moral reasoning and judgments. Findings revealed that, for the "nature park" scenario, 5th graders' moral judgments of decision rightness were influenced less by intentions of the decision makers in the scenarios when compared to their older counterparts. Further analyses showed that this was due to 5th graders' inability to differentiate between biocentric and anthropocentric intentions. Half of the 5th grade participants

treated the two intention conditions equivalently. On the other hand, there was not a significant influence of age on participants' moral judgments for the "cats" scenario. Similar to their older counterparts, 5th graders were also able to make moral distinctions between biocentric and anthropocentric intentions and tended to find biocentric intentions morally superior to anthropocentric intentions. Kortenkamp and Moore attributed this difference to a possible influence of the context of the "cats" scenario. In "cats" scenario, biocentric and anthropocentric intentions could have been more distinct because the anthropocentric intention of the decision-maker was based on more self-centered concerns (i.e., letting cats out of the house so they do not wreck her furniture). Therefore, the researchers concluded that overall, their study revealed age-related changes about participants' environmental moral reasoning and judgments and indicated a developmental trend in biocentric moral reasoning with respect to age.

Kahn and his colleagues studied environmental moral reasoning through an array of research studies in which interviews with adults, adolescents, and children from different age groups and different locations around the world were conducted. Their research had important contributions and implications to the literature regarding individuals' moral conceptions and moral reasoning about environmental issues. Kahn (Kahn, 1999, 2002) summarized and interpreted five of these studies to provide an overall picture of environmental moral reasoning and its development. These studies and basic information about their participants are presented in Table 2.1.

Table 2.1
Studies Summarized and Interpreted by Kahn (1999, 2002)

Study	Participants	Participants' place of residence
Kahn (1997)	Children in grades two (8 years old), five (11.5 years old), and eight (14.5 years old)	Texas, USA
Kahn & Friedman (1995)	Children in grades one (7 years old), three (9 years old), and five (11 years old)	Texas, USA
Kahn & Friedman (1998)	Parents (i.e., primary caretakers; including grandmothers and other guardians) of children who participated in Kahn and Friedman's (1995) study ^a	Texas, USA
Howe, Kahn, & Friedman (1996)	Children in grade five (13 years old)	Amazon, Brazil
Kahn & Lourenço (2002)	Children in grade five (10 years old) and eight (13 years old); adolescents in grade eleven (16 years old); college-grade students (19 years old)	Lisbon, Portugal

* Mean age of the participants are given in parentheses,

^a Mean age of the participants was not specified

Participants of these studies varied not only in their age groups and nationalities, but also showed differences in their socio-economic backgrounds and characteristics of their place of residence. For instance, while participants of Kahn and Friedman's (1995, 1998) study were poor in economic standing, fifth grade children in Kahn and Lourenço's (2002) study predominantly came from middle to upper class backgrounds. Moreover, places where they lived included an inner-city (Kahn & Friedman, 1995, 1998), a large urban city (Howe, et al., 1996) as well as a small remote village that is inaccessible except by boat (Howe et al., 1996). Therefore, these studies collectively, allowed for comparisons about cross-cultural trends related to environmental moral reasoning.

Findings of Kahn and his colleagues' research revealed that individuals' (including children) moral reasoning about environmental issues involved a wide array of

concerns ranging from egoistic concerns for the self to larger ecological communities of which humans may be a part. On the other hand, despite the differences in the characteristics of their participants, patterns of environmental moral reasoning observed in the studies were remarkably similar. Personal interests such as recreation or personal concerns such as punishment and being judged negatively by others were some of the main egoistic concerns expressed by the participants. Concerns for the welfare of others, beliefs in the intrinsic value of nature, and moral principles of justice and rights were among the main considerations that formed the basis of the participants' anthropocentric or ecocentric/biocentric environmental moral reasoning. Analyses of the interviews revealed that most of the children and the parents tended to have predominantly human-centered affiliations with nature and, thus, expressed largely anthropocentric moral considerations while reasoning about environmental issues. On the other hand, adolescents and college-age students in Kahn and Lourenço's (2002) study expressed higher levels of concerns regarding nature's rights and intrinsic value when they were asked about morality of environmental problems. Kahn (2002) interpreted this difference in environmental moral orientations of children (who were more anthropocentric) and adolescents and college age participants (who were more ecocentric/biocentric) in Kahn and Lourenço's (2002) study as an indication of structural-developmental nature of environmental moral reasoning where ecocentrism/biocentrism was regarded as a higher level.

In a later study, Severson and Kahn (2010) investigated environmental moral reasoning of orchard farm workers' children. A total of 40 children in second grade (7 years old) and fifth grade (10 years old) were interviewed. Two different methodologies were used to examine children's environmental moral reasoning. In the first methodology, a story where there are no humans in it ("alien" story) was created to explicitly separate human interests from considerations of nature and children were asked questions about this story. In the second methodology, the researchers used the same approach and similar form of interview questions that were utilized in Kahn and his colleagues' previous studies (see Table 2.1). In this

methodology, children were asked questions about their judgments regarding a scenario (“irrigation canal” scenario) about pouring leftover pesticides into an irrigation canal.

Analyses of the interviews revealed interesting findings. Contrary to children who participated in Kahn and his colleagues’ previous research, a vast majority of children (90%) based their moral judgments and justifications on biocentric considerations when they were asked questions about the “alien” story. The two primary justification categories used by the children were “intrinsic value of nature” (i.e., value of nature not derived from human interests) and “justice” (i.e., beliefs that nature deserves respect and fair treatment, has rights, and/or merits freedom). Nevertheless, there were differences regarding the influence of grade level on the use of these two justification categories: while there was a developmental trend in the use of justice considerations among responses of 2nd and 5th grade children, no effect of grade level was found with respect to the use of moral considerations that referred to the intrinsic value of nature. Severson and Kahn (2010) interpreted this finding as a supporting empirical evidence for research that proposes that conceptions of others’ welfare emerge earlier than conceptions of fairness and justice in one’s moral development.

Another interesting finding obtained from Severson and Kahn’s (2010) study was the difference in children’s moral considerations expressed in response to the “alien” story and “irrigation canal” scenario. Although children expressed mostly biocentric considerations about the “alien” story, their judgments and moral justifications about the “irrigation canal” scenario were predominantly based on human-centered (anthropocentric) considerations. Severson and Kahn attributed this finding to the possible influence of the differences in the methodologies used for the “alien” story and “irrigation canal” scenario (In the “alien” story human interests and concerns for nature were explicitly separated and recipients of harms in this story were clearly non-humans. On the other hand, recipients of harms in “irrigation canal” scenario were ambiguous). Therefore, the researchers concluded that the two methodologies

uncovered different structural processes of children's environmental moral reasoning, which requires further research. Nevertheless, the study had important implications for the emergence of biocentric moral reasoning in children as young as 7 years old, which is an earlier age range that had been proposed by developmental literature (Kahn, 1999).

Lee et al. (2012) examined moral reasoning patterns of 18 South Korean pre-service science teachers (PSTs) about nuclear power generation, climate change, and embryonic stem cell research issues. In line with Choi, Lee, Shin, Kim and Krajcik's (2011) framework, the researchers focused on "character and values" which are conceptualized as the primary driving forces, guidelines, and points of reference that individuals use in their moral judgments as well as actions related to the global socioscientific issues (SSI). In this conceptualization, *ecological worldview*, *socioscientific responsibility*, and *social and moral compassion* were identified as the three key elements or dimensions of the character and values that characterize global citizens. Basically, ecological worldview is perceived as reflections of individuals' personal affinity with nature as well as their consciousness about the embeddedness of humans in the natural system, which is supposed to result in increased levels of care for the environment and feelings of moral responsibility to protect it. Socioscientific responsibility reflects individuals' perceptions about their responsibility and accountability for the socioscientific issues in terms of the creation of the related problems and their solutions. Finally, social and moral compassion is defined as the level of moral awareness and sensitivity to the issues embedded in SSI together with feelings of care, empathy, and respect for others including humans and other non-human beings in different places of the world.

In addition to these three elements/dimensions of the character and value (i.e., ecological worldview, socioscientific accountability, social and moral compassion), Lee et al. (2012) also examined the broadness of PSTs' perspectives with regard to the SSI. That is, the researchers investigated whether the PSTs' considerations were limited to personal concerns and feelings (i.e., personal level), reflected concerns

about their own country or locality (i.e., societal level), or included the well-being of all globe including all living and non-living beings (i.e., global level). Therefore, the rubric they used to examine the PSTs' discussions about SSI had a two axial framework: (1) dimensions of value and character, and (2) broadness of their perspectives regarding the SSI. A close examination of this framework shows that intersection points of the "ecological framework" and the three categories of perspectives (i.e., personal, societal, global) show a close parallelism with the tripartite classification of environmental moral reasoning patterns (i.e., egocentrism, anthropocentrism, ecocentrism) proposed in the present study. More specifically, personal level of ecological worldview matches closely with egocentric moral reasoning; societal level of ecological worldview corresponds to anthropocentric moral reasoning; and global level of ecological worldview shows parallelism with ecocentric moral reasoning.

Analyses of Lee et al. (2012) revealed that, in the overall, the PSTs who participated in the study were able to perceive the SSI as moral problems. Moreover, they enacted all the three elements/dimensions of character and values (i.e., ecological worldview, socioscientific accountability, social and moral compassion) while reasoning about the issues. However, their perspectives were limited to personal and societal levels, lacking moral considerations for global wellbeing. Lee et al. (2012) interpreted this finding as an indication of the dominance of egocentric, anthropocentric, and sometimes ethnocentric (i.e., prioritizing one's own country) perspectives in their participants' moral reasoning about the SSI. Similarly, the researchers concluded that most of the PSTs who participated in their study lacked a holistic view of ecological consciousness. Most of them emphasized egocentric and anthropocentric views in such a way that they revealed their unawareness about the interrelatedness of local environments to larger ecosystems and the biosphere. Finally, the PSTs failed to perceive themselves as major moral agents who were responsible and competent to resolve the SSIs under consideration.

Lee et al.'s (2013) study provided important findings and implications about integration of ethics and moral reasoning into educational programs. In their study, the researchers showed the utilization of SSI-based educational programs for cultivating moral reasoning of students. In a 3-4 week SSI instruction program developed on genetic modification technology and applied for ninth grade students in South Korea ($N = 132$), the researchers examined developments in reasoning patterns with respect to the three elements of character and values (i.e., ecological worldview, socioscientific accountability, social and moral compassion). Their research utilized a mixed-method approach. Video-tapes of classroom observations, audio-tapes of semi-structured interviews with 24 students and the teacher who implemented the instructional program, and a questionnaire (i.e., Character and Values as Global Citizens Assessment) were used as data collection instruments.

Quantitative analyses revealed moderately positive impacts of the program on the elements of character and values, except for ecological worldview. The researchers attributed this finding to the ceiling effect of the high scores obtained from the corresponding subscale of the Character and Values as Global Citizens Assessment (GVGCA). Nevertheless, qualitative analyses of the study revealed contradictions and limitations found in environmental moral reasoning of the students. For instance, while students exhibited awareness about the embeddedness of human beings in nature and the reciprocal relationships between humans and the environment, their views were mostly limited to egocentric or anthropocentric concerns (e.g., impact of genetically modified food on health) rather than broader considerations for the wellbeing of the ecosystems. Similarly, the participants' views about sustainable development were focused more on maximizing human benefit rather than a mutually beneficial development for both humans and the environment. On the other hand, at the end of the SSI instruction, the students were observed to show more sensitivity to the moral and ethical aspects of the issues and became more compassionate to other people and other living beings. Moreover, although they did not enact willingness and efficacy to participate in pro-environmental action to a large degree, they exhibited higher levels of responsibility for contributing to

the solution of problems that arise from applications of genetic modification technology.

2.5 Epistemological Beliefs and Environmental Moral reasoning

This section of the chapter is divided into two subsections. In the first subsection, the theoretical background of personal epistemology and related models are presented. In the second subsection, a literature review that summarizes and synthesizes research conducted to examine relationships between epistemological beliefs and moral reasoning is given. As a whole, the section gives an overall picture of previous research with respect to their findings, similarities and differences among them, and implications for the current study. By this way, the theoretical background and rationale that led to the examination of the relationships among epistemological beliefs and environmental moral reasoning patterns are provided to the readers.

2.5.1 Personal epistemology and epistemological models

Epistemology is regarded as one of the main branches of philosophy (Schmidtz & Willott, 2002). This philosophical branch derives its name from the Greek words of *epistēmē* meaning "knowledge" and *logos* meaning "study of". Correspondingly, this branch of philosophy is mainly concerned with the "origin, nature, limits, methods, and justification of human knowledge" (Hofer, 2002). Individuals' views about knowledge and knowing including definition of knowledge as well as construction and evaluation of it are examined under a general heading or an umbrella term of "personal epistemology" (Hofer, 2001, 2004; Hofer & Pintrich, 2002; Schommer, 1990). Although questions related to personal epistemology such as "How do I know what I know" mainly fall into the territory of philosophy and have been discussed in this field for many years, they have recently been of interest to

educational and instructional psychologists as well (Hofer, 2004). Aside from their contributions to the general literature on personal epistemology, these research studies have revealed important implications for education. For instance, researchers found that beliefs about knowledge and knowing affect and mediate knowledge acquisition and knowledge construction processes (Hofer, 2001). Similarly, these beliefs are found to be influential in students' approaches to and preferences for learning (e.g., learning as a passive reception of knowledge vs. learning as an active construction of knowledge) (Hofer, 2002).

As also explained in detail in Hofer and Pintrich's (1997) review and mentioned elsewhere (e.g., Abd-el Khalick, 2003; Hofer, 2001, 2002), Perry's (1970) work is accepted to be the starting point of psychological research on personal epistemology. In his study, Perry investigated the role of personal epistemology on intellectual and ethical development of undergraduate students who were almost entirely male. Based on responses of the participants to the questions he asked during the interviews, Perry grouped participants' perceptions of knowledge and meaning-making into four main developmental stages: dualism (received knowledge), multiplicity (subjective knowledge), relativism (procedural knowledge), and commitment (constructed knowledge). Belenky, Clinchy, Goldberger, and Tarule's (1986) study, which was carried out with women from diverse educational settings, is another landmark study in personal epistemology literature. This study was based on Perry's work and provided a portrait about women's epistemological perspectives and explained their development in a five-position model. According to this model, women are stated to move through five epistemological positions (i.e., silence, received knowledge, subjective knowledge, procedural knowledge, and constructed knowledge, respectively) as their beliefs about knowledge and knowing mature. Different from single-sex studies of Perry and Belenky et al., Baxter-Magolda (1987, 1992) conducted research with college students of both sexes who were undergraduate students in a small university. Baxter Magolda's main interest was to examine gender-related implications of epistemological development and influence of epistemological assumptions on interpretations of educational experiences. Her

analyses revealed that although there may be gender-related patterns in early stages, overall pattern of epistemological development is similar for males and females. Moreover, she identified a developmental sequence of four qualitatively different “ways of knowing” (i.e., absolute, transitional, independent, contextual) in her Epistemological Reflection model.

Both Belenky et al. (1986) and Baxter-Magolda (1987, 1992) utilized Perry’s (1970) approach and interviewed participants in a way that allowed interviewees to freely describe their own meaning making about knowledge and knowing in response to open-ended questions asked throughout the interviews. On the other hand, King and Kitchener (1994) used ill-structured problems in their interview protocols to study epistemological assumptions of individuals that underline their reasoning and judgments about ill-structured issues. Their research, which covered long years of cross-sectional and longitudinal studies and included interviews with individuals ranging from high school age to adulthood, lead to the formation of the Reflective Judgment model. In this model, there are seven stages of epistemological reasoning that are grouped into three levels of Reflective Judgment (i.e., pre-reflective, quasi-reflective, and reflective).

Kuhn (1991) is another researcher who studied epistemological nature of solving ill-structured problems. Similar to King and Kitchener (1994), she conducted interviews in which individuals, including teens as well as adults in their sixties, were asked questions about their thoughts about current social dilemmas. Responses of the interviewees were categorized on a three-level epistemological views scale (i.e., absolutist, multiplist, evaluativist), which is mainly based on Perry’s (1970) scheme. These epistemological views were conceived as reflections of epistemological standards or levels of epistemological understanding that underlie argumentative reasoning.

In contrary to abovementioned unidimensional models, in Schommer’s (1990, 1994) Epistemological Beliefs model personal epistemology was conceptualized as a

system of more or less independent epistemological belief dimensions. These five dimensions were hypothesized to be reflections of epistemological beliefs about structure, certainty, source of knowledge, and control and speed of knowledge acquisition which were labeled as simple knowledge, certain knowledge, omniscient authority, innate ability, and quick learning, respectively. In the present study, Schommer's Epistemological Beliefs model was utilized to study epistemological beliefs of pre-service science teachers (PSTs). Therefore, more detailed information about the dimensions proposed in this model is provided in this section of the chapter.

Simple Knowledge dimension in Schommer's Epistemological Beliefs model reflects beliefs about the complexity of knowledge and ranges from beliefs that view structure of knowledge as being constituted of isolated bits of facts to a composition of highly interrelated concepts. Tendencies for seeking single answers and avoiding integration of knowledge are indicators of naïve epistemological beliefs in this dimension. Beliefs about certainty of knowledge are included in the *Certain Knowledge* dimension of the Epistemological Beliefs model. This dimension is conceptualized as a continuum ranging from epistemological beliefs which view knowledge as a certain and absolute construct to knowledge that is tentative and evolving. Avoiding ambiguity is a general characteristic of individuals who have naïve beliefs in this epistemological belief dimension. The third dimension identified in Epistemological Beliefs model is *Omniscient Authority* and reflects beliefs about the source of knowledge; that is, whether knowledge is handed down by authority or generated from self-reflection and reason. As individuals' beliefs in this epistemological belief dimension develop, their dependency on authority decreases and their predisposition for criticizing authority increases. *Innate Ability* is one of the epistemological belief dimensions proposed as a reflection of individuals' beliefs about learning. In contrary to individuals who view learning ability as fixed at birth, individuals who have sophisticated beliefs in this epistemological belief dimension view the capacity for learning as an entity that can be developed by hard work. Finally, *Quick Learning* is another dimension related with epistemological beliefs

about learning. It ranges from beliefs that learning occurs quickly or not at all to beliefs that perceive learning as a gradual process which may require concentrated effort.

Schommer's (1990, 1994) approach for studying personal epistemology differs from other research not only because it conceptualizes personal epistemology as a system of more or less independent beliefs, but also the methodology used is quantitative in nature. Her methodology and the Epistemological Questionnaire, which was designed to tap the hypothesized epistemological belief dimensions, contributed much to the literature. Many researchers utilized Schommer's methodology and used pretest-posttest measures to examine effectiveness of educational programs in developing views of students about knowledge and knowing. Similarly, this approach was preferred over others for examining relationships between personal epistemologies and other constructs, especially in larger scale studies (Hofer, 2002).

2.5.2 Relationships between epistemological beliefs and environmental moral reasoning

In the present study, Schommer's (1990, 1994) theoretical framework was utilized to examine personal epistemologies of pre-service science teachers (PSTs). The reason for choosing Schommer's epistemological framework over others is mainly based on the nature of personal epistemology construct. That is, as also stated by Zeidler et al. (2013), unidimensional stage-like developmental epistemological models are less likely to fully capture details of fluid and dynamic constructs, such as epistemological beliefs, and their possible relationships with other constructs. Therefore, it is believed that Schommer's Epistemological Beliefs model, which conceptualizes personal epistemology as a system of more or less independent beliefs and thus entails a multidimensional view, is more appropriate to study the potential relationships between epistemological beliefs and environmental moral reasoning, as hypothesized in the present study. In the following paragraphs,

rationale for hypothesizing relationships between epistemological beliefs and environmental moral reasoning is provided with the support of various theoretical and empirical research studies.

Research shows that epistemological beliefs influence individuals' approaches to new information as well as their meaning-making of the information they encounter (Hofer, 2002). Accordingly, epistemological beliefs are influential on individuals' understanding of and reasoning about issues surrounding them, especially the ones which are ill-structured and lack definite solutions (Schraw et al., 1995). Moreover, research findings reveal that epistemological beliefs have important roles in individuals' decisions about socioscientific issues (SSI) as well as their justifications for their decisions (Zeidler et al., 2013). These features of epistemological beliefs imply close relationships between epistemological beliefs and moral reasoning because critical analysis of available and relevant information embedded in issues is a prerequisite for informed moral reasoning and subsequent moral judgments (Simmons & Zeidler, 2003).

Zeidler et al.'s (2013) study provided significant support for this contention by revealing how epistemological beliefs may play deterministic roles in individuals' decisions about moral and ethical issues. In their cross-cultural study, the researchers examined high school students' (from Jamaica, South Africa, Sweden, Taiwan, and the United States) epistemological reasoning about socioscientific issues (SSI), which evolved around allocation of scarce medical resources. Students' way of framing the issues, decision-making, and related explanations they invoked to support and justify their decisions were accepted as reflections of their epistemological reasoning. Moreover, since the topic of the SSI selected for the study (i.e., allocation of scarce medical resources) was representative of moral dilemmas inherent in the issues of distributive justice, participants' responses and reactions to the SSI were accepted as indicators of their moral reasoning as well. In addition to the participants' written responses that revealed their conceptualizations of the SSI, a close examination of the epistemological orientation categories (i.e.,

fairness, pragmatism, emotive reasoning, utility, theological issues) obtained from inductive analyses of data revealed how epistemological beliefs and moral reasoning were related. Moreover, the study had important implications about the influence of students' views about science on their moral reasoning about SSI. These relationships were observed more clearly when responses of Taiwanese students were compared and contrasted with their counterparts from other countries. Taiwanese students were found to conceptualize the SSI in epistemologically more sophisticated ways. Similarly, their responses to the quantitative instrument (i.e., EBAPS) showed that their views about science (NOS views) were more sophisticated than other students. Therefore, the researchers interpreted the ability of Taiwanese students to extend the SSI-related moral considerations from immediate and foreseeable concerns (e.g., longevity of the patient and organ) to more distant and abstract ones (e.g., potential contribution of the patient to the community) as a possible influence of the sophistication of their epistemological beliefs and NOS views.

Other research studies that found relationships between individuals' NOS views and moral reasoning about SSI (e.g., Zeidler et al., 2002) also add supporting empirical evidence to the existence of relationships between epistemological beliefs and environmental moral reasoning patterns, as proposed in the present study, since views about NOS are accepted to be reflections of scientific epistemological beliefs (Abd-el-Khalick, 2003; Zeidler, 2014). Moreover, the relationships between moral reasoning and epistemological beliefs as well as NOS views that were observed in individuals' reasoning about various SSI contexts were expected to be found in the contexts of environmental issues used in the present study since many of the environmental issues are also regarded as SSI (Lee et al. 2012; Sadler & Zeidler, 2004; Zeidler, 2014). In the following paragraphs underlying rationale of the proposed relationships between each of the epistemological belief dimensions (i.e., simple knowledge, certain knowledge, omniscient authority, quick learning, and innate ability) and environmental moral reasoning are discussed.

Simple Knowledge. An individual who has naïve beliefs in this epistemological belief dimension may be inclined to avoid knowledge integration while reasoning about issues since he/she believes that knowledge consists of discrete facts (Bendixen et al., 1998; Mintchik & Farmer, 2009). From an environmental moral reasoning perspective, these individuals may be unable to relate ecological concepts to each other, even if they are knowledgeable about the individual ecological concepts related to an environmental issue. Moreover, being unable to analyze and synthesize the environmental issues may prevent them from perceiving the big picture related to environmental issues. As a result, narrowness of their vision may influence their perceptions and interpretations about the moral implications of the environmental issues, and their moral reasoning about those issues. Bendixen et al.'s arguments add support to this claim. The researchers stated that individuals who believe in simple knowledge generally exhibit lower levels of moral reasoning because they have a tendency to over simplify even the more complex moral dilemmas and, as a result, consider only simple, rather than more complex and comprehensive, solutions regarding those dilemmas.

Certain Knowledge. Individuals who hold naïve beliefs in this epistemological belief dimension believe that knowledge is a certain and not changing phenomenon (Mintchik & Farmer, 2009). Research shows that these individuals generally show less patience in solving difficult tasks (Dweck & Leggett, 1988) and exhibit lower levels of problem solving abilities (Schommer-Aikins, 2002). Therefore, it can be claimed that naïve beliefs in this epistemological belief dimension will cause individuals to exhibit lower levels of environmental moral reasoning. More specifically, in order to exhibit higher levels of environmental moral reasoning, individuals should be aware that most of the environmental issues are complex and ambiguous in nature. Moreover, they should see the importance and value of considering many contextual factors for interpreting various aspects of the environmental issues including moral implications embedded in them. Nevertheless, beliefs in certainty of knowledge affect individuals' interpretation of knowledge and conclusions drawn from them in negative ways. For instance, even the information

or knowledge at hand shows characteristics of tentativeness and ambiguity; individuals who strongly believe in the certainty of knowledge tend to distort that information or knowledge in a way that they perceive them as if they were certain and unambiguous (Schommer, 1990). This tendency will prevent individuals from devoting their time to fully comprehend the environmental issues and related problems and thus exhibit lower levels of environmental moral problems. Moreover, believing in certainty of knowledge may cause individuals to be less sensitive to environmental problems such as global warming and their consequences which are not fully evident and directly observable at the time of being (Ozturk, 2009). As a result, these individuals may exhibit lower levels of environmental moral reasoning since sensitivity to issues and their moral aspects are regarded among the indicators of higher levels of moral reasoning (Rest, 1984; Rest et al., 1999).

Omniscient Authority. Beliefs in *omniscient authority* make individuals tend to believe that authorities have access to otherwise inaccessible knowledge (Bendixen et al., 1998). Therefore, these individuals avoid criticizing any decisions or actions of the authorities (Topcu, 2011). The influence of this naïve epistemological belief on moral reasoning has been studied in previous research. Findings consistently show that if people believe in the existence and legitimacy of omniscient authority, they tend to have lower levels of moral reasoning. The main reason for this situation may be their propensity to give more importance to external sources of moral standards such as conventional rules and norms of society, rather than self-chosen ethical and moral principles (Bendixen et al., 1998) that indicate higher levels of moral reasoning and development (Kohlberg, 1976, 1986). Curtis, Billingslea, and Wilson's (1988) study provides support for this argument. In their study, the researchers examined the relationships between participants' principled moral reasoning scores and attitudes toward two types of authorities, namely private/personal (e.g., parents, boss, teacher, etc.) and public/impersonal (e.g., government, police, courts, etc.). Their analyses resulted in significantly negative correlations between positive attitudes toward authorities and principled moral reasoning scores, which indicate higher levels of moral reasoning. Moreover,

analyses revealed that converse relationship between principled moral reasoning and positive attitudes toward authority was weaker for private/personal authorities ($r = -.37$), than public/impersonal authorities ($r = -.60$) which are perceived as the main agents of societal norms (Kammeyer, Ritzer, & Yetman, 1990).

Quick Learning. Naïve believers of this epistemological belief assume that learning should necessarily happen in the first attempt and see concentrated effort for knowledge acquisition as a waste of time (Mintchik & Farmer, 2009). Moreover, they tend to think that solutions to problems should be found quickly; if not, no solution can be found even with hard work and concentrated effort (Bendixen et al., 1998). Accordingly, in the present study it was hypothesized that avoidance from concentrated effort to fully understand the moral aspects embedded in environmental issues and their potential solutions may negatively influence environmental moral reasoning of the participants. Moreover, previous research findings revealing significant correlations between this epistemological belief dimension and environmental attitudes as well as environmental behaviors (Ozturk, 2009) also make it worthwhile to test the relationship between ‘quick learning’ epistemological belief dimension and environmental moral reasoning.

Innate Ability. This epistemological belief dimension is related to beliefs about ability to learn and ranges from the belief that ability to learn is innate and fixed at birth to ability to learn is acquired (Schommer, 1990). People who have naïve epistemological beliefs in this dimension perceive learning ability as a talent rather than a skill that can be enhanced with the help of educational processes (Mintchik & Farmer, 2009). Research shows that when individuals have less sophisticated beliefs in innate ability, they tend to show less interest and spend less time in studying and solving a problem, especially when they have made mistakes before (Schommer, 1998). This situation is also valid for environmental problems and implies a relationship between this epistemological belief dimension and environmental moral reasoning. That is to say, individuals who spend less time in understanding and solving environmental issues most probably will gather less information about

environmental problems including the moral aspects inherent in them (Kortenkamp & Moore, 2001).

Although relationships between epistemological beliefs and moral reasoning seem to be intuitively obvious, number of empirical research that explicitly examined these relationships is relatively scarce. Bendixen et al.'s (1998) study is one of these few studies. It is an important study in this area since it showed how epistemological beliefs contributed to the explanation of the variance in moral reasoning even when the effects of other critical variables (i.e., age, gender, syllogistic reasoning skills, year in school, academic major, estimated grade point average) were removed. Participants of the study were a total of 154 undergraduate students who were enrolled in an introductory psychology course. Participants' responses to demographic questions, syllogisms test (used to measure basic logical reasoning skills), Epistemic Beliefs Inventory (EBI), and short form of Rest's (1979) Defining Issues Test (DIT) were used for data analyses. Bendixen et al. conducted factor analysis to examine the factor structure of EBI and found that participants' responses to the scale yielded five factors that represented five epistemological belief dimensions, as expected. All the factors were found to have high degrees of face validity with unambiguous loadings on only one factor that is directly related with the construct being examined. As in other studies that utilized DIT, P-scores were used as representations of the participants' principled/post-conventional moral reasoning for each moral scenario. In order to test the relationships between these epistemological belief dimensions and principled/post-conventional moral reasoning scores (P-scores), correlation and hierarchical multiple regression analyses were performed. Correlation analyses revealed that simple knowledge ($r = -.25$) and quick learning ($r = -.22$) epistemological belief dimensions were negatively correlated with P-scores in statistically significant ways. Since lower scores in the EBI scale indicate more sophisticated epistemological beliefs in the related dimensions, these findings showed that participants' moral reasoning levels tended to increase as their beliefs in simple knowledge and quick learning epistemological beliefs became more sophisticated.

Furthermore, after removing the effects of other variables (i.e., age, gender, syllogistic reasoning skills, year in school, academic major, estimated grade point average), four of the five epistemological belief dimensions collectively explained 13% of the P-score variance in a statistically significant way. Innate ability epistemological belief dimension did not significantly contribute to the equation. Although the amount of the total contribution of the four epistemological belief dimensions in explaining variance in post conventional moral reasoning (P-scores) was not high in terms of practical significance, the researchers interpreted their finding as an important indication of the role that epistemological beliefs play on individuals' moral reasoning and decision making. According to the researchers, since this unique proportion of variance explained by epistemological beliefs was higher than any of the variance explained by other variables of the study, it clearly showed how epistemological beliefs were related to moral reasoning and decision making above and beyond several social and personal variables.

Mintchik and Farmer (2009) investigated the relationships between epistemological beliefs and moral reasoning in an accounting context with a sample of 140 accounting students (93 seniors, 12 non-degree seekers, 35 master students). For data collection, the researchers used an instrument developed by Thorne (2000) which aims to measure respondents' moral reasoning levels based on their responses to specific accounting ethical dilemmas in a way that is similar to that of Rest's (1984) Defining Issues Test. In addition, Schommer's (1990) Epistemological Questionnaire was administered to assess participants' epistemological beliefs. Factor analysis of the data obtained from Schommer's Epistemological Questionnaire yielded four factors representing four epistemological belief dimensions (i.e., simple knowledge, certain knowledge, quick learning, and innate ability), which cumulatively explained 55.5 % of the variance in the participants' responses. Correlation analyses revealed that there was not a statistically significant relationship between any of the four epistemological belief dimensions and moral reasoning levels. Only when the analyses were repeated with each of the items in the Epistemological Questionnaire separately, statistically significant correlations were

found between participants' moral reasoning scores and responses to some of the items in Epistemological Questionnaire. Researchers interpreted these significant relationships as possible indicators of some latent constructs (e.g., locus of control, preference for learning environment) that are hidden in the items but not captured by the questionnaire. Nevertheless, statistically insignificant correlations between epistemological belief dimensions and moral reasoning may also be attributed to the low internal reliability values (ranged from .42 to .64) of the factors that emerged from the factor analysis of the Epistemological Questionnaire.

In a later study, Topcu (2011) examined Turkish elementary student teachers' ($N = 96$ (27 male, 69 female); age range = 20 to 25 years) epistemological beliefs and moral reasoning and the relationships between them. The study was a mixed-method study in nature and included semi-structured interviews ($N = 14$) and administration of a questionnaire (i.e., Schommer's (1990) Epistemological Questionnaire). Moral reasoning levels of the participants were measured by Rest's (1986) Defining Issues Test. Similar to Mintchik and Farmer (2009), factor analysis of the participants' responses to Schommer's Epistemological Questionnaire yielded four factors representing four epistemological belief dimensions (i.e., quick learning, certain knowledge, simple knowledge, innate ability). These factors accounted for the 57.3 % of the variances of the participants' scores. Interestingly, results of quantitative and qualitative analyses revealed contradictory findings with respect to the participants' epistemological beliefs in 'certain knowledge' dimension. Although mean scores they obtained from the 'certain knowledge' dimension of the Epistemological Questionnaire indicated that they had naïve beliefs regarding the certainty of knowledge, their responses to the interview questions were indicative of more sophisticated beliefs in this epistemological belief dimension. Interviewees asserted that knowledge is not certain but is subject to change owing to new discoveries and innovations, changes in time and society, and nature of disciplines like science and sociology. There may be some possible explanations regarding the contradictory findings obtained from quantitative and qualitative analyses. Firstly, epistemological beliefs of elementary student teachers selected for the interviews

may be different from epistemological beliefs of other elementary student teachers that participated in the quantitative phase of the study. Secondly, as also stated by Topcu (2011), items in translated version of the Epistemological Questionnaire may be insufficient and ineffective in reflecting underlying meanings of the statements in Schommer's (1990) original questionnaire and capturing epistemological beliefs of its respondents. Low reliability values obtained from Topcu's study as well as the previous others that used the same instrument (e.g., Yilmaz-Tuzun & Topcu, 2008) add support to this contention. Alternatively, inconsistencies obtained from the quantitative and qualitative phases of the study may be attributed to methodological issues such as the characteristics of the interviews including the methods used for conducting and analyzing them. For instance, the interview question "Do you think knowledge changes, or it is something that does not change? Why do you think that?" may have caused the interviewees to feel that there was a "correct" answer for the question that was implied in the question itself. Moreover, since the researcher was teaching in the same university where the participants were enrolled in, their responses to the interview question may have been different from their real thoughts due to data collector characteristics internal validity threat (Fraenkel, Wallen, & Hyun, 2012). Finally, since the qualitative criteria for interpreting responses of the interviewees was not defined in full detail in the study, it is not clear whether the interviewees' responses to the interview question did really show the sophistication of their epistemological beliefs or whether the qualitative findings were influenced by misinterpreting key words in the interviews in a way that they meant more than they really did.

Regarding the relationships between epistemological beliefs and moral reasoning, Topcu's (2011) analyses did not result in any significant relationships between participants' principled/post conventional moral reasoning levels (P-scores) and any of the four epistemological belief dimensions (i.e., quick learning, certain knowledge, simple knowledge, innate ability) that were identified through factor analysis of epistemological beliefs data. Different from Mintchik and Farmer (2009), Topcu did not conduct any further analysis to look for the relationships between

scores obtained from separate items in the Epistemological Questionnaire and P-scores obtained from Defining Issue Test.

Although very few in number, there are also research studies in which the relationships between epistemological beliefs and moral reasoning were examined from a cross-cultural perspective. For instance, in a dissertation study, Ren (2006) examined these relationships with a sample of American ($N = 149$) and Chinese ($N = 303$) college students who majored in education. In this research, participants' moral reasoning levels were studied by an updated version of Defining Issue Test (DIT-2) (Rest et al., 1999) which aims to measure respondents' principled/post conventional moral reasoning levels through their responses to five vignettes. In addition, Epistemic Beliefs Inventory (Bendixen et al., 1998; Schraw, Bendixen, Dunkle, 2002) was administered to the participants to assess their epistemological beliefs. In addition to the differences observed in moral reasoning and epistemological belief scores, analyses of the relationships between epistemological beliefs and moral reasoning revealed different findings for American and Chinese pre-service teachers. For the American sample, small but statistically significant correlations were found between principled/post-conventional moral reasoning and simple knowledge ($r = -.20, p < .05$), omniscient authority ($r = -.30, p < .01$), and quick learning ($r = -.20, p < .05$) epistemological belief dimensions. On the other hand, none of the correlations were statistically significant for the Chinese sample. These findings implied that culture was an influential factor not only on individuals' epistemological beliefs and moral reasoning separately but also on the relationships displayed between these constructs.

In another dissertation study, Jeong (2003) explored the influence of culture on the relationships between epistemological beliefs and moral reasoning with a sample of 243 Korean (151 female, 92 male; age range = 18-38 years; mean age = 22.1) and 191 American (142 female, 49 male; age range = 17-49 years; mean age = 21.2) undergraduate students who were taking education courses. Jeong's research was very similar to that of Bendixen et al. (1998) and followed the same procedures:

first, participants completed Bendixen et al.'s Epistemic Beliefs Inventory, syllogism test, demographic questionnaire, and Rest's (1979) Defining Issues Test. Next, relationships were investigated through correlation and multiple regression analyses. Before investigating the hypothesized relationships between epistemological beliefs and moral reasoning, the researcher performed factor analyses to examine factor structure of Epistemic Beliefs Inventory. Analyses yielded five factors representative of the five epistemological belief dimensions hypothesized by Schommer (1990) for both Korean and American sample that explained 40.5 % and 44.4 % of the sample variations, respectively.

For the Korean sample, statistically significant correlations were found between omniscient authority ($r = -.35, p < .01$), certain knowledge ($r = -.32, p < .01$), and quick learning ($r = -.13, p < .05$) epistemological belief dimensions and principled/post-conventional moral reasoning scores. In addition, multiple regression analyses revealed that combination of omniscient authority and certain knowledge epistemological belief dimensions accounted for 17% of the variance in P-scores. Inclusion of the remaining epistemological belief dimensions (i.e., simple knowledge, innate ability, quick learning) did not result in a significant increase (only 1.6 %) in predictive power of the equation. For the U.S. sample, significant correlations were found between omniscient authority ($r = -.35, p < .01$), simple knowledge ($r = -.31, p < .01$), and quick learning ($r = -.18, p < .05$) epistemological belief dimensions and principled/post-conventional moral reasoning scores. Multiple regression analyses also revealed the importance of epistemological beliefs on moral reasoning where a combination of omniscient authority, simple knowledge, and quick learning scores explained 17.7% of the variance in P-scores. Inclusion of the remaining epistemological belief dimensions (i.e., certain knowledge and innate ability) did not result in a significant increase (only 0.5 %) in predictive power of the equation.

Based on his findings, Jeong (2003) concluded that for both Korean and American samples, epistemological beliefs explained a substantial proportion of the variance in

principled/post-conventional moral reasoning scores above and beyond the effects of gender, age, education, GPA, academic major, and syllogistic reasoning.

Nevertheless, the two samples showed some differences regarding the relationships between epistemological beliefs and moral reasoning. For instance, while certain knowledge epistemological belief dimension was found to be significantly correlated with moral reasoning of Korean undergraduates, it was not found to be related with American undergraduates' moral reasoning. This situation was reversed for simple knowledge epistemological belief dimension. While this dimension was found to have an important role in American undergraduates' moral reasoning levels, it did not have any significant relationship with Korean students' moral reasoning scores. The researcher interpreted these differences as indicators of (1) the independence of epistemological beliefs from each other (i.e., each epistemological belief dimension operates independently) and (2) influence of culture as a mediating factor of the relationships between epistemological beliefs and moral reasoning.

In conclusion, it is clear that literature requires further research to clarify the relationships between epistemological beliefs and moral reasoning. While findings of some of the research studies confirm hypothesized relationships between their variables related to epistemological beliefs and moral reasoning, other studies did not reveal any significant relationships, and still some others reveal contrasting results for their subsamples belonging to different cultural groups. Furthermore, to the best of the researcher's knowledge, nobody has explicitly examined relationships between epistemological beliefs and moral reasoning in an environmental moral reasoning context. All of the reviewed studies, except Mintchik and Farmer (2009), examined participants' moral reasoning toward general social moral dilemmas. Mintchik and Farmer's dilemmas, on the other hand, were concentrated on morality in accounting contexts. Moreover, in all of these studies, P-scores reflecting principled/post-conventional moral reasoning levels, which is the highest level in Kohlberg's (1976, 1986) theory of moral development, were used. In contrast, in the present study environmental moral reasoning of the participants was studied under the tripartite framework of egocentric, anthropocentric, and ecocentric moral

reasoning. The choice of this framework provided basically two advantages to the researcher. First, in contrary to Kohlberg's framework that is frequently criticized for being dominated by cognitive processes, in this framework moral reasoning is conceptualized as a composition of cognitive and affective elements, as suggested by the literature (Greely, 2008; Persing, 2006; Zeidler & Schafer, 1984). Second, with this framework the researcher had the possibility of examining moral reasoning of their participants from a broader spectrum. That is to say, P-scores only give relative standing of individuals' moral reasoning with respect to principled/post-conventional moral reasoning level. On the other hand, with the tripartite framework the researcher had the possibility to examine details about the variations in moral reasoning patterns of the participants. The varieties in moral reasoning are particularly important in environmental contexts because research shows that differences in moral orientations of individuals may have different implications for environmental attitudes and behaviors (Bjerke & Kaltenborn, 1999; Thompson & Barton, 1994). Therefore, examining the relationships between epistemological beliefs and moral reasoning from a broader spectrum will contribute a lot to the related literature.

2.6 Values and Environmental Moral Reasoning

One of the main purposes of the present study was to investigate the relationships between values and environmental moral reasoning patterns. In accordance with this purpose, related research was reviewed and is presented to the readers in two subsequent subsections. In the first subsection, research on the meaning, content, and structure of values are covered. In this subsection a substantial place is given to Schwartz's (1992, 1994) value theory, which was utilized to examine the proposed relationships in the current study. Then, in the second subsection, research that contributed to the literature regarding the relationships between values and environmental moral reasoning patterns are summarized and implications of their findings are discussed.

2.6.1 Meaning, content, and structure of values

Values, which are regarded as the bases of environmental ethics (Palmer, 1997), constitute one of the main constructs of the present study. Having its roots in the Latin word *valere* (i.e., to be strong, worthy), the term value is used to refer “what something is worth, opinions about that worth, and moral principles” (Dietz et al., 2005, p.339). Actually, each of these usages reflects underlying nuances in their meanings. That is, the first usage stresses the independency of the value of an object from what others assign to it, its intrinsic value; on the other hand, the second definition highlights the necessity of opinions of people about the value of an object; and the third definition accepts the standards and principles as criteria for valuing (Dietz et al., 2005).

Green (1993) pointed to the importance of the language we use while talking about “values” and stressed how a wrong usage may create obstacles and even be destructive to educational thought. Moreover, according to Green, the choice of language use also influences the ways we think and behave in our everyday lives. For instance, if we use “people having values” rather than “things having values”, implications inherent in the meaning of value greatly change. Value becomes something that people possess or prefer; not the worth of things that are already present in the world and presented to people to experience. This situation will not only impede educational discourse such as asking educational questions about the value or worth of things, what is desired, or what is desirable. It will also make it less possible to talk about the different perspectives on what things have worth and welcome different ways of life, social structures, cultures, and forms of life including non-human species. Finally, Green argued that the notion of “values change” is another misconception or misinterpretation of values because values, as social structures that form our relations, do not change but their indicators (i.e., domain, range, context, standards, and rank order) change resulting in an overall change in the world we live in.

The dictionary meaning of the term value is given as “relative worth, utility or importance” (*Merriam-Webster's*, n.d.). This definition points to an important feature of this construct: its relativity. The importance of this feature has been described by researchers such as Hart (2003) who defined values as reflections of individuals’ beliefs about *relative* worth of things such as community, equity, justice, nature, and environment. Similarly, Schwartz and Bilsky (1987) listed “being ordered by relative importance” (p.551) among the basic features of values. The importance of values and their relativity for individuals’ decisions, judgments, and behaviors are also acknowledged by ethical theory and social science theory. These theories basically state that individuals make decisions and judgments by weighting the relative values they attribute to different things (Dietz et al., 2005). Green (1993) highlighted this relativity issue by identifying “rank order” as one of the indicators of values to explain how some values may receive more attention or may be given more importance than others depending on the situation such as urgency of need and necessity for action.

Thompson and Barton (1994) suggest that values held by individuals may impede or foster the translation of their pro-environmental attitudes to pro-environmental behaviors. More specifically, the authors state that if the relative value individuals give to human-centered issues such as comfort, quality of life, and human health is greater than the value attributed to the intrinsic value of nature, then, it will be less probable for the translation of positive views about the necessity of environmental protection or conservation to actual pro-environmental behaviors to occur, especially when doing so requires making sacrifices.

Similar to relativity, universality is an important feature of values. Numerous studies conducted with samples from different countries show that although the priority of importance given to different values may change from person to person, or from culture to culture, the total number of values held by individuals is fairly small and their content and structure are universal (De Groot & Steg, 2007). That is to say, values held by individuals form similar categorizations and the relationships (i.e.,

conflicts and compatibilities) between these categories/types of values do not change from country to country or from culture to culture (Schwartz, 1992). Schwartz and his colleagues (e.g., Schwarz, 1992, 1994; Schwartz & Bardi, 2001; Schwartz & Bilsky, 1987, 1990; Schwartz & Sagiv, 1995) provided empirical evidence that supported the notion of universality in the content and structure of values.

Schwartz and Bilsky (Schwartz, 1992; Schwartz & Bilsky, 1987, 1990) identified five main characteristics of values and conceptualized values as (1) concepts or beliefs (2) pertaining to desirable end states or modes of conduct that (3) transcend specific situations, (4) guide selection or evaluation of behavior, people, and events, and (5) are ordered by importance relative to other values to form a system of value priorities. In a modified version of this definition values were conceptualized as “goals” and, in addition to their previously identified characteristics, their important role as guiding principles for individuals’ lives and other social entities were emphasized (Schwartz, 1994; Schwartz & Bardi, 2001; Schwartz & Sagiv, 1995). In their studies, Schwartz and his colleagues adopted Rokeach’s (1973) research methodology and provided participants a list of values with additional explanatory phrases near each of them. Then, respondents were asked to rate each value in terms of their importance as “guiding principles” in their lives on a 9 point-scale (opposed to my values (-1), not important (0), important (3), very important (6), supreme important (7); ratings of 1, 2, 4, and 5 are unlabeled). Their samples represented a variety of adults and adolescents with diverse occupation, socioeconomic status, culture, language, and educational level. For instance, participants in Schwartz’s (1992) study were from 20 countries. Schwartz (1994) studied 97 samples from 44 countries. There were five culturally diverse samples representing different societies in Schwartz and Bilsky’s (1990) study. Schoolteachers in 56 nations and college students in 54 nations participated in Schwartz and Bardi’s (2001) research. Finally, 88 samples from 40 countries were represented in Schwartz and Sagiv’s (1995) study. Based on all these studies, Schwartz and his colleagues achieved to identify a set of values that are held by various human groups in all over the world. Consistencies across findings are accepted as support for the validity of Schwartz’s

Value Theory commonly utilized in research examining human values (Dietz et al., 2005).

Schwartz's Value Theory includes a total of 56 values (see Table 1.1 for a full list) that form ten value types (i.e., power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security). These values and value types are stated to derive from three basic individual and social requirements: (1) our biological needs, (2) coordinated social interaction, and (3) smooth functioning and survival of groups. As an example, pursuit of *conformity* value type and the values that belong to this value type (i.e., politeness, honoring parents and elders, being obedient, and self-discipline) are theorized to be developed as responses to perceived requirements of group survival, which lead individuals to avoid hurting others (Schwartz, 1994). In addition to revealing content of human values and explaining their bases, Value Theory provides explanations about the structure of the relationships among those values. According to this theory, values and corresponding value types are based on a continuum of related motivations that form a circular structure (Struch, Schwartz, & Kloot, 2002). In this theoretical model, values are arranged in a way that competing motivational types of values are placed in opposite directions from the center of the circle and compatible motivational types of values are in close proximity (see Figure 2.1). For instance, value types of *power* and *universalism* are placed on diametrically opposite sides of the circle because they imply opposing motivational goals: while *power* emphasizes control and dominance, basic desire of *universalism* is equality for all. On the other hand, value types that share common motivational emphases are adjacent to each other on the circular plane. For instance, value types of *power* and *achievement* are adjacent because they both emphasize social superiority and esteem. Moreover, *achievement* value type is also adjacent to *hedonism* because they share motivational emphasis of self-centered satisfaction (Schwartz, 1992, 1994). Further examination of the theoretical model reveals a unique relationship between *tradition* and *conformity* value types. Since these two value types are proposed to share a single motivational goal (i.e., "subordination of self in favor of socially imposed

expectations” (Schwartz, 1994, p. 24), they are placed in the same ‘slice’ of the circle.

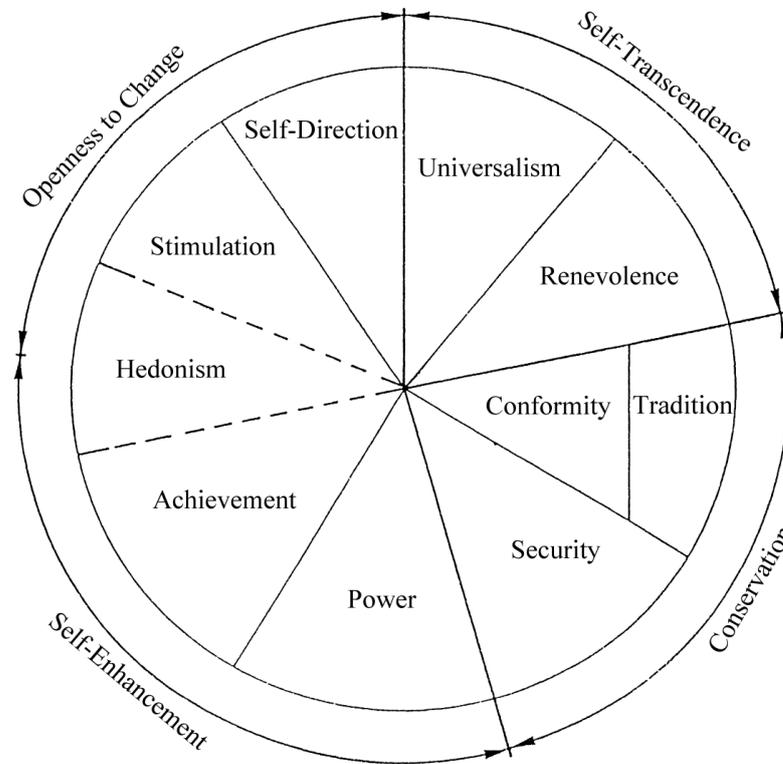


Figure 2.1. Relations among motivational types of values and value categories proposed in Schwartz Value Theory

Finally, as demonstrated in Figure 2.1, relationships identified among ten motivational types of values manifests an arrangement of four value categories (i.e., openness to change, conservatism/tradition, self-transcendence, and self-enhancement) that are organized in two bipolar dimensions. One of these dimensions is referred as *self-enhancement versus self-transcendence* dimension and includes values that reflect personal interests and values that focus on concerns for others, which form the two opposite poles of the dimension. The other dimension (i.e., *openness to change versus conservation/tradition*) demonstrates the conflicts

between values that pursuit independence and readiness for new experiences and the ones that stress preservation of status quo and protection of stability.

2.6.2 Relationships between values and environmental moral reasoning

As mentioned previously, values are frequently used in research that examines individuals' approaches toward environmental issues and human-environmental relationships (Bjerke & Kalternborn, 1999; Corraliza & Berenguer, 2000; Stern, Dietz, & Guagnano, 1995). These research studies also include attempts to explain how values held by individuals may be related to differences in their environmental moral reasoning. Findings reveal that there are two basic foundations of an individual's view of environmental ethics and subsequent environmental moral reasoning: 1) degrees of values that an individual gives to different aspects of the environment, 2) scope of the outcomes of environmental problems that he/she considers important (Dietz et al., 2005). In the present study, relationships between values and environmental moral reasoning were empirically examined within this framework. The following paragraphs present an overview of literature that focused on these relationships.

Schultz and Zelezny (1999) investigated the relationships between values and environmental orientations. In their study, the researchers collected data from 2160 English and Spanish-speaking college students in 14 different countries (Argentina, Canada, Colombia, Costa Rica, Dominican Republic, El Salvador, Ecuador, Mexico, Panama, Peru, Paraguay, Spain, United States, and Venezuela). To examine the respondents' ecocentric/biocentric approaches toward the environment the researchers used Thompson and Barton's (1994) ecocentrism-anthropocentrism scale and Dunlap, Van Liere, Mertig, and Jones's (2000) revised New Ecological Paradigm (NEP) scale, which is a measure of pro-environmental/ecological worldview. 37 items of Schwartz's (1992) value survey were used for collecting data on values. A series of regression analyses were performed to investigate the

relationships between values and ecocentrism-anthropocentrism measures. Since results revealed consistent findings for each country, the researchers conducted regression analyses by combining data sets of all countries. Findings of the analyses provided support for the value-basis theory of environmental orientations. In the overall, ten value types identified by Schwartz (1994) explained 11%, 12%, and 15% of the total variance in the participants' NEP, ecocentrism, and anthropocentrism scores, respectively. In addition, the study revealed some details about the relationships between values and environmental orientations (i.e., ecocentrism, anthropocentrism). For instance, there was a positive relationship between universalism value type and the participants' NEP scores. On the other hand, the participants who gave more importance to values related to power and tradition tended to have lower scores in NEP. As expected, the results were very similar for Thompson and Barton's (1994) ecocentrism subscale. Ecocentrism was found to be positively related with universalism but negatively related with power and tradition value types. On the contrary, the two value types of power and tradition, in addition to the security value type, were positive predictors of anthropocentrism. These findings offer some important implications for the present study. Firstly, taken together with research revealing the role of values on individuals' moral reasoning (Zeidler, 2014), the relationships found between values and ecocentrism-anthropocentrism measures imply that values may be one of the most important influential factors that result in differences in individuals' environmental moral reasoning patterns. Secondly, similarities between ecocentrism and NEP with respect to the values that had positive and negative relationships with each measure (universalism was positively related whereas power and tradition were negatively related with ecocentrism and NEP) indicates that ecocentric moral reasoning may be a higher level of environmental moral reasoning when compared to anthropocentrism because NEP is a reflection of the view that sees humans as an integral part of nature and thus results in higher levels of moral concerns for the environment.

In a later study, Schultz and his colleagues (Schultz et al., 2005) included a more diverse set of countries (Brazil, the Czech Republic, Germany, India, New Zealand, and Russia; $N_{total} = 988$) in their sample to test the relationships between values and environmental orientations in other languages and cultures. Different from the previous study (Schultz & Zelezny, 1999), all 56 items in Schwartz's (1992, 1994) value survey were used. Moreover, Schultz's (2001) instrument which measures three types of environmental concerns (i.e., egoistic, altruistic, biospheric) oriented around three different sets of valued objects (self, other people, and all living organisms, respectively) was utilized. Dunlap et al.'s (2000) NEP scale was also among the data collection instruments of the study. For examination of their data, the researchers conducted analyses with both 10 value types and 4 value categories identified by Schwartz. Findings revealed that *power* was negatively correlated with NEP scores for five of the six samples in the study. In addition, results revealed a consistent pattern regarding the relationships between value categories and environmental concerns. Biocentric environmental concern was found to be positively correlated with self-transcendence, but negatively correlated with self-enhancement value category. The results were reversed for egoistic environmental concern yielding a positive relationship with self-enhancement and negative relationship with self-transcendence value category. For further investigation, the researchers performed multiple regression analysis on the aggregated sample with clusters of value types falling into self-enhancement (power, achievement) and self-transcendence (universalism, benevolence) value categories and environmental concerns focused on self (egocentrism) and all living organisms (biocentrism). In order to be able to examine the unique influence of universalism value type independent of the two values that are directly related with environmentalism (i.e., protecting the environment, unity with nature), analysis were conducted with two separate universalism variables created by the researchers: universalism-environment (included these two value items) and universalism-excluding environment (included the remaining seven value items in universalism value type). Analyses showed that adherence to benevolence led the participants to be less egocentric in terms of their environmental concerns. In addition, regardless of

including or excluding the two values which are directly related with environmentalism (i.e., protecting the environment, unity with nature), universalism value type significantly contributed to the explanation of the variances in their egocentric and biocentric environmental concerns. Participants who gave more importance to universalism as a guiding principle in their lives were more likely to have biocentric environmental concerns but less likely to have egocentric environmental concerns. Therefore, Schultz et al.'s (2005) study provided cross-cultural evidence for the existence of relationships between values and environmental orientations. This contention was further supported by the findings that showed explanatory effect of universalism value type on egocentrism and biocentrism, which remained even after environment-related values were removed from the analyses.

Stern and Dietz's (1994) study also helped to explain relationships between values and egocentric, anthropocentric, and ecocentric/biocentric orientations, which are stated to mainly derive from concerns for self, other people, non-human species and the biosphere, respectively. In their study, the researchers conducted telephone interviews with a random sample of 199 adults in America. In addition to 32 value items identified by Schwartz (1992), Stern and Dietz used two new items (i.e., preventing pollution, respecting the earth) to better able to differentiate ecocentric/biospheric values from altruistic (anthropocentric) values in the scale. However, contrary to their expectation, biospheric and altruistic value items could not be differentiated and loaded on the same factor (Factor 1: biospheric-altruistic value orientation). The other three factors were named as openness to change, egoistic, and traditional value orientation. The researchers used these four factors to predict the variances in participants' awareness of environmental consequences for self, other people, and non-human species and the biosphere. Loading of biospheric and altruistic value items on a same factor was an interesting result because, as also stated by the researchers, the distinction between valuing the environment for its own sake (i.e., biospherism/ecocentrism) and for the benefit of humans (i.e., altruism/anthropocentrism) is quite clearly proposed by environmentalist theorists

and activists. Stern and Dietz interpreted this finding as an important clue for further research and suggested investigating whether ability to differentiate between these two constructs (ecocentrism, anthropocentrism) was an indication of environmental consciousness that is most probably possessed by environmentalists but may not be well-developed in general public as in the participants of their study.

Results of Stern and Dietz's (1994) multiple regression analyses showed that biospheric-altruistic value orientation was an influential factor to sensitize participants to each of the egocentric ($B = .38$), anthropocentric ($B = .23$), and ecocentric/biocentric ($B = .29$) consequences of environmental issues. On the other hand, traditional value orientation was found to be negatively related with beliefs or concerns about environmental issues' influences on self ($B = -.12$) and the biosphere ($B = -.12$). Egoistic value orientation factor was also negatively correlated with beliefs about environmental issues' adverse effects on the biosphere ($B = -.25$). Finally, openness to change value orientation was not found to be a statistically significant predictor of any of these variables. Stern and Dietz interpreted these findings as evidence supporting the influence of values in making people more sensitized to negative consequences of environmental issues for themselves, other people or other living beings in the biosphere (as biospheric-altruistic values did) or overlooking them (as egoistic and traditional values did), which was an indication of the close link between environmental orientations and basic human values.

Research shows that values do not only influence the sensibility of individuals to certain aspects of the environmental problems and affect their environmental orientations, but also may be deterministic on their environmental moral reasoning levels. For instance, de Groot and Steg's (2007) study demonstrated the importance of values for pro-environmental personal norms, which are feelings of moral obligation to act in pro-environmental ways (Nordlund & Garvill, 2002; Stern, 2000). In their study, the researchers utilized Schwartz's (1992, 1994) value theory and used de Groot and Steg's (2008) scale to study the values held by participants. In this scale, de Groot and Steg (2008) included some of the value items (eleven

items) in Schwartz value taxonomy and added two biospheric items to better represent biocentric/ecocentric value orientations, which they believed were lacking in Schwartz's value taxonomy. De Groot and Steg (2007) hypothesized that value items selected from Schwartz's self-enhancement value orientation would represent egoistic values, and the remaining value items that fall into self-transcendence value orientation would represent altruistic (anthropocentric) and biospheric (ecocentric) values. Data of the study was collected from five European countries (Austria, Czech Republic, Italy, the Netherlands, and Sweden). Completed questionnaires belonged to a total of 490 respondents (45% male, 55% female; age range = 17-72 years; mean age = 38.21). In line with the expectations of the researchers, confirmatory factor analysis of the data revealed a three-factor structure (i.e., egoistic, altruistic/anthropocentric, biospheric/ecocentric) in their participants' values. Further analyses conducted with these three value orientations showed that biocentrism/ecocentrism was positively related to personal norm scores for each of the five countries. Moreover, there were statistically significant low positive relationships between altruistic value orientations and personal norm scores for Netherlands ($r = .18$) and Sweden ($r = .32$). On the other hand, relationships between egoistic values and personal norm scores were found to be negative for Czech Republic ($r = -.28$) and Netherlands ($r = -.31$).

In order to clarify the explanatory influence of values on pro-environmental personal norms, de Groot and Steg (2007) performed multiple regression analyses. Supporting the findings of the correlation analyses, results showed that, on the whole, stronger biospheric value orientation was related to higher levels of pro-environmental personal norm (PN) ($\beta = .40$). On the contrary, having a more egoistic value orientation was found to result in lower levels of PN ($\beta = -.20$). Similar patterns were obtained when the analyses were repeated separately for each of the five countries. Since pro-environmental personal norm, by its definition, can be regarded as an indication of environmental moral reasoning, these findings add cross-cultural evidence for the relationships between values and moral reasoning of individuals toward environmental issues.

Nordlund and Garvill's (2002) study also contributed to the theoretical background of the present research. By using path analysis, the researchers provided a holistic and comprehensive portrait about the relationships between values and environmental moral reasoning. Actually, their study was designed to test a hierarchical model proposed to explain relationships of values (general and environmental), problem awareness, and personal norms (i.e., perceived moral obligations to protect the environment) to pro-environmental behavior. The authors used value items that belong to self-enhancement and self-transcendent value orientations in Schwartz's (1992, 1994) value theory. Moreover, they classified participants' orientations toward the environment (environmental values) into two: ecocentric or anthropocentric. Data of the study was collected from a Swedish sample of 1400 individuals. Before conducting path analysis, the researchers examined correlations between the study variables. Findings revealed that while self-transcendence values were moderately positively correlated with higher levels of perceived moral obligations to protect the environment (i.e., personal norm) and ecocentrism, self-enhancement had small positive correlation with anthropocentrism. Results of path analysis also supported these findings and revealed statistically significant relationships (ranging from small to medium) between values and ecocentrism, anthropocentrism, and personal norms. Moreover, according to the path analysis results, the participants who were more ecocentric toward the environment tended to feel higher levels of moral obligation to protect it ($\beta = .21$). In conclusion, findings of the study revealed relationships between values and environmental orientations. Furthermore, the study had direct implications to the present research by demonstrating how individuals' feelings of moral obligation to protect the environment, which is very closely related with environmental moral reasoning, derived from the importance they gave to the intrinsic value of nature (i.e., ecocentrism) and their readiness to make sacrifices for the common good (i.e., self-transcendence).

2.7 (Pre-service) Teachers in Environmental Education

The vitality of teacher education for the effectiveness and success of environmental education (EE) has been constantly stated from the very beginning of international efforts for enhancing EE. For instance in 1972, teacher training was specifically included in recommendations of *Stockholm Declaration* (UN, 1972; e.g., recommendation 95). Similarly, in the *Belgrade Charter* (UNESCO/UNEP, 1975) teachers were listed among the major categories of audiences in EE within formal education sector. In the *Tbilisi Declaration* (UNESCO, 1977), teachers were stated to have important roles and responsibilities for achieving EE objectives.

Accordingly, necessity of providing training to pre-service and in-service teachers was frequently emphasized. The emphasis on the importance of teachers for EE continued to exist in the subsequent landmark EE conferences and their reports as well. For example, in *Brundtland Report* (WCED, 1987) teachers were seen as key agents for increasing understanding and awareness of the young about the environment, its associated problems, and solutions. In line with this, promoting pro-environmental attitudes and increasing environmental awareness of teachers as well as enhancing their capabilities to successfully address environmental issues in their teaching was stated to be a critical issue for the success of EE. In a similar vein, statements that referred to the importance and necessity of including pre-service and in-service training in efforts for empowering EE took place in the report of UN Conference on Environment and Development (*Agenda 21*; UN, 1992).

Strengthening pre-service and in-service teacher training was also called for in the most recent UN reports on Decade of Education for Sustainable Development (e.g., *Shaping the Education of Tomorrow*, UNESCO, 2012; *Shaping the Future We Want*, UNESCO, 2014) and in the other important documents of UNESCO (e.g., *Climate Change Education for Sustainable Development*, UNESCO, 2010).

Nonetheless, maybe no statement can better explain the importance of teacher education than the one used in the 1990 report of UNESCO/UNEP: “The priority of priorities” (p.1). In this report, the urgent need for teacher training was reaffirmed

and environmentally educated teachers were proclaimed to be the priority of environmental and educational priorities. Moreover, competencies that were seen to be necessary for being an effective EE teacher were listed and operationalized. In addition to the reports of these international conferences, the key role of teachers in EE and, thus, the vitality and the need of pre-service and in-service teacher training programs have been stated in individual research studies (e.g., Marcinkowski, 2009; May, 2000; Mckeown & Hopkins, 2003; Potter, 2009). In some of these studies (e.g., Mckeown & Hopkins, 2003), no specific attention was given to teachers of any discipline and potential contributions of teachers of all disciplines (e.g., mathematics, history, science, etc.) were explained. In some others (Garrison et al., 2015), particular examples were given to demonstrate how teachers teaching in specific disciplines (e.g., ecology, nature study) may play vital roles in teaching practices. Some researchers made suggestions for increasing the efficiency of EE efforts. Among the suggestions they proposed were increasing support and funding for teacher (pre-service and in-service) training and research (Potter, 2009).

In fact, we can see the implications regarding the importance of research in teacher education in the very early writings of EE. For example, Maloney and Ward (1973) argued that in order to promote desired changes in individuals we should first “go to” them. By this way, we can understand the characteristics of our population of interests with regard to our study topics, which will make it possible to achieve educational aims (e.g., promoting pro-environmental attitudes and behaviors). In this respect, in the present study the researcher collected data from pre-service science teachers with the purpose of understanding and fostering desired changes in their characteristics with respect to the study variables (i.e., environmental moral reasoning, epistemological beliefs, and values). Similar to Denmark and Canada (Blum et al., 2013), EE in Turkey is mostly integrated in science education (Tuncay et al., 2012; Tuncay-Yuksel et al., 2015). Therefore, science teacher education is a convenient place to implement EE objectives in the country. Based on this and research showing the multiplier effect of pre-service teacher education on EE

(Powers, 2004) pre-service science teachers who will be the future implementers of EE in the country were selected as the study sample.

2.8 Summary

Main themes of the literature review of the study included environmental education (EE), environmental ethics, environmental moral reasoning, epistemological beliefs, values, and (pre-service) teacher education within the context of EE. Organization of these themes moved from more general to more specific research literature. With this approach an overall picture about the starting point and rationale of the study and the place of its main construct, environmental moral reasoning, in the broader literature was given first. Then, studies conducted on epistemological beliefs and values were reviewed and their implications for the specific research questions of the present study were interpreted. Finally, a review of literature that exhibited the crucial role of (pre-service) teachers for an overall success of EE was presented in order to better interpret the significance of the study and its potential to contribute to EE research and practice.

As revealed in the chapter, promoting desired changes in individuals has been seen as the most promising solution to the environmental problems (Kopnina, 2012; Marcinkowski, 2009; Sauve, 2005; Stapp et al., 1969; Tilbury, 1995; Winter, 2000). In accordance with this fact, throughout the history a number of educational movements has arisen which had their own conceptualizations of the environment, teaching strategies and methods that they used in their educational programs, etc. Sometimes efforts were made to distinguish between these particular educational programs or clarify the degree and nature of overlap among them (Kopnina, 2012; McKeown & Hopkins, 2003; Passmore, 1972). Nevertheless, as also revealed in the landmark documents of EE, helping learners to develop more pro-environmental human-environment relationships constitute a common overarching aim of all environment-related education. This situation naturally brings the necessity of

integrating ethics in EE. That is to say, ethics has a crucial role in individuals' perceptions about and judgments of relationships and their behaviors within those relationships (Bonnett, 2002, 2007; Garrison et al., 2015; York & Becker, 2012). Correspondingly, in an expected manner, in international EE documents and individual research studies references were made to ethics as an important construct that should be taken into consideration in EE efforts.

Study of ethics in human-environment relationships contexts is specified as the study of environmental ethics (Palmer, 2012). More specifically, the philosophical branch of environmental ethics can be thought as an umbrella that covers environmental moral reasoning by providing explanations about the “oughts” and “shoulds” with respect to human-environment relationships (Palmer, 1997; Pojman & Pojman, 2012). Although all forms this philosophical way of thinking reach a consensus on the necessity of adopting a moral approach for the preservation and protection of the environment, there are differences in the reasons or “paths” that they reach to such a necessity (Traer, 2009). Differences in the definition of “value” and its interpretation within human-environment relationships seem to be the main explanation for these differences (Kortenkamp & Moore, 2001; Palmer, 2012).

At this point, the construct of environmental moral reasoning arises. Environmental moral reasoning research carries the theoretical discussions of environmental ethicists regarding the moral aspects of human-environment relationships to the “stage” of empirical literature. This research field owes a great part of its theoretical background to moral reasoning and moral development models each of which contributed a lot to our understandings about how individuals perceive and react to moral aspects of the issues as well as why there are differences in their moral reasoning patterns. While some of these models adapted a cognitive-developmental approach and argued for the context-free nature of moral reasoning (Kohlberg, 1976, 1986), others based their explanations to more affective elements (Gilligan, 1982). Still, others advocated the need for the necessity of both cognitive and affective elements for a more holistic view of morality and proposed it as a content and

context dependent construct (Rest, 1984; Rest et al., 1999). Nevertheless, reviewing the related research leads to a common conclusion: as one's moral considerations include and apply to broader communities, he/she is expected to exhibit higher levels of moral reasoning. Correspondingly, many researchers in the field of science and environmental education propose broadening of students' moral perspectives as an important educational goal. In this respect, the *functional scientific literacy* and *socioscientific issues (SSI)* frameworks are the two promising approaches that highlight the importance of cultivation of moral reasoning and serve for its accomplishment in science and environmental education (Sadler & Zeidler, 2004; Zeidler, 2003, 2014; Zeidler & Keefer, 2003; Zeidler & Lewis, 2003; Zeidler & Sadler, 2011; Zeidler, et al., 2005).

Researchers in the field of environmental moral reasoning also propose having a broader perspective of moral considerations as an indication of higher levels of environmental moral reasoning (Mueller et al., 2011; Lee et al., 2013; Lee et al., 2012). They support the contention that considering the welfare of the all ecosystems and the biosphere (i.e., ecocentrism) rather than just humans (i.e., anthropocentrism) or the selves (i.e., egocentrism) can be considered superior in terms of environmental moral reasoning (Kahn 1999, 2002; Kahn & Lourenço, 2002; Karpiak & Baril, 2008; Schultz & Zelezny, 1999; Thompson & Barton, 1994). Correspondingly, in the present study a tripartite framework (i.e., egocentrism, anthropocentrism, ecocentrism) was used to examine environmental moral reasoning patterns of the participant pre-service science teachers.

Findings of related research conducted on environmental moral reasoning suggest that, in addition to the content and context of issues, moral reasoning and judgments about environmental issues are affected by both cognitive and affective characteristics of individuals (Greely, 2008; Kortenkamp & Moore, 2009; Persing, 2006; Zeidler & Schafer, 1984). A consistent conclusion that emerges from these research studies is the importance of individuals' perceptions, conceptualizations, and interpretations about the moral aspects of issues, which are among the possible

reasons of the differences in moral reasoning patterns (Karpiak & Baril, 2008; Lee et al., 2013; Lee et al., 2012; Zeidler et al., 2013). Building from these research studies, the present study utilized a conceptual framework that incorporated epistemological beliefs and values to explain the variances in environmental moral reasoning patterns of the pre-service science teachers (see Figure 1.1.).

The studies that investigated relationships between epistemological beliefs and moral reasoning report mixed results. In-depth investigations enriched with qualitative methods generally show that individuals' moral reasoning patterns are influenced by how they approach to new information and how they make meaning of the information they encounter (Simmons & Zeidler, 2003; Zeidler et al. 2013; Zeidler et al., 2002). However, when the hypothesized relationships between epistemological beliefs and moral reasoning are examined through quantitative research methods, results obtained from the analyses are inconsistent. While some of the studies report statistically significant relationships with a range of small to medium effect sizes (e.g., Bendixen et al., 1998), some others did not capture any significant relationships (e.g., Mintchik & Farmer, 2009; Topcu, 2011), or the relationships show differences from one subsample to another (e.g., Jeong, 2003; Ren, 2006). This discrepancy in quantitative findings of related research may be attributable to the difficulty of measuring epistemological beliefs via self-reported instruments (De Backer, Crowson, Beesley, Thoma, & Hestevold, 2008) and suggests the need for additional work. Moreover, lack of quantitative research that specifically examined the relationships between epistemological beliefs and environmental moral reasoning patterns implies a need for the present study.

On the other hand, existence of relationships among values and environmental moral reasoning seems to be more consistent in findings of related research studies. As realized in the present study, many of the research that studied values and their relationships with other constructs utilized Schwartz's (1992, 1994) value theory (e.g., Nordlund & Garvill, 2002; Schultz & Zelezny, 1999; Schultz et al., 2005; Stern & Dietz, 1994). When relationships of values with self-centrism

(egocentrism), human-centrism (anthropocentrism), and nature-centrism (biocentrism/ecocentrism) were examined, findings generally revealed empirical support for value-basis theory of environmental orientations. In some of these research (e.g., Schulz & Zelezny, 1999) quantitative analyses were performed with the ten value types (i.e., power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security) identified in Schwartz value theory. In some others (e.g., Nordlund & Garvill, 2002), researchers preferred to use Schwartz's four value categories (i.e., self-enhancement, self-transcendence, openness to change, conservation/tradition). In addition, some researchers such as Stern and Dietz (1994) conducted factor analyses to determine the dimensions of values in their study data. Findings revealed that, regardless of the value dimensions (value type, value category or value dimensions determined by factor analyses) used for analyses, statistically significant relationships were generally captured among values and environmental moral reasoning. While the relationships among higher levels of environmental moral reasoning (e.g., pro-environmental personal norm, ecocentric moral reasoning) and self-transcendence values tended to be positive, the findings were reversed for self-enhancement values revealing negative relationships among these constructs. On the other hand, findings regarding relationships of openness to change and conservation/tradition values with environmental moral reasoning did not reveal a general pattern.

All in all, the purpose of the study was to contribute to environmental education research and practice. Therefore, selection of the constructs to be studied in this research was based on research literature which included intergovernmental and international documents that historically shaped, and continue to shape, environmental education (EE) as well as individual research studies that tested the validity of the suggestions stated in these documents. This literature also contributed to the conceptual and theoretical framework of the study and the hypothesized relationships within these frameworks. Based on the emphasis given to teacher education in EE (Marcinkowski, 2009; May, 2000; Mckeown & Hopkins, 2003; Potter, 2009), supplementary importance of pre-service teachers for the success of

EE efforts (Powers, 2004), and specific EE context of the country (Tuncay et al., 2012; Tuncay-Yuksel et al., 2015), sample of the study was chosen among Turkish pre-service science teachers. Accordingly, besides its contribution to the related literature, findings of the study would have additional significance for EE efforts of the country.

CHAPTER III

METHOD

The present chapter specifies the methods that were employed throughout the study. It starts with a review of research questions. Then, information about research design, population and sample, instrumentation, data collection and data analysis procedures is given. Finally, assumptions, limitations, and delimitations of the study are represented.

3.1 Research Questions

Overarching RQ: To what extent, if any, are environmental moral reasoning patterns of pre-service science teachers predicted by their epistemological beliefs and values?

Sub-RQ 1: How are epistemological beliefs of pre-service science teachers related to their environmental moral reasoning?

Sub-RQ 2: How are values of pre-service science teachers related to their environmental moral reasoning?

3.2 Research Design

In the present study, it was mainly aimed to investigate environmental moral reasoning of pre-service science teachers (PSTs) in relation to their epistemological

beliefs and values. To serve for this purpose, the proposed research questions were explored quantitatively through correlational research design. In line with the purposes of correlational research (Fraenkel et al., 2012), likelihood of relationships that epistemological beliefs and values of PSTs have with their environmental moral reasoning was examined. PSTs' responses to survey questions constituted the data of the study.

Collected data was factor analyzed to obtain environmental moral reasoning, epistemological belief, and value dimensions. Mean values calculated for each dimension (factor) were used as the study variables. In line with the purpose of the study, environmental moral reasoning dimensions were entered to the analyses as endogenous (dependent) variables, while variables of epistemological beliefs and values were used as exogenous (independent) variables. In order to assess the relationships of environmental moral reasoning patterns with epistemological beliefs and values, path analyses were conducted. Path analysis is a structural equation modeling (SEM) technique that has the power of applying several multiple regression analyses with multiple endogenous and exogenous variables (Kline, 2011). Accordingly, with the help of this data analysis technique it was possible for the researcher to reach an overall conclusion about the joint predictive power of epistemological beliefs and values on environmental moral reasoning. For utilization of the path analyses, steps of *model specification* (i.e., proposing hypothesized relationships in a path model), *model identification* (i.e., checking whether there is a unique set of parameter estimates in the model or not), *model estimation* (i.e., estimating model parameters), *model testing* (i.e., evaluating fit of the model), and, if required, *model modification* (i.e., making modifications on the model to obtain a better fit – conducted if model fit of the original path model is less than satisfactory) were followed (Schumacker & Lomax, 2010).

Aside from the steps followed for data analyses, design of the study required a number of procedures including identification of the population, sample, and data collection instruments, translation and/or adaptation of the instruments via pilot

studies, and administration of the adapted instruments in the main study. In the following sections of the chapter, the readers will find information about the details of the strategies employed for each of these procedures.

3.3 Population and Sample

The population of interest in this study was Turkish pre-service science teachers. However, as in most of the cases, it would be unfeasible to access this population. Therefore, the researcher restricted the study's population to pre-service science teachers enrolled in public universities located in Central Anatolia region of Turkey. For the sampling procedure, cluster sampling method was used. As a first step, all public universities that had Elementary Science Education departments were determined. There were a total of 13 public universities that met this criterion. Three of these universities were in the same city. Of these 13 universities, preservice science teachers enrolled in 6 universities were included in this study.

For the selection of these 6 universities, their convenience to the researcher (i.e., distance from the city where the researcher lived, and accordingly time, energy, and money that would cost to collect data) was considered. Number of PSTs enrolled in the Elementary Science Education departments was another criterion for the selection of the universities. Some of the universities and/or the education faculties in the universities were very new and total number of students enrolled in the first, second, third, and fourth grades of elementary science education departments were very few (in some universities total number of PSTs was only 40). As a result, the researcher determined her accessible population to be pre-service science teachers enrolled in six public universities of five different cities located in Central Anatolia Region of Turkey. Total number of PSTs in this accessible population was 2722. 1524 of them were reached by the researcher. This constituted 56 % (55.95 %) of the accessible population. They were enrolled in the first, second, third, and fourth grades in morning and evening elementary science education programs of their

universities. Their mean age was calculated to be 20.51 years. Detailed information about demographic characteristics of the study sample is tabulated in Table 3.1.

Table 3.1
Demographic Characteristics of the Sample

Variable		Frequency (f)	Percentage (%)
Gender	Male	255	16.7
	Female	1248	81.9
	Not identified	21	1.4
University	University 1	190	12.5
	University 2	439	28.8
	University 3	312	20.5
	University 4	103	6.8
	University 5	180	11.8
	University 6	300	19.7
Grade level	First	292	19.2
	Second	326	21.4
	Third	462	30.3
	Fourth	438	28.7
	Not identified	6	.4
Program	Morning education	1117	73.3
	Evening education	358	23.5
	Not identified	49	3.2

As tabulated in the table, percentages of participant PSTs in the first, second, third, and fourth grades were relatively proportional to each other. Conversely, there was an unequal distribution regarding the gender of the participants and the programs they were enrolled in (morning/evening education). Number of female students was much more than the number of male students. Similarly, more than 70% of the sample was comprised of students in morning education programs of the universities. These disproportionate distributions (mostly female, mostly morning

education) are in line with the student profile of elementary science education departments of the universities in Turkey. On the other hand, relatively small number of PSTs in University 4 who were reached by the researcher did not result from the nature of the population. This university (University 4) is a large university who had 403 PSTs registered to its elementary science education department at the time when the data of the study was collected. However, the researcher could reach only 25.24% of these PSTs ($N=103$) because most of the instructors in the university were not willing to give their classes for data collection.

3.4 Instrumentation

Three instruments were used for data collection: Bendixen, Schraw, and Dunkle's (1998) Epistemic Beliefs Inventory, 37-item version of Schwartz's (1992, 1994) value survey (Schulz & Zelezny, 1998, 1999), and environmental scenarios (and related questions) developed by Persing (2006). Translation and adaptations of the instruments were realized with the help of the Academic Writing Center (AWC) of METU throughout an iterative process. AWC is a consultancy service that functions under the supervision of the School of Foreign Languages of the university. In the center, tutors who are experienced instructors from the Department of Basic English and Department of Modern Languages of the university provide face-to-face consulting service to meet academic writing needs of graduate students and faculty members. In addition to AWC, language (e.g., grammar, sentence structure, presence of any types of ambiguity, etc.) and format of the translated data collection instruments was checked by an experienced literature teacher who had been teaching literacy in high schools for more than 10 years. Moreover, a professor in Elementary Science Education department of Middle East Technical University supervised the translation and adaptation processes. Expertise provided by the consultants in AWC, literature teacher, and the professor contributed to the achievement of content related validity of the instruments (Fraenkel et al., 2012).

Following translation and adaptation of the instruments, pilot tests were conducted. Based on analyses of pilot data and written and oral feedback taken from the participants, necessary revisions (e.g., excluding items from the instruments, revising wordings of the item statements) were made. Graphical representation summarizing the instrumentation procedure of the study is given in Figure 3.1. Information about details of each individual instrument including the procedures followed for their development, their scoring scales, and factor structures is given in the subsequent sections. Final versions of the instruments as they were presented to the participants of the main study are provided in Appendix A.

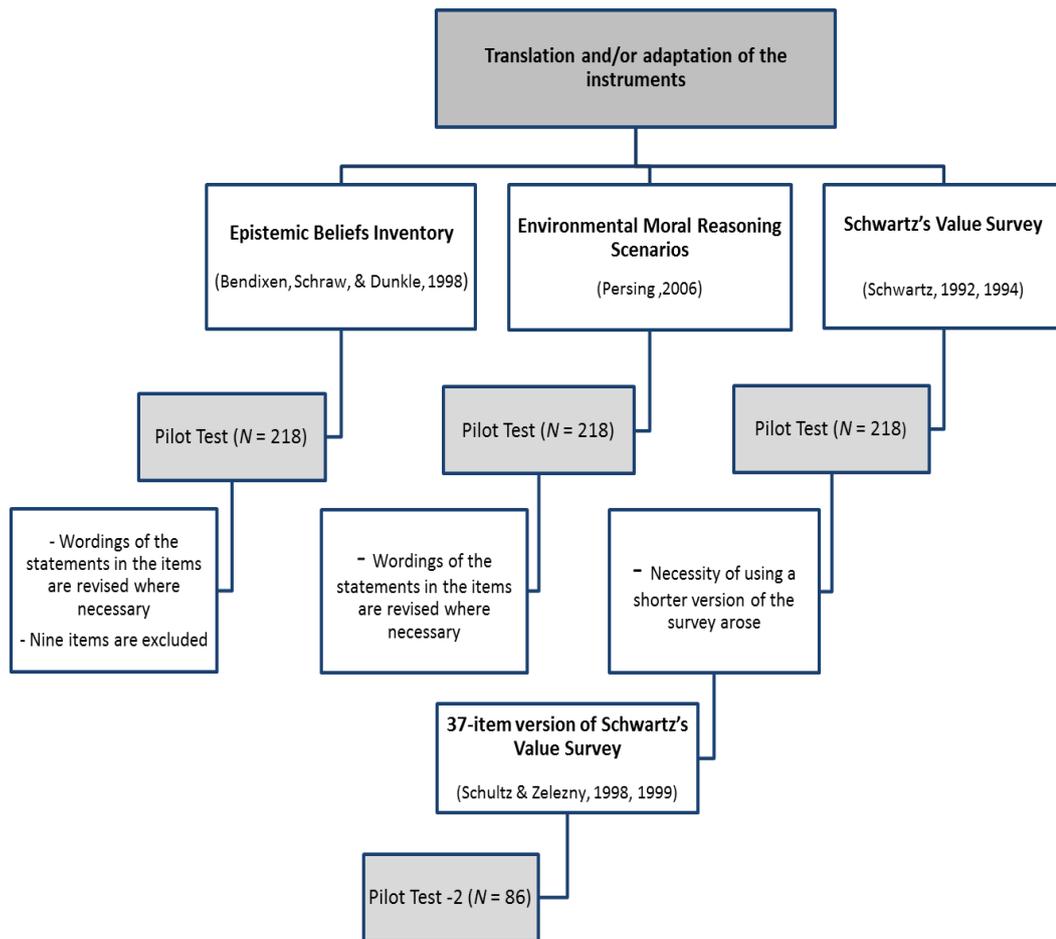


Figure 3.1 Summary of the instrumentation procedure

3.4.1 Epistemic Beliefs Inventory

Epistemic Beliefs Inventory (EBI) is a 32-item instrument that is based on Schommer's (1990, 1994) epistemological beliefs model. As explained previously, this model proposes five epistemological belief dimensions (i.e., simple knowledge, certain knowledge, omniscient authority, innate ability, quick learning). Correspondingly, EBI measures individuals' beliefs regarding structure, certainty, and source of knowledge in addition control and speed of knowledge acquisition/learning. Respondents of the instrument are asked to indicate their degree of agreement with the item statements on a 5-point Likert type scale ranging from "strongly disagree" (1) to "strongly agree" (5). While lower scores obtained

from the scale indicate more sophisticated epistemological beliefs, higher scores are indicators of naïve epistemological beliefs.

Even though EBI was based on Schommer's (1990, 1994) epistemological beliefs model and six items in EBI were adapted from items used in Schommer's (1990) Epistemological Questionnaire (EQ), the instrument itself was developed as an alternative to the EQ (Bendixen et al., 1998; Schraw et al., 1995). That is to say, the researchers aimed to construct a scale that overcomes some problems that are generally faced with the use of EQ such as unexplainable item loadings, item-to-factor overlaps, and inability to capture beliefs about source of knowledge (i.e., omniscient authority) (Schraw et al., 2002). Findings of Schraw et al. (1995) and Bendixen et al. (1998) showed that the researchers successfully achieved their aim of developing a short, reliable, and valid instrument that is able to measure all of the five epistemological belief dimensions. Analyses of their data resulted in clear five-factor solutions and all items unambiguously loaded on only one factor that corresponded to the related epistemological belief dimension. Cronbach's α values calculated for the factors (subscales) ranged from .67 to .87.

Although EBI was translated into Turkish and used to collect data in an unpublished dissertation study conducted by Onen (2009), examination of the items in this translated instrument revealed the need for a new translation and adaptation. Due to some problems regarding semantic and/or conceptual meanings of the words/statements used in the items, the instrument was found to be insufficient in giving underlying meanings of the items in its original version. For instance, Onen translated "smart" into Turkish as "akıllı". However, in Turkish "akıllı" does not match well with the word "smart", which is used in the items of the original version of the EBI (e.g., "Smart people are born that way"). Instead, use of the word "zeki" better gives the underlying meanings of the items that aim to measure individuals' epistemological beliefs about innate ability to learn. Correspondingly, one of the definitions of "smart" is given as "showing intelligence" (Merriam-Webster's, n.d.) and in educational research literature "zeka" (noun form of "zeki") is used to refer to

“intelligence”. For instance, “multiple intelligence” is translated and used as “çoklu zeka” in all of the research papers that are published in Turkish.

Therefore, by revising translations of some items in Onen’s instrument and re-translating some others from Bendixen et al.’s (1998) original EBI (a total of 19 items), the researcher ended up with a new Turkish version of the EBI (Tuncay-Yuksel, Yilmaz-Tuzun, & Zeidler, 2015). The developed instrument was pilot tested with 218 pre-service science teachers. Collected data was exposed to exploratory factor analysis (EFA) via Statistical Package for Social Sciences (SPSS) version 21 for Windows. Factorability of the data was confirmed by Kaiser-Meyer-Okin (.76) and the Barlett’s (1954) Test of Sphericity ($p = .00$) values. Examination of the analysis results with regard to Catell’s (1966) scree test (scree plot) and Kaiser’s (1970, 1974) criterion suggested existence of four interpretable factors with an explanatory power of 39.64 %. Maximum correlation among the factors was .15, which allowed the researcher to apply orthogonal factor rotation methods.

Accordingly, varimax rotation was used and its results were interpreted for deciding on the factor structure of the study data. Results showed that items that measured respondents’ beliefs in *quick learning* and *certain knowledge* epistemological dimensions loaded on the same factor. The remaining items collapsed into three factors that corresponded to epistemological belief dimensions of *innate ability*, *simple knowledge*, and *omniscient authority*. Based on this factor solution, a total of nine items that had negative factor loadings or factor loadings less than .40 were excluded from the instrument. Item to factor loadings in addition to eigenvalues and internal consistencies (mean inter-item correlation, Cronbach’s α) of the factors are given in Table 3.2.

Table 3.2

EBI Factor Structure for the Pilot Study

Factor 1: Quick Learning & Certain Knowledge (eigenvalue = 5.37; mean inter-item correlation = .30; α = .83)

- If you don't learn something quickly, you won't ever learn it (.77)
- Working on a problem with no quick solution is a waste of time (.75)
- If you haven't understood a chapter the first time through, going back over it won't help (.74)
- What is true today will be true tomorrow (.67)
- If two people are arguing about something, at least one of them must be wrong (.62)
- How well you do in school depends on how smart you are (.60)
- People who question authority are trouble makers (.58)
- If a person tries too hard to understand a problem, they will most likely end up being confused (.51)
- The moral rules I live by apply to everyone (.51)
- When someone in authority tells me what to do, I usually do it (.44)
- People can't do too much about how smart they are (.42)
- Truth means different things to different people (.40)*

Factor 2: Innate Ability (eigenvalue = 3.39; mean inter-item correlation = .33; α = .71)

- Smart people are born that way (.68)
- Some people will never be smart no matter how hard they work (.68)
- Some people are born with special gifts and talents (.63)
- Really smart students don't have to work as hard to do well in school (.53)
- Some people just have a knack for learning and others don't (.51)

Factor 3: Simple Knowledge (eigenvalue = 2.08; mean inter-item correlation = .26; α = .58)

- The best ideas are often the most simple (.60)
- Instructors should focus on facts instead of theories (.46)
- Things are simpler than most professors would have you believe (.45)
- Too many theories just complicate things (.42)

Factor 4: Omniscient Authority (eigenvalue = 1.84; mean inter-item correlation = .34; α = .51)

- Parents should teach their children all there is to know about life (.65)
- People should always obey the law (.63)

* Reverse coded

In addition to factor analysis results, feedback of the participants was utilized for the adaptation and revision of the instrument. At each of the data collection sites of the

pilot study, the researcher explained the purpose of the study to the participants in detail and asked them to provide feedback about the instruments, especially about the clarity of the items. As a response, many participants provided feedback either by orally stating during the data collection periods or writing their ideas on the data collection sheets. Moreover, short (5-10 minutes) informal interviews were made with a minimum of 20 pre-service science teachers after data collection periods. The researcher took notes about all of the written and oral feedback. Then, based on the taken feedback, necessary revisions were made.

3.4.1.1 Factor structure of the Epistemic Beliefs Inventory

After the above mentioned revisions, 23-item version of the instrument was administered to the participants of the main study ($N = 1524$). Then, collected data were subjected to factor analyses to investigate its factor structure. As a first step, factorability of the data was checked. Kaiser-Meyer-Olkin (.81) and the Bartlett's (1954) Test of Sphericity ($p = .00$) values showed that the data was suitable for exploratory factor analysis (EFA). Results suggested five interpretable factors with eigenvalues greater than one. These five factors explained 42.81 % of the sample variation. Since correlations among the factors were below the traditional .30 level (maximum correlation was .20), varimax rotation was used to interpret factor solution of the data (Tabachnick & Fidell, 2007). Results showed that adapted version of the EBI yielded five factors that corresponded to operational definitions of *quick learning*, *simple knowledge*, *innate ability*, *omniscient authority*, and *certain knowledge* epistemological belief dimensions.

This finding was similar to Bendixen et al. (1998) and Schraw et al.'s (1995) results who also found five factors that correspond to the five dimensions of epistemological beliefs and interpreted this as an indication of their instruments validity. Except from one item, which is not included in the subsequent data analyses, all items loaded on their factors with a minimum factor loading of .40. 22 items that constituted the final version of the adapted instrument, their factor

loadings, and reliability values of the obtained factors (mean inter-item correlation, Cronbach's α) are tabulated in Table 3.3.

Table 3.3

EBI Factor Structure for the Main Study

Factor 1: Quick Learning (eigenvalue = 3.53; mean inter-item correlation = .28; α = .70)

- Working on a problem with no quick solution is a waste of time (.68)
- If you haven't understood a chapter the first time through, going back over it won't help (.67)
- If you don't learn something quickly, you won't ever learn it (.65)
- People shouldn't question authority (.59)
- How well you do in school depends on how smart you are (.48)
- When someone in authority tells me what to do, I usually do it (.44)

Factor 2: Simple Knowledge (eigenvalue = 2.27; mean inter-item correlation = .21; α = .57)

- Too many theories just complicate things (.67)
- The best ideas are often the most simple (.59)
- Instructors should focus on facts instead of theories (.58)
- Things are simpler than most professors would have you believe (.53)
- If a person tries too hard to understand a problem, they will most likely end up being confused (.53)

Factor 3: Innate Ability (eigenvalue = 1.52; mean inter-item correlation = .20; α = .56)

- Smart people are born that way (.72)
- Some people will never be smart no matter how hard they work (.61)
- Some people just have a knack for learning and others don't (.55)
- Some people are born with special gifts and talents (.53)
- Really smart students don't have to work as hard to do well in school (.49)

Factor 4: Omniscient Authority (eigenvalue = 1.48 ; mean inter-item correlation = .24; α = .39,)

- People should always obey the law (.76)
- Parents should teach their children all there is to know about life (.59)

Factor 5: Certain Knowledge (eigenvalue = 1.05; mean inter-item correlation = .21; α = .52)

- The moral rules I live by apply to everyone (.53)
 - If two people are arguing about something, at least one of them must be wrong (.47)
 - Truth means different things to different people* (.50)
 - What is true today will be true tomorrow (.42)
-

*Reverse coded

This five-factor structure was further tested and cross-validated through two confirmatory factor analyses (CFA). Analysis of Moment Structures (AMOS) statistical package program version 21 for Windows was employed for the analyses. Cross-validation helped the researcher to see if factorial structure of the instrument was replicated across different samples of the same population (Byrne, 2010). Since sample of the study was large enough ($N = 1524$), Byrne (2010) and Cudeck and Browne's (1983) approach was followed and the total sample was divided into two random subsamples (Subsample A, Subsample B). Demographic characteristics of the participants in these two subsamples were compared in terms of university enrolled, grade level, gender, and mean age. Findings revealed that the two subsamples were highly equivalent (Table 3.4).

Table 3.4

Comparison of the Cross-validation Samples in Terms of Demographic Characteristics

		Subsample A ($N = 762$)	Subsample B ($N = 762$)	Total Sample ($N = 1524$)
University (%)	University 1	12.7	12.2	12.5
	University 2	28.0	29.7	28.8
	University 3	20.9	20.1	20.5
	University 4	6.6	7.0	6.8
	University 5	13.8	9.8	11.8
	University 6	18.1	21.3	19.7
Grade Level (%)	First	19.7	18.6	19.2
	Second	22.4	20.3	21.4
	Third	30.6	30.1	30.3
	Fourth	27.2	30.3	28.7
Gender (%)	Male	80.7	83.1	81.9
	Female	17.7	15.7	16.7
Mean Age		20.5	20.6	20.5

Examination of the model fit indices obtained from the two CFA indicated that the data showed good model fit for both of the subsamples (Subsample A: $\chi^2 = 618.60$, $df = 199$, $\chi^2/df = 3.11$, GFI = .93, AGFI = .91, CFI = .81, RMSEA = .05, RMR = .07, SRMR = .06; Subsample B: $\chi^2 = 605.85$, $df = 199$, $\chi^2/df = 3.04$, GFI = .93, AGFI = .91, CFI = .81, RMSEA = .05, RMR = .06, SRMR = .06). This finding provided supporting evidence for the construct validity of the adapted EBI and its five-factor structure. AMOS outputs of the CFA models with standardized estimates for Subsample A and Subsample B are given in Appendix B.

3.4.2 Value Survey

In the present study, Schwartz's (1992, 1994) value theory is used as the theoretical framework for examining pre-service science teachers' (PSTs) value orientations. Correspondingly, data on the participant PSTs' values was planned to be collected by Schwartz's (1992, 1994) value survey. This value survey is very widely used around the world to investigate, compare, and contrast value orientations of individuals who belong to different countries and different cultures. In fact, the survey is so widely used that it has been translated to many languages and made it possible to collect data from over 75.000 respondents who inhabit in different countries and belong to a variety of cultural groups (Schwartz, 2006). The survey consists of 56 value items (e.g., social justice, creativity, pleasure, etc.) each of which is followed by a phrase given in parenthesis to further specify its meaning. In this survey, respondents are asked to rate the importance of each value item as "a guiding principle" in their lives. The survey is designed on a 9-point Likert type scale ranging from "opposed to my values" (-1) to "of supreme importance" (7).

Turkish version of the instrument used in the present study was translated by three bilingual social psychologists in Kusdil and Kagitcibasi's (2000) study. In that study, the researchers added four value items (i.e., chastity in woman, superiority of men, hospitality, secularism) to Schwartz's (1992, 1994) value survey with the

purpose of examining possible influences of family preference and religious orientation on value orientations. Nevertheless, the added items were not related with the purpose of the present study. Therefore, only the 56 value items that exist in the original version of the Schwartz Value Survey were kept and pilot tested with 218 pre-service science teachers.

In his “draft users manual” Schwartz (2009) defined some criteria to be followed by researchers while analyzing data collected via his survey. These criteria include data cleaning procedures that will serve to have undistorted results obtained from data analysis. Based on these criteria, researchers should drop respondents who leave 15 or more items blank and/or who use a particular scale anchor 35 times or more. Moreover, if a respondent leaves more than 30% of the items in a scale (which will be used for calculating dimension scores) unanswered he/she should also be dropped from the data sheet. Accordingly, the number of missing items and frequency of each scale anchor used was calculated for each respondent of the pilot study. Calculations showed that none of the participants left more than 15 items of the survey blank. However, investigation of the frequencies of individual scale anchors for each participant revealed the requirement of excluding data belonging to 58 participants from the data sheet. Calculations showed that these 58 participants used scale anchors 3 (important), 6 (very important), and/or 7 (of supreme importance) more than 35 times, which indicated that they failed to discriminate among their values (Schwartz, 2009).

One of the reasons of the participants’ failure in discriminating among their values and concentrating their responses at specific scale anchors may be due to the length of the instrument. As also stated by Lindeman and Verkasalo (2005), Schwartz Value Survey may be perceived to be too long to complete by the participants. Moreover, the instrument has a relatively high cognitive load on part of the participants because it requires evaluation of each value item in terms of its importance as a guiding principle in the respondents’ life (Demirutku, 2007). Therefore, considering the length of time and cognitive effort required to complete

the instrument as well as findings of the pilot study, the researcher decided to use a shorter version of Schwartz Value Survey in the main study. By this way, it was aimed to avoid feelings of fatigue in the participants and prevent repetition and casual patterns in their responses, which may cause threats to internal validity. Based on review of literature and discussions made with a professor who is competent in the area of educational research, 37-item version of the Schwartz Value Survey developed by Schultz and Zelezny (1998, 1999) was considered to be appropriate to be used in place of its original version. Then, Turkish translations of the 37 value items (Kusdil & Kagitcibasi, 2000) were subjected to a second pilot study with another sample of 86 pre-service science teachers (see Figure 3.1). It was noticed that this version of the value survey was effective in overcoming the problems faced with the use of the original 56-item version.

Selection of the 37-items in Schultz and Zelezny's (1998, 1999) study was based on findings of Schwartz (1994) who collected data from 25.863 individuals inhabiting in 44 different countries. In developing the shorter version of the Schwartz's scale, the researchers selected four items with the highest frequency of occurrence from each of the ten value type regions calculated by smallest space analysis. The total number of items in Schultz and Zelezny's value survey is less than 40 because some value types in Schwartz's study (stimulation, hedonism) had less than four value items.

3.4.2.1 Factor structure of the Value Survey

Instrumentation procedure of the value survey used in the present study continued with examining factor structure of the data collected from the main study ($N = 1524$). As a first step, Schwartz's (1992, 1994) four-value category classification (i.e., self-transcendence, self-enhancement, openness to change, tradition) was tested with confirmatory factor analysis (CFA) via Analysis of Moment Structures (AMOS, version 21 for Windows) statistical program. Output obtained from the

analysis revealed that this four-factor model did not result in positive definite covariance. Then, factor structure of the value survey was tested with another CFA to see if the 10-value type classification as identified in the Schwartz's value theory (i.e., universalism, benevolence, power, achievement, self-direction, stimulation, hedonism, tradition, conformity, security) was confirmed by the data of the study. Similar to the previous CFA, this analysis did not result in positive definite covariance matrix. Non-positive definite covariance matrix is indicator of very strong associations between two or more of the constructs of the model that is being tested. In statistical terms, this problem is named as collinearity (Kline, 2011). In fact, for the present study this situation was very clear in the first model tested (four-value category model). The covariance between self-transcendence and tradition value categories was .99. Likewise, in the second model some of the covariance values between the ten value types were so extremely large that they exceeded the value of 1.00 (benevolence-tradition, tradition-conformity, and benevolence-conformity). AMOS outputs showing standardized estimates of the initial models tested based on Schwartz value theory (i.e., four-value category model, 10-value type model) are given in Appendix C.

In the subsequent steps of examining factor structure of the value survey, an exploratory approach was adapted. First, data of the study was subjected to exploratory factor analysis (EFA) with principal component analysis method via Statistical Package for Social Sciences (SPSS, version 21 for Windows). Both Kaiser-Meyer-Olkin (.93) and the Barlett's Test of Sphericity ($p = .00$) values confirmed factorability of the data. As also suggested by the first CFA, Kaiser's criterion (eigen values) and Catell's scree test (scree plot) indicated a three-factor solution. This three factor solution explained 39.24 % of the sample variation. All items loaded on their factors with a minimum factor loading of .40. Since the correlation between the first and third factor was .30 and thus the assumption of independent factors was not fully met, results of direct oblimin rotation technique were used and interpreted. Results showed that values representing self-transcendence and tradition value categories in Schwartz value theory collapsed into

a single factor (Factor 1; eigenvalue = 9.59). Values representing openness to change and self-enhancement value categories factorized as two distinct factors (Factor 2 (eigenvalue = 2.90) and Factor 3 (eigenvalue = 2.04), respectively). Factor loadings of only three value items (v14, v30, v34) did not fit in this general pattern. V14 (choosing own goals) loaded to Factor 1 although it represents self-direction value type in openness to change value category in Schwartz value theory. V30 (broad minded) loaded to Factor 2 although it represents universalism value type in self-transcendence value category. V34 (obedient) loaded to Factor 3 although it represents conformity value type in tradition value category.

As realized for the Epistemic Beliefs Inventory (EBI), factor structure of the value survey examined through EFA was further tested for its validity and replicability by subjecting the collected data to two CFA. Similar to the procedures followed for EBI, sample of the study was randomly divided into two equivalent subsamples (Subsample A, Subsample B; see Table 3.4 for comparison of the demographic characteristics of each subsample). In Byrne's (2010) terms, Subsample A ($N = 762$) served as the *calibration sample* where procedures were applied to obtain a best-fitting model. Subsample B ($N = 762$) served as the *validation sample* where the structure of the obtained best-fitting model was tested and validated. The first CFA conducted with all of the value items in the scale did not exhibit adequate fit for the calibration sample ($\chi^2/df = 5.57$, GFI = .77, AGFI = .74, CFI = .72, RMSEA = .08, RMR = .23, SRMR = .07). Then, as a first step, the three value items that did not represent their factors (v14, v30, v34) were removed from the measurement model. Although removal of these items improved the model fit to some degree, it still did not result in acceptable model fit indices ($\chi^2/df = 5.66$, GFI = .79, AGFI = .76, CFI = .73, RMSEA = .08, RMR = .22, SRMR = .08). In fact, lack of good model fit indices seems to be a general problem in research studies that attempt to test factor structure of this scale with CFA (Demirutku, 2007; T. Milfont, personal communication, January 25, 2015; W. Schultz, personal communication, January 20, 2015). This problem was also reported by Spini (2003) who tested factor structure of

Schwartz's (1992, 1994) value survey by using data collected from 3787 university students.

In order to remedy the problem of lack of model fit, the measurement model was re-specified and re-tested via a step by step procedure by removing value items based on their modification index (MI) and standardized residual covariance values provided by the AMOS output (Byrne, 2010). Inspection of residuals larger than 2.58 and relatively high MI values representing error covariance of the items resulted in the adapted CFA model. The model showed acceptable model fit for the calibration ($\chi^2 = 847.14$, $df = 185$, $\chi^2/df = 4.58$, $GFI = .90$, $AGFI = .87$, $CFI = .86$, $RMSEA = .07$, $RMR = .18$, $SRMR = .06$) and validation ($\chi^2 = 899.14$, $df = 185$, $\chi^2/df = 4.86$, $GFI = .89$, $AGFI = .87$, $CFI = .83$, $RMSEA = .07$, $RMR = .20$, $SRMR = .07$) samples. AMOS CFA outputs of the measurement models are provided in Appendix D.

The resulting value survey included 21 value items, which formed three factors (subscales). As seen in Table 3.5, values belonging to Schwartz's (1992, 1994) *self-transcendence* and *tradition* value categories formed a single factor. The other two factors included values in *openness to change* and *self-enhancement* value categories.

Table 3.5

Factors (Subscales) of the Adapted Value Survey

Factor 1: Self-transcendence & Tradition (mean inter item correlation = .34; α = .84)			
Value item		Value type	Value category
v16	helpful	benevolence	self-transcendence
v13	honoring parents and elders	conformity	tradition
v10	humble	tradition	tradition
v28	loyal	benevolence	self-transcendence
v11	protecting the environment	universalism	self-transcendence
v19	forgiving	benevolence	self-transcendence
v26	family security	security	tradition
v37	clean	security	tradition
v22	politeness	conformity	tradition
v9	a world of beauty	universalism	self-transcendence
v6	unity with nature	universalism	self-transcendence
Factor 2: Openness to Change (mean inter item correlation = .32; α = .70)			
Item		Value type	Value category
v20	pleasure	hedonism	openness to change
v21	freedom	self-direction	openness to change
v25	creativity	self-direction	openness to change
v3	an exciting life	stimulation	openness to change
v31	daring	stimulation	openness to change
Factor 3: Self-enhancement (mean inter item correlation = .33; α = .70)			
Item		Value type	Value category
v8	authority	power	self-enhancement
v12	influential	achievement	self-enhancement
v23	wealth	power	self-enhancement
v29	ambitious	achievement	self-enhancement
v1	social power	power	self-enhancement

3.4.3 Environmental Moral Reasoning Scenarios

Participants' environmental moral reasoning was examined by means of four environmental scenarios adapted from Persing's (2006) study. The scenarios reflect moral dilemmas explained in short paragraphs. The dilemmas take place in four particular outdoor recreation contexts (i.e., hiking, picnicking, fishing, and camping) and are mainly about performing specific acts that are potentially harmful to the environment (e.g., leaving garbage after picnicking). At the end of the scenarios, respondents are presented with nine statements each of which reflects a different moral concern. Then, they are asked to what extent each statement would be important for them in order not to perform the environmentally damaging action described in the scenarios. Responses are based on a five point Likert type scale that ranges from "not at all important" (1) to "very important" (5). Two dimensions determine the types of environmental moral reasoning reflected by the statements: centers of moral concern (i.e., self, other people, nature/ecosystem/biosphere) and underlying reasons of moral considerations (i.e., belief in the intrinsic value of nature, desire for living in harmony with it, personal interest, and issues of welfare, aesthetic, and justice). For example, if a statement refers to moral considerations related with the welfare of other people (e.g., If we pollute the water, it can cause people to get sick if they swim in it), it is labelled as a reflection of "anthropocentric-welfare" environmental moral reasoning because its center of moral concern is other people and it mainly focuses on the issue of welfare. Moreover, statements referring to the intrinsic value of nature and necessity of living in harmony with it are labelled as indicators of "ecocentric-intrinsic" and "ecocentric-harmony" environmental moral reasoning, respectively. In addition to responding to the moral reasoning statements on a Likert type scale, in a separate question, participants are also asked to indicate the statement they agreed most. These items are interpreted as reflections of environmental moral motivations because they indicate the environmental moral considerations that would be most motivating for the respondents for deciding not to perform the environmentally

damaging actions that are described in the moral dilemma scenarios (Greely, 2008; Persing, 2006).

The instrument has some characteristics that made it suitable to be used in the present study. Firstly, it presents several environmental scenarios that provide different moral dilemma contexts. This is an important characteristics because, as proposed by the Neo-Kohlbergian approach (Rest, Narvaez, Bebeau, & Thoma, 1999; Rest, Narvaez, Thoma, & Bebeau, 2000) and shown by findings of previous research (e.g., Kortenkamp & Moore., 2001, 2009), situational factors including the contexts of the moral dilemmas may be influential on individuals' moral reasoning. Secondly, the instrument enables collecting quantitative data on environmental moral reasoning since responses to the item statements coming after each scenario are based on Likert type scale. This characteristic of the instrument makes it appropriate to be used in research studies that aim to reach large sample sizes and enables employing a variety of data analysis techniques.

Adaptation of the instrument to be used for the present study required an iterative procedure realized with the participation of the researcher, consultants in academic writing center (AWC) of the university including a consultant having a master's degree in sociology, a professor who is expert in moral reasoning, and an experienced literature teacher teaching high school literacy courses for more than ten years. During the adaptation procedure, attention was paid on the clarity of the sentences both in the scenarios and in the item statements following each scenario. The literature teacher contributed to the achievement of this purpose by providing her expertise in sentence structure, grammar, and punctuation. Furthermore, the researcher, professor, and consultants put effort to meet the equivalence of the English and Turkish versions with regard to the contexts described in the scenarios as well as the meanings and implications of the statements following them. Based on suggestions of the AWC consultant who has a sociology background, additional effort was put to adapt the context of the camping scenario for Turkish culture. That is, original version of the scenario explains a moral dilemma about washing leakage

of a freezer pack from a cooler (a container used for keeping food and drinks cold) in a lake where the characters went for swimming. However, freezer packs and coolers are not common in Turkey. In fact, there are not any specific words that directly meet the meaning of these concepts in Turkish. Therefore, this scenario was adapted in a way that it explained a dilemma about washing dishes with detergent in the lake where the characters went for camping and swimming. By this way, main issues that are expected to evoke moral considerations in its respondents (i.e., possibility of polluting the lake with chemicals that may be harmful to the lake and all the things that live and swim in it) remained the same but the context of the scenario became more appropriate for Turkish culture.

The scenarios and the related questions were pilot tested with 218 pre-service science teachers. As realized for the two other instruments used in the study (i.e., Epistemic Beliefs Inventory, Value Survey), oral and written feedback of the participants obtained during and after data collection periods along with the collected data were examined. Based on these examinations, some minor changes were made on the instrument to improve its clarity and validity. In addition to some changes made in the wordings of the statements, some additional information was provided to the respondents to guide them while answering the questions. For instance, questions of the participants that were asked during the data collection periods and collected data sheets showed that some participants had a tendency to leave all the questions unanswered if they thought they would perform the environmentally damaging action described in the related scenario. In order to prevent this, a note was written at the beginning of the questions which states not to leave the questions empty because they measure relative importance of each statement for them. Similarly, a note saying “please select only one” was added to the instrument at the beginning of the question that asks participants to indicate the statement they agreed most. Although this additional note might seem unnecessary, collected data showed that quite a large number of respondents selected more than one option for the corresponding question.

3.4.3.1 Factor structures of the environmental moral reasoning scenarios

After making necessary revisions on the four environmental scenarios (i.e., hiking, picnicking, fishing, and camping), related questions, and item statements, the instrument was administered to 1524 pre-service science teachers (PSTs) in the main study. PSTs' responses to the item statements reflecting their environmental moral reasoning were factor analyzed for each scenario to reveal their factor structure. At first, data was subjected to exploratory factor analysis (EFA) with principle component analysis method via Statistical Package for Social Sciences (SPSS) version 21 for Windows. Then, confirmatory factor analyses (CFA) were applied to the data collected from the two random subsets of the study sample (Subsample A, Subsample B; see Table 3.4) through Analysis of Moment Structures statistical program (AMOS, version 21 for Windows). Similar to the Epistemic Beliefs Inventory (EBI) and the value survey used in the study, these CFA served for the purpose of cross-validating factor structures of PSTs' environmental moral reasoning that they exhibited in response the four environmental scenarios.

Findings of EFA suggested two-factor solutions for each environmental scenario, which explained 54.86 to 63.08 percent of the total variance in the related items. Model fit indices obtained from the CFA also supported the resulting two-factor solutions. More detailed information about factor analysis results of each environmental moral reasoning scenario is given in the subsequent sections.

Hiking scenario

Kaiser-Meyer-Oklin (KMO) (.87) and Barlett's (1954) Test of Sphericity ($p = .00$) values confirmed appropriateness of the related data for EFA. Catell's (1966) scree test (scree plot) and Kaiser's (1970, 1974) criterion provided evidence for the existence of two factors with eigenvalues greater than one. These two factors explained 54.86 % of the total sample variance. The correlation between the factors was .26. Although this correlation value is not very high and thus let the researcher use orthogonal rotation techniques (e.g., Varimax, Quartimax, Equamax), direct

oblimin rotation technique was used to interpret the factors because it resulted in a simpler factor solution (Tabachnick & Fidell, 2007).

Table 3.6 tabulates the factor structure of the data for the hiking scenario together with the related item statements and the environmental moral reasoning categories they represent. As seen in the table, participants' responses to this scenario did not reveal a purely nature-centered (ecocentric) moral reasoning factor. Conversely, PSTs' moral considerations regarding the nature collapsed into the same factor (factor 1) with concerns centered on the self (egocentric) and humans (anthropocentric). Therefore, it seems that, for the hiking scenario, participant PSTs did not evaluate moral standing of nature/environment as separate from its utility for humans. A detailed examination of the items in this factor (factor 1) implies that serving humans as an agent of pleasure constituted an important aspect/reason for giving a moral standing to the environment described in the scenario. Continuity of the aesthetical pleasure as well as justice issues that would make this continuous pleasure possible for the self and other people were emphasized in the related item statements. Hence, this factor (factor 1) was labeled as *utility of nature*. The second factor obtained from the EFA did not include any nature-centered (ecocentric) moral consideration. For this factor (factor 2) PSTs' responses concentrated on welfare issues regarding themselves and other people. Losing benefits derived from the natural area explained in the scenario (going to hiking; item y_a) and potential harms that may result from damaging it (falling and getting hurt; item y_c) were the concerns reflected in the item statements belonging to this factor. Accordingly, factor 2 of the hiking scenario was labeled as *threats to human welfare*.

Table 3.6

Factor Structure of the PSTs' Environmental Moral Reasoning in Response to the Hiking Scenario

Factor 1: utility of nature (eigenvalue =3.73; mean inter-item correlation = .42; α = .83)		
Item		Moral reasoning category
y_f	It is important to live in balance with nature and not harm more than we need to (.83)	eco. – harmony
y_b	There are some parts of nature that should remain as they are and not be disturbed (.78)	eco. – intrinsic
y_d	All the plants and animals in the field are living beings just like us and hiking through the field may hurt them (.71)	eco. – justice
y_i	I should be responsible to the places I enjoy so I can continue to enjoy them (.69)	ego. – justice
y_g	I want to leave the field pretty and attractive for others to enjoy viewing (.69)	anthro. – aesthetic
y_h	The trail belongs to everyone and nobody has the right to ruin it for others (.68)	anthro. – justice
y_e	There wouldn't be as many flowers for me to enjoy viewing (.43)	ego. – aesthetic
Factor 2: threats to human welfare (eigenvalue = 1.21; mean inter-item correlation = .29; α = .44)		
Item		Moral reasoning category
y_c	The field doesn't have a trail through it and if people started hiking through the field they could fall and get hurt (.79)	anthro. – welfare
y_a	It could tear up the field and then the park officials might close the trail to hikers and I could not go there anymore (.73)	ego. – personal interest

Model fit indices obtained from the CFA confirmed this factor structure for Subsample A ($\chi^2 = 145.06$, $df = 26$, $\chi^2/df = 5.58$, GFI = .96, AGFI = .93, CFI = .93, RMSEA = .08, RMR = .03, SRMR = .04) and Subsample B ($\chi^2 = 245.41$, $df = 26$, $\chi^2/df = 9.44$, GFI = .93, AGFI = .87, CFI = .90, RMSEA = .11, RMR = .05, SRMR

= .06). AMOS outputs of the related CFA models with standardized estimates are given in Appendix E.

Picnicking scenario

After confirming factorability of the related data (KMO = .89; $p = .00$), Catell's (1966) scree test (scree plot) and Kaiser's (1970, 1974) criterion were examined to decide the number of factors obtained for the picnicking scenario. As tabulated in Table 3.7, data suggested two factors with eigenvalues greater than one. These two factors explained 58.05 % of the total sample variance. Direct oblimin rotation technique was used for statistical interpretation since the correlation between the factors was relatively high ($r = .28$).

Findings of EFA showed that clustering of PSTs' responses to the moral reasoning statements about the picnicking scenario had a very similar pattern with that of the hiking scenario. Similar to the hiking scenario, PSTs' nature-centered (ecocentric) moral considerations did not form a separate factor but collapsed into the same factor (factor 1) with human-centered concerns which were based on nature's utility for humans as a source of pleasure. More specifically, PSTs' evaluated intrinsic value of nature, importance of living in harmony with nature, and rights of nature together with human-centered aesthetical concerns (e.g., No one wants to see litter and garbage when they are out on a picnic; item p_f) and justice issues that were focused on the continuity of the pleasure derived from the environment (e.g., Nobody has the right to litter the picnic area, it is there for everyone to enjoy; item p_c). Therefore, as realized for hiking scenario, this factor (factor 1) was labeled as *utility of nature*. Items that fell into the second factor (factor 2) also had a very similar pattern with that of hiking scenario. Welfare of the self and other people, which were expressed as concerns for the direct costs (paying money to clean the picnic area; item p_h) and indirect loss of benefits (not visiting the picnic area again; item p_a) that would be faced as a result of damaging the picnic area, were the main

focal points of considerations. Accordingly, factor 2 of the picnicking scenario was labeled as *threats to human welfare*.

Table 3.7
Factor Structure of the PSTs' Environmental Moral Reasoning in Response to the Picnicking Scenario

Factor 1: utility of nature (eigenvalue =4.04; mean inter-item correlation = .46; α = .85)		
Item		Moral reasoning category
p_d	The picnic area is a part of nature and should be preserved for its own sake (.84)	eco. – intrinsic
p_g	It is important for people to live in balance with nature and not disturb it any more than we have to (.81)	eco. - harmony
p_b	The plants and animals in the area are living creatures just like us and they have a right to live in a clean area just like we do (.75)	eco. – justice
p_c	Nobody has the right to litter the picnic area, it is there for everyone to enjoy (.74)	anthro. – justice
p_i	I should be responsible to the places I enjoy so I can continue to enjoy them (.62)	ego. – justice
p_f	No one wants to see litter and garbage when they are out on a picnic (.60)	anthro. – aesthetic
p_e	I want it to be kept clean for the next time I visit (. 49)	ego. – aesthetic
Factor 2: threats to human welfare (eigenvalue = 1.18; mean inter-item correlation = .25; α = .39)		
Item		Moral reasoning category
p_h	If people litter, it costs money to clean it up and the people who use the picnic area are the ones who will end up paying for it (.86)	anthro. – welfare
p_a	If the picnic area is left dirty, I will not want to visit again (.56)	ego. – personal interest

CFA conducted with the data obtained from the two random subsamples supported this factor structure by resulting in acceptable model fit indices (Subsample A: $\chi^2 = 217.89$, $df = 26$, $\chi^2/df = 8.38$, GFI = .94, AGFI = .89, CFI = .91, RMSEA = .10, RMR = .04, SRMR = .05; Subsample B: $\chi^2 = 253.61$, $df = 26$, $\chi^2/df = 9.75$, GFI = .92, AGFI = .86, CFI = .90, RMSEA = .11, RMR = .05, SRMR = .06). See Appendix E for the CFA models with standardized estimates.

Fishing scenario

Kaiser-Meyer-Oklin (KMO) (.84) and Barlett's (1954) Test of Sphericity ($p = .00$) values confirmed factorability of the data belonging to the fishing scenario. Based on Catell's (1966) scree test (scree plot) and Kaiser's (1970, 1974) criterion, two factors with eigenvalues greater than one were obtained from the EFA (see Table 3.8). These two factors explained 57.30 % of the total sample variance. To interpret the factors, direct oblimin rotation technique was used as the correlation between the factors ($r = .36$) was higher than the traditional .30 level (Tabachnick & Fidell, 2007).

As seen in Table 3.8, PSTs' environmental moral reasoning pattern was different for this scenario when compared with their reasoning patterns about hiking and picnicking scenarios. That is to say, for the hiking and picnicking scenarios human-centered aesthetical pleasure derived from the environment and its continuity seemed to be the dominant concerns of the first factors (*utility of nature*; see Table 3.7 and Table 3.8). These concerns collapsed into the same factor with nature-centered moral considerations and implied that PSTs had a utilitarian approach regarding the moral standing of nature about these two scenarios. On the other hand, for the fishing scenario, PSTs evaluated nature-centered (ecocentric) moral considerations separate from human-centered aesthetical concerns. Items that reflected ecocentric moral reasoning (i.e., desire for living in harmony with nature (item ba_a), rights of living creatures (item ba_f), and intrinsic value of nature (item

ba_d)) were evaluated together with human-centered moral considerations that focused on justice principles. Namely, items centered on rules and rights of people (item ba_b) and personal responsibility (item ba_i) formed a factor (factor 1) together with nature-centered moral reasoning items. Since the main rationale underlying ecojustice philosophy is also about positioning environmental concerns in a larger framework of justice principle, including social justice and related issues (Britton & Tippins, 2014; Mueller & Tippins, 2010; Sachs & Peterson, 1995), this factor was labeled as *ecojustice*. Aesthetical concerns for the self and other people formed another factor (factor 2) with human-centered welfare considerations. Item statements that represented aesthetical concerns reflected people's desire for seeing a lot of (big) fish in the creek (item ba_c, item ba_e). Similarly, welfare considerations reflected concerns for losing the opportunity of catching (big) fish in the creek (item ba_h, item ba_g). Since the main focus of these considerations was on humans, the researcher labeled this factor (factor 2) as *humans*.

Table 3.8

Factor Structure of the PSTs' Environmental Moral Reasoning in Response to the Fishing Scenario

Factor 1: ecojustice (eigenvalue = 3.72; mean inter-item correlation = .42; α = .78)		
Item		Moral reasoning category
ba_a	We can live in harmony with nature without taking fish we don't need (.81)	eco. – harmony
ba_d	Fish belong in the creek, it is their home (.80)	eco. – intrinsic
ba_f	Fish are living creatures just like us and have a right to live (.74)	eco. – justice
ba_b	Nobody has the right to break the rules because the creek is there for everyone (.70)	anthro. – justice
ba_i	I should be responsible to the places I enjoy so I can continue to enjoy them (.48)	ego. – justice
Factor 2: humans (eigenvalue = 1.44; mean inter-item correlation = .44; α = .76)		
Item		Moral reasoning category
ba_h	If it is fished out I cannot fish there anymore (.87)	ego. – personal interest
ba_g	Other people come to the creek to fish and would like the opportunity to catch big fish (.86)	anthro. – welfare
ba_e	People want to see a creek full of fish (.57)	anthro. – aesthetic
ba_c	I like to see a lot of big fish in the creek (.54)	ego. – aesthetic

CFA conducted with data obtained from the two random subsamples resulted in reasonable model fit indices (Subsample A: $\chi^2 = 286.01$, $df = 26$, $\chi^2/df = 11.00$, GFI = .92, AGFI = .86, CFI = .86, RMSEA = .12, RMR = .07, SRMR = .07; Subsample B: $\chi^2 = 272.69$, $df = 26$, $\chi^2/df = 10.49$, GFI = .92, AGFI = .86, CFI = .89, RMSEA = .11, RMR = .07, SRMR = .07). Nevertheless, investigation of modification indices calculated by AMOS showed that MI values between the residuals of the two items (i.e., ba_h, ba_g) were relatively high indicating high

correlation between them. Correspondingly, residuals of these two items were allowed to covary, which improved the model fit. This re-specification resulted in good fit for both of the Subsample A ($\chi^2 = 170.48$, $df = 25$, $\chi^2/df = 6.82$, $GFI = .95$, $AGFI = .92$, $CFI = .92$, $RMSEA = .09$, $RMR = .05$, $SRMR = .05$) and Subsample B ($\chi^2 = 133.42$, $df = 25$, $\chi^2/df = 5.33$, $GFI = .96$, $AGFI = .93$, $CFI = .95$, $RMSEA = .08$, $RMR = .05$, $SRMR = .05$). AMOS outputs showing standardized estimates of the re-specified CFA models are given in Appendix E.

Camping scenario

As realized for the other three scenarios (i.e., hiking, picnicking, fishing), data belonging to the camping scenario was first checked for factorability. After confirming appropriateness of data for EFA ($KMO = .88$; $p = .00$), Catell's (1966) scree test (scree plot) and Kaiser's (1970, 1974) criterion were examined to decide the number of factors. As tabulated in Table 3.9, a two-factor solution was suggested by the EFA results. These two factors explained 63.08 % of the total sample variance. To interpret the factors, varimax rotation technique was used as the emerging factors were uncorrelated ($r = .01$).

Different from the other three scenarios, for this scenario, PSTs' human-centered (egocentric and anthropocentric) concerns were completely separated from their nature-centered (ecocentric) moral considerations (see Table 3.9). All of the item statements reflecting egocentric and anthropocentric moral reasoning were clustered into a separate factor (factor 1). Concerns described in the item statements of this factor mainly reflected respondents' desires for a clean lake for themselves and other people. Benefits of the lake described in the scenario as a source of aesthetical beauty (item g_f, item g_d), potential harms of polluting it (item g_g, item g_b), and justice issues reflecting responsibilities required for continuity of the pleasure derived from the lake (item g_h, item g_i) were the considerations described in the item statements of this factor. Since all of these considerations were reflections of

moral reasoning centered on humans, the researcher named this moral reasoning factor (factor 1) as *humans*. Results of EFA also suggested that, for this environmental scenario, participants of the study regarded rights of nature (item g_c), its intrinsic value (item g_a), and necessity of living in balance/harmony with the environment as moral considerations that are independent from nature's utility for humans. All of the moral reasoning statements that represented nature-centered (ecocentric) moral reasoning were collapsed into a single factor (factor 2). Therefore, name of the factor (factor 2) that constituted these nature-centered moral considerations was labeled as *nature*.

Table 3.9

Factor Structure of the PSTs' Environmental Moral Reasoning in Response to the Camping Scenario

Factor 1: humans		
(eigenvalue = 4.40; mean inter-item correlation = .48; α = .85)		
Item		Moral reasoning category
g_g	If the lake got polluted I wouldn't swim in it anymore (.86)	ego. – personal interest
g_f	I like to swim in water that is clean (.84)	ego. – aesthetic
g_d	People want to see clean water when they go swimming, not dirty, gray water (.71)	anthro. – aesthetic
g_h	The lake is for everyone to enjoy and we should keep it clean for everyone (.63)	anthro. – justice
g_i	I should be responsible to the places I enjoy so I can continue to enjoy them (.51)	ego. – justice
g_b	If we pollute the water, it could cause people to get sick if they swim in it (.44)	anthro. – welfare
Factor 2: nature		
(eigenvalue = 1.28; mean inter-item correlation = .52; α = .76)		
Item		Moral reasoning category
g_c	The lake is a living thing with fish and plants and has a right to live and be healthy just like us (.84)	eco. – justice
g_a	The lake and the fish have value for their own sake and deserve respect (.79)	eco. – intrinsic
g_e	We are part of nature and so we must learn to live in balance with it (.72)	eco. – harmony

CFA conducted with the data obtained from the two random subsamples resulted in reasonable model fit indices (Subsample A: $\chi^2 = 384.78$, $df = 26$, $\chi^2/df = 14.80$, GFI = .89, AGFI = .81, CFI = .87, RMSEA = .14, RMR = .05, SRMR = .08; Subsample B: $\chi^2 = 314.27$, $df = 26$, $\chi^2/df = 12.09$, GFI = .91, AGFI = .84, CFI = .90, RMSEA = .12, RMR = .04, SRMR = .06). Nevertheless, investigation of modification indices of the AMOS output showed that MI values between the residuals of the two items (i.e., g_g, g_f) were relatively high indicating high correlation between them. Correspondingly, residuals of these two items were

allowed to covary, which improved the model fit (Model fit indices for Subsample A: $\chi^2 = 196.85$, $df = 25$, $\chi^2/df = 7.87$, GFI = .94, AGFI = .90, CFI = .94, RMSEA = .10, RMR = .03, SRMR = .06; Model fit indices for Subsample B: $\chi^2 = 206.56$, $df = 25$, $\chi^2/df = 8.26$, GFI = .94, AGFI = .89, CFI = .94, RMSEA = .10, RMR = .03, SRMR = .05). As a result, two-factor solution explored via EFA was validated and its replicability was supported. AMOS outputs of the re-specified CFA models with standardized estimates are given in Appendix E.

3.5 Data Collection

Following the initial processes of the selection, translation, and adaptation of the instruments, data collection of the study was realized in 2013 (2012-2013 Spring, 2013-2014 Fall academic semesters). As shown in Figure 3.2, data collection included pilot tests of the instruments and the main study (Also see Section 3.4 and Figure 3.1 for details of the instrumentation procedures and pilot studies). Before administration of the instruments, permission of the Human Subjects Ethics Committee was taken from the Applied Ethics Research Center of METU (Appendix F). Then, official correspondence between the presidencies of METU and the universities that constituted the clusters of the data collection sites was realized. By means of this correspondence procedure, necessary permissions for data collection were taken from ethical committees of the related universities.

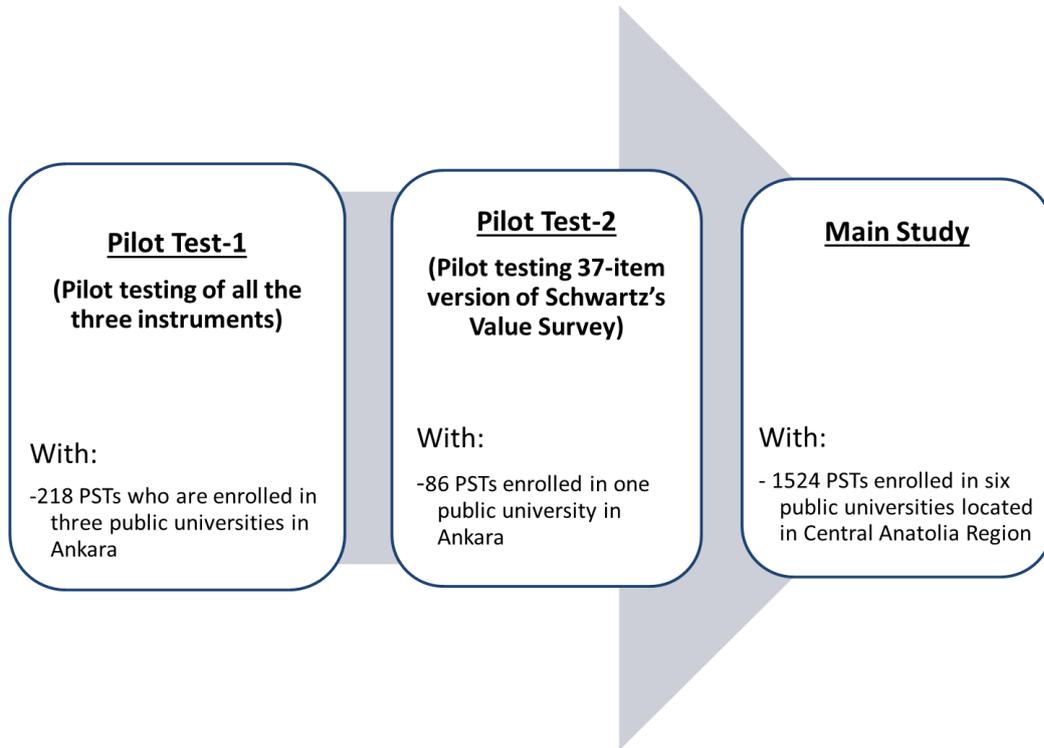


Figure 3.2. Summary of the data collection procedure

In order to control for the location internal validity threat, all PSTs completed the data collection instruments in their classrooms (Fraenkel et al., 2012). After taking permissions from the METU Ethics Committee and presidencies of the universities, the researcher e-mailed to the instructors to make arrangements about the time of their classes they could give for data collection. The instructors were informed about the presence of the necessary permissions, overall purpose of the study, and the time required for completion of the instruments. Based on the arranged times, the researcher went to the universities to collect data. Collecting data by the same researcher was used as a control for data collector characteristics internal validity threat (Fraenkel et al., 2012). At each data collection site, the researcher introduced herself and informed the participants about the study. She explained the importance of their answers for the study and requested them not to leave any of the items unanswered since there is no right or wrong answers. Participants were also

reminded that their responses would be kept confidential and used only for research purposes. To confirm their voluntary participation and awareness of their rights, such as right of excluding themselves from the study at any time they like, they signed a consent form.

With the help of the program that the researcher is enrolled in (i.e., OYP) it was possible to receive grant from the Institute of Social Sciences of the university. Therefore, at the beginning of the study a project was written and submitted to the institute (Project No: 1125) in order to meet financial expenses. With this grant, a private firm was arranged to design data collection instruments as optical forms and enter collected data to excel and SPSS data sheets. Using optical forms had many advantages for the study. First of all, it offered a better organization and visual quality of the data collection instruments. As observed by the researcher, this made participants to be more motivated while responding. Furthermore, since sample of the study was very large, use of optical forms was a necessity to enter collected data to data sheets in an easy and precise way and avoid a likely instrument decay internal validity threat (Fraenkel et al., 2012). Each optical form had a unique form ID on its pages, which made it possible to re-check participants' responses on the forms and the electronic data sheets. It took about 30 minutes for the participants to respond to the data collection instruments.

3.6 Data Analysis

In line with its research design, quantitative data analysis techniques were employed on the study data. These techniques can be categorized as preliminary analyses, descriptive analyses, and inferential analyses. Preliminary analyses were carried out for data screening (e.g., missing data, outliers) and checking assumptions of the inferential analyses (e.g., normality). Descriptive analyses were used as a means to describe characteristics of the sample in terms of demographic information and responses given to the subscales of the data collection instruments. Means, standard

deviations, and minimum and maximum values were the main statistics used for this purpose. Finally, inferential analyses were used to factor analyze participants' responses to the data collection instruments and investigate research questions.

Exploratory factor analyses (EFA) were conducted by utilizing principal components analysis technique. Before interpreting findings, appropriateness of the data for EFA were checked based on Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy (Kaiser, 1970, 1974) and Barlett's (1954) Test of Sphericity values (Pallant, 2007; Tabachnick & Fidell 2007). Catell's (1966) scree test (scree plot) and Kaiser's (1970, 1974) criterion were used to determine the appropriate number of factors found in the data sets. Methods to be used for factor rotation (orthogonal vs. oblique) were decided based on the magnitude of the correlations among the obtained factors. Confirmatory factor analyses (CFA) were conducted to test the validity of the instruments and replicability of their factor structures. A variety of model fit indices were used for assessing "goodness of fit" of the CFA results, which indicate validity of the instrument factor structures. As suggested by Hair, Black, Babin, and Anderson (2010), selected fit indices represented all of the three categories (i.e., absolute fit indices, incremental fit indices, and parsimony fit indices). In addition to the most fundamental Chi-square (χ^2) statistics, GFI, RMSEA, RMR, and SRMR were selected from the array of "absolute fit indices". Moreover, CFI as the "incremental fit index" and AGFI as the "parsimony fit index" were used to determine the validity of the specified measurement models (instrument factor structures). Table 3.10 tabulates the model fit indices selected for the present study and their suggested values. Refer to Hu and Bentler (1999), Kline (2011), Schumacker and Lomax (2010), Sumer (2000), and Tabachnick and Fidell (2007) for details of these model fit indices and interpretations of their values.

Table 3.10

Model Fit Indices Used for the Study

Model Fit Index		Values Indicating Good Fit
Chi-square	χ^2	The smaller the better
Degrees of Freedom	df	-
Normed Chi-square Fit Index	χ^2/df (CMIN/DF)	$\leq 2^a$ to 5^b
Goodness of Fit Index	GFI	$\geq .90^{b,c}$
Adjusted Goodness of Fit Index	AGFI	$\geq .90^{b,c}$
Comparative Fit Index	CFI	$\geq .90^{a,b,d}$
Root Mean Square Error of Approximation	RMSEA	$\leq .05^{b,c}$ to $.10^a$
Root Mean Square Residual	RMR	$\leq .08^d$ to $.10^e$
Standardized Root Mean Square Residual	SRMR	$\leq .08^d$ to $.10^e$

* *Reference:* ^a Tabachnick & Fidell (2007), ^b Sumer (2000), ^c Schumacker & Lomax (2010), ^d Hu and Bentler (1999), ^e Kline (2011)

Path analyses were used to examine whether epistemological beliefs and values held by the participant PSTs were significantly correlated with their environmental moral reasoning. These analyses also served for investigating the extent to which environmental moral reasoning patterns of the PSTs' were predicted by their epistemological beliefs and values. Multiple regression was not an appropriate and sufficient data analysis technique for answering this research question because exploration of this research question required simultaneous analysis of the relationships among multiple endogenous and exogenous variables (Tabachnick & Fidell, 2007). In structural equation modeling (SEM) terminology, the terms endogenous and exogenous variables are used as synonyms for dependent and independent variables, respectively (Byrne, 2010; Raykov, & Marcoulides, 2006). Accordingly, dimensions of epistemological beliefs and values constituted exogenous variables of the path model that was tested in the present study. On the other hand, dimensions of environmental moral reasoning (i.e., environmental moral

reasoning patterns) that the PSTs exhibited for the environmental scenarios constituted endogenous variables of the model.

Two statistical programs were used for data analyses. Statistical Package for Social Sciences (SPSS, version 21 for Windows) was used for the preliminary analyses, descriptive analyses, and exploratory factor analysis. On the other hand, for the analyses that cannot be performed by SPSS, the researcher utilized Analysis of Moment Structures (AMOS, version 21 for Windows). These analyses were confirmatory factor analyses and path analyses.

3.7 Assumptions, Limitations, and Delimitations of the Study

The study is based on some assumptions and it has some limitations and delimitations that may influence the conclusions and interpretations made on the findings. These can be listed as in the following:

- Since participants of the study were ensured that their participation was not compulsory but based on their willingness, they could withdraw from the study whenever they like, and their responses would be kept confidential, it is assumed that responses given to the data collection tools were sincere and truthful.
- It is assumed that there was not any interaction among the participants while responding to the data collection instruments. This was tried to be controlled by the researcher who was present in all of the data collection sites.
- Sample of the study was determined to be pre-service science teachers enrolled in six public universities in Central Anatolia region of Turkey. This sample is assumed to be representative of the accessible population it belongs. Nevertheless, due to the reasons explained in Section 3.3,

generalizability of the findings to all pre-service science teachers enrolled in public universities in Central Anatolia region of Turkey is limited.

- All data collected throughout the study was based on self-report measures, which may not represent complete objectivity. Influence of this limitation was tried to be alleviated by the frequent reminding of the researcher to the participants that there is no right or wrong answer for any of the items in the instruments. Moreover, a possible social desirability bias was tried to be overcome by anonymity and confidentiality of the participants and their responses.
- Environmental moral reasoning patterns exhibited by the participants are valid for the four scenarios (i.e., hiking, picnicking, fishing, camping) used in the study. In line with the principles of Neo-Kohlbergian approach of morality (Rest, Narvaez, Bebeau, & Thoma, 1999; Rest, Narvaez, Thoma, & Bebeau, 2000), use of different scenarios or different outdoor recreation contexts may elicit different environmental moral reasoning patterns.
- Ordering of the four scenarios (i.e., hiking, picnicking, fishing, camping) was not counterbalanced but the same ordering was used for all of the participants. This situation is regarded as a limitation of the study since ordering of the scenarios may have made a difference on the participants' responses.
- There may be various variables (e.g., demographic variables such as age, gender, etc.) that are potentially influential on environmental moral reasoning patterns. Nonetheless, in the present study the researcher delimited her independent (exogenous) variables to the theoretical constructs of epistemological beliefs and values so as to test the structural model that is hypothesized throughout the study.

3.8 Summary

The present study is a quantitative study that has a design of correlational research. Design, data collection, data analysis and interpretations of their findings were guided by the research questions that mainly served for investigating relationships of the PSTs' environmental moral reasoning patterns to their epistemological beliefs and values. Participants of the main study were 1524 pre-service science teachers (PSTs) enrolled in the first, second, third, and fourth grades of six public universities in Central Anatolia Region of Turkey. Apart from the main study, pilot studies were conducted in order to validate the survey instruments. Before pilot tests, necessary translations and/or adaptations were made on the original versions of the instruments with the help of the Academic Writing Center (AWC) of Middle East Technical University (METU), a professor in the field of science education, and an experienced literature teacher. Final versions of the instruments that emerged at the end of the studies (pilot tests and the main study) and provided data used for the analyses were: 22-item version of Bendixen et al.'s (1998) Epistemic Beliefs Inventory (EBI), 21-item version of Schwartz's (1992, 1994) Value Survey, which was adapted from its 37-item version used in Schultz and Zelezny's (1998, 1999) studies, and four environmental scenarios and related questions developed by Persing (2006).

Exploratory and confirmatory factor analyses were conducted to explore the factor structures of the instruments and examine their reliability and validity. For interpretation of the reliabilities of the instrument subscales (obtained factors), values of Cronbach's α and mean inter-item correlation were used. This choice was based on the fact that some of the subscales that emerged from the factor analyses had very few items (in some cases, only two items). In literature, it is suggested to use mean inter-item correlation value as criterion for interpreting reliability of scales/subscales that have small number of items because, in contrary to Cronbach's α , mean inter-item value is not affected by the number of items in scales/subscales (Briggs & Cheek, 1986; Pallant, 2007). Optimal range of this reliability value is

stated to be .2 to .4 (Briggs & Cheek, 1986). Examination of mean inter-item correlation values, together with values of Cronbach's α , revealed that the instruments adapted throughout the study had good reliability. In addition, model fit indices obtained from the confirmatory factor analyses showed that instrument factor structures were valid and replicable (Byrne, 2010).

After taking necessary permissions (ethical permission, permissions from the universities and the instructors), the researcher collected data in the participants' own classrooms. Participation to the study was on voluntary basis and participants were informed about their rights via consent forms. Anonymity and confidentiality of the participant responses were assured. Optical forms were used for data collection. Obtained data was subjected to preliminary, descriptive, and inferential analyses via SPSS and AMOS statistical analysis programs. Preliminary analyses were mainly used for data screening and checking assumptions of inferential analyses used in the study. Descriptive analyses were conducted to give information about the sample characteristics in terms of mean, standard deviation, and minimum and maximum values. Finally, factor analyses (EFA and CFA) and path analyses were the inferential analyses conducted in the study. While factor analyses were used to examine factor structures of the instruments, path analyses were utilized for testing research questions. Assumptions, limitations, and delimitations of the study were listed at the end of the chapter.

CHAPTER IV

RESULTS

This chapter is divided into three main sections. In the first section, findings of preliminary analyses including data screening procedures that were applied prior to descriptive and inferential analyses are given. In the second section, descriptive statistics about the study variables are presented. Results of inferential analyses (i.e., path analyses) and findings concerning the appropriateness of the study data for the analyses (i.e., requirements and assumptions) are given in the third section of the chapter. The chapter concludes with an overall summary of the results.

4.1 Preliminary Analyses (Data Screening)

Before conducting the main analyses, data of the study were first screened to check for possible errors. Data screening revealed that 13 participants gave “out of range” responses to the scale item which asked the respondents their ages (12 participants coded their ages between 0 to 12 and one participant coded his/her age as 91). Since these responses were erroneous and would distort the results of the subsequent analyses (e.g., mean age of the sample), data cells corresponding to those respondents’ ages were deleted and left as missing value. Remaining items in the data sheet did not reveal any inaccuracy.

In addition to checking accuracy of input in the data sheet, further preliminary analyses were conducted for checking missing values, outliers, and distribution of

the variables. Procedures followed for data screening and their findings are presented below.

Missing Data

In addition to participants' demographic characteristics, data of the study had one categorical variable to be used in descriptive analyses. The variable was measured by one question in each of the four environmental moral reasoning scenarios (i.e., hiking, picnicking, fishing, and camping), which asked participants to specify the moral reasoning statements that they agreed most for each scenario. Since responses to the questions indicated environmental moral considerations of the participants that would be most motivating for them for deciding not to perform the environmentally damaging actions described in the scenarios, this variable was named as environmental moral motivation (Greely, 2008; Persing, 2006). Similar to the items reflecting demographic characteristics of the sample, missing values in participants' responses to the environmental moral motivation questions (four questions in total; one question for each scenario) were kept as missing. Table 4.1 tabulates the frequencies (*f*) and percentages (%) of missing data in the categorical variables.

Table 4.1

Frequencies and Percentages of Missing Data in the Categorical Variables

Variable	Frequency (f)	Percentage (%)
Demographic Characteristics		
Gender	21	1.4
University	-	-
Grade level	6	.4
Program	49	3.2
Environmental Moral Motivation		
for hiking scenario	17	1.1
for picnicking scenario	16	1.0
for fishing scenario	18	1.2
for camping scenario	13	0.9

For the rest of the items SPSS missing value analysis (MVA) was performed. Results showed that maximum percentage of the missing values in the items was 4.0 %. Since data set of the study was large enough and the percentages of the missing data points were much below 10%, missing data were not a problematic issue for the present research (Hair et al., 2010). In fact, percentages of the missing values were below 5%, which is a stricter criterion that is suggested by Kline (2011) and Tabachnick and Fidell (2007). Nonetheless, it was necessary to impute these missing data points for the inferential analyses conducted via AMOS statistical package program (i.e., confirmatory factor analyses, path analyses). These analyses, which are included in the Structural Equation Modeling (SEM) family, require complete data sets to work with (Gallagher, Ting, & Palmer, 2008). Moreover, Maximum Likelihood (ML) estimation method used for these analyses is a full-information method where model parameters are estimated all at once. Accordingly, this estimation method assumes that there are no missing values in the analyzed data files (Kline, 2011). *Multiple Imputation* was the method used for imputation of the missing data. This method uses several steps to estimate missing data and has several advantages such as retaining sampling variability, having no assumptions of

randomness of missing data, being advantageous for multiple data sets, and being applicable to longitudinal data (Tabachnick & Fidell, 2007). Therefore, this method takes greater advantage of the data structure (Kline, 2011) and is suggested for missing data imputation (Hair et al., 2010; Kline, 2011; Tabachnick & Fidell, 2007).

Outliers

A number of procedures were applied to detect univariate and multivariate outliers in the data set. Iterative examination of boxplots, comparison of 5% trimmed means and original means of the variables, and inspection of the standardized values for each variable were the procedures realized for detecting univariate outliers. Critical value for the standardized values was determined to be $|3.29|$ as suggested by Tabachnick and Fidell (2007). Mahalanobis distance, Cook's distance, and Leverage value were the criteria used for detecting multivariate outliers. In the overall, screening of the data for outliers revealed the necessity of removing 22 cases (respondents) from the data sheet. Detailed information about the findings of outlier analyses is provided in the related sections of each inferential data analyses.

Normality

For checking univariate normality of the study variables (i.e., dimensions of epistemological beliefs, value categories, and foci of environmental moral reasoning), skewness and kurtosis values as well as histograms of each variable were examined. As tabulated in Table 4.2, maximum absolute value of skewness was $|0.96|$ and maximum absolute value of kurtosis was $|1.24|$. George and Mallery (2003) identified skewness and kurtosis values within the range of ± 1 as excellent and the ones within ± 2 range as acceptable. The normality statistics of the variables of the present study were in this suggested range (most of them were in ± 1 range). Therefore, the study variables were found to have a normal distribution. Examination of the histograms also supported this finding.

Table 4.2

Univariate Normality Statistics

Variable	Skewness		Kurtosis		
	Statistic	Std.error	Statistic	Std.error	
Epistemological Belief Dimension					
Quick Learning	0.87	0.06	0.98	0.13	
Simple Knowledge	-0.14	0.06	-0.02	0.13	
Innate Ability	-0.13	0.06	-0.21	0.13	
Omniscient Authority	-0.65	0.06	0.27	0.13	
Certain Knowledge	0.48	0.06	0.19	0.13	
Value Category					
Self-transcendence – Tradition	-0.94	0.06	0.62	0.13	
Openness to Change	-0.33	0.06	-0.59	0.13	
Self-Enhancement	-0.23	0.06	-0.17	0.13	
Focus of Environmental Moral Reasoning					
Hiking scenario	Utility of nature	-0.86	0.06	0.96	0.13
	Threats to human welfare	-0.35	0.06	-0.24	0.13
Picnicking scenario	Utility of nature	-0.96	0.06	1.24	0.13
	Threats to human welfare	-0.33	0.06	-0.20	0.13
Fishing scenario	Ecojustice	-0.64	0.06	0.25	0.13
	Humans	-0.43	0.06	-0.09	0.13
Camping scenario	Humans	-0.83	0.06	0.74	0.13
	Nature	-0.96	0.06	1.17	0.13

4.2 Descriptive Analyses

4.2.1 Epistemological Beliefs

Bendixen et al.'s (1998) Epistemic Beliefs Inventory (EBI) was used for measuring epistemological beliefs. In this instrument, respondents are asked to indicate the

degree of their agreement with the statements given in the items on a five point scale (ranges from (1) “strongly disagree” to (5) “strongly agree”). Due to the meanings of the item statements, higher scores indicate lower levels of (more naïve) epistemological beliefs. Conversely, lower scores obtained from the instrument indicate that the respondents had more sophisticated epistemological beliefs.

In this context, descriptive analyses of the participant pre-service science teachers’ (PSTs’) responses showed that their epistemological beliefs in omniscient authority ($M = 3.79$, $SD = .83$) were the most naïve when compared to the other epistemological belief dimensions. Their epistemological beliefs in simple knowledge ($M = 3.26$, $SD = .64$) and innate ability ($M = 3.26$, $SD = .71$) were relatively less naïve. Nevertheless, results showed that the PSTs still tended to agree with the simplicity of knowledge (i.e., simple knowledge) and believe that learning is an ability that is fixed at birth (i.e., innate ability). On the other hand, they exhibited more sophisticated beliefs in certain knowledge epistemological belief dimension ($M = 2.31$, $SD = .71$). Similarly, descriptive statistics calculated for quick learning ($M = 2.04$, $SD = .62$) indicated sophistication of the PSTs’ beliefs in this epistemological belief dimension. According to the findings, the participants of the study were aware that learning is not a quick process that happens immediately but requires ongoing hard work. Mean (M), standard deviation (SD), minimum ($Min.$), and maximum ($Max.$) values calculated for the five epistemological belief dimensions are tabulated in Table 4.3.

Table 4.3

Descriptive Statistics for Epistemological Beliefs

Epistemological Belief Dimension	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Quick Learning	2.04	.62	1.00	4.33
Simple Knowledge	3.25	.64	1.20	5.00
Innate Ability	3.26	.71	1.00	5.00
Omniscient Authority	3.79	.83	1.00	5.00
Certain Knowledge	2.31	.71	1.00	5.00

4.2.2 Values

The participants' values were measured through their responses to the 37 value items selected from Schwartz's (1992, 1994) value survey and used in studies of Schultz and Zelezny (1998, 1999). Responses to the value items range from (-1) "opposed to my values" to (7) "of supreme importance" and indicate the relative importance of each value item as a "guiding principle" in the respondents' lives. In addition to these two end points (i.e., -1 and 7), item scale includes (0) "not important", (3) "important", and (6) "very important" as well as the numbers between them. In Table 4.4, descriptive statistics, namely, mean (*M*), standard deviation (*SD*), minimum (*Min.*) and maximum (*Max.*) scores, for the values held by the participant PSTs are given.

Table 4.4

Descriptive Statistics for Values

Value Category	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
ST_T	5.75	.89	2.18	7.00
OC	4.93	1.18	.60	7.00
SE	4.06	1.35	-1.00	7.00

Note. ST_T = Self-transcendence – Tradition, OC = Openness to Change, SE = Self-enhancement.

As seen in the table, PSTs gave the least importance to the self-enhancement (SE) values as guiding principles of their lives ($M = 4.06$, $SD = 1.35$). In fact, minimum value ($Min. = - 1.00$) calculated for this variable indicated that some of the PSTs exhibited a negative reaction to SE value items and regarded them as opposed to their own value systems. Evaluation of the openness to change (OC) values by the PSTs was in between “important” (3) to “very important” (6) ($M = 4.93$, $SD = 1.18$). When the mean ($M = 5.75$) and minimum ($Min. = 2.18$) scores calculated for the self-transcendence and tradition (ST_T) value category were examined; it was seen that participants of the study gave the highest importance to the value items falling into this value category. Moreover, standard deviation ($SD = .89$), which is a measure of the variability in score distribution (Gravetter & Wallnau, 2004), showed that scores of the PSTs in this value category (i.e., ST_T) were not scattered but mostly concentrated around the mean score ($M = 5.75$).

4.2.3 Environmental Moral Reasoning

In line with Neo-Kohlbergian approach (Rest et al., 1999, 2000) and research findings (e.g., Kortenkamp & Moore, 2001, 2009) that show the importance of dilemma context for moral reasoning, environmental moral reasoning of the PSTs were measured based on their responses to four environmental moral dilemma scenarios (i.e., hiking, picnicking, fishing, camping). Accordingly, in this section of the chapter descriptive findings about the PSTs’ environmental moral reasoning are interpreted both within and between these scenarios. Assessment of the participants’ responses were made on a five-point Likert type scale ranging from (1) “not at all important” to (5) “very important”. Therefore, scores calculated for the scale items indicated the level of support or importance given to different moral aspects of the dilemma scenarios (see section 3.4.3 for detailed information about the moral aspects of the dilemmas referred in the environmental moral reasoning item statements).

As also seen in Table 4.5, foci (categories) of environmental moral reasoning showed differences based on the dilemma scenario they were exhibited for. That is to say, they had some nuances in their meanings and revealed implications about how the participant PSTs interpreted the moral reasoning dilemma contexts. Nonetheless, one moral reasoning category obtained for each of the four scenarios was relatively more human-centered when compared to the other (i.e., threats to human-welfare vs. utility of nature for the hiking and picnicking scenarios; humans vs. ecojustice for the fishing scenario; humans vs. nature for the camping scenario). Examination of the descriptive statistics showed that these more human-centered moral reasoning received lower support from the participants. Their mean (*M*) and minimum (*Min.*) scores were relatively lower when compared with the moral reasoning categories that included more nature-centered (ecocentric) items. Mean scores (*M*) showed that importance given by the participants to the nature-centered moral aspects of the scenarios was higher than “more important”. More specifically, mean scores of the “utility of nature”, “ecojustice”, and “nature” moral reasoning categories were higher than 4.00, which correspond to “very important” in the five-point Likert scale. Moreover, distributions of the scores in these more nature-centered moral reasoning categories were concentrated around the mean scores (see standard deviation (*SD*) values in Table 4.5).

Table 4.5

Descriptive Statistics for Environmental Moral Reasoning

Scenario	Focus of environmental moral reasoning	<i>M</i>	<i>SD</i>	<i>Min.</i>	<i>Max.</i>
Hiking	Utility of nature	4.27	.56	1.57	5.00
	Threats to human-welfare	3.23	.89	1.00	5.00
Picnicking	Utility of nature	4.40	.51	1.86	5.00
	Threats to human-welfare	3.57	.83	1.00	5.00
Fishing	Ecojustice	4.24	.57	2.00	5.00
	Humans	3.66	.80	1.00	5.00
Camping	Nature	4.40	.57	1.67	5.00
	Humans	4.26	.61	1.67	5.00

Environmental moral reasoning of the participants was also examined based on total amount of moral considerations they expressed for the environmental scenarios.

Descriptive analyses showed that, on the whole, participant PSTs expressed higher levels of moral considerations for the camping scenario ($M_{\text{overall}} = 4.33$) followed by the picnicking ($M_{\text{overall}} = 3.99$) and fishing ($M_{\text{overall}} = 3.95$) scenarios. Mean value of moral considerations expressed for the hiking scenario ($M_{\text{overall}} = 3.75$) was relatively lower when compared to the other three scenarios. Mean values of the overall moral considerations expressed for the four environmental scenarios are illustrated in Figure 4.1.

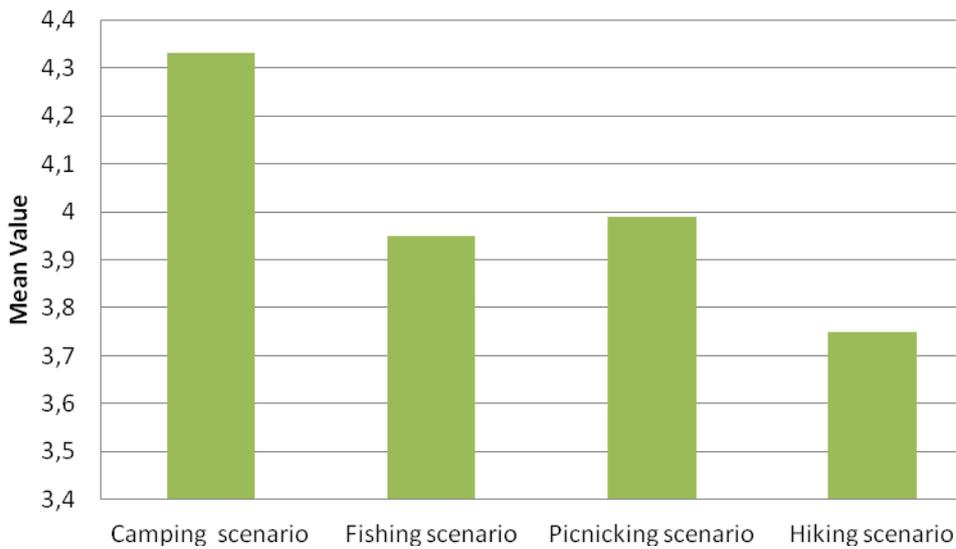


Figure 4.1. Mean values of the overall moral considerations expressed for the environmental scenarios

As explained previously, the participants of the study were not only asked to indicate the importance of each environmental moral reasoning item statement for them. In addition, after each scenario, they were asked to answer the question “Which of the above reasons do you agree with most?” PSTs’ answers to this question were regarded as reflections of their environmental moral motivations, which can be considered as the primary reasons (motivating factors) that may avoid them from performing environmentally damaging actions (Greely, 2008; Persing, 2006). Examination of the percentages (%) of the PSTs answers to this question revealed a trend across the scenarios. For all of the scenarios, the most frequently given answer to the related question reflected ecocentric moral considerations that focused on justice principle (i.e., ecocentric – justice). Percentages of the corresponding frequencies were more than 20% for each environmental scenario. Therefore, it can be claimed that ecocentric – justice moral considerations were the most important environmental moral motivators for the participants of the study. On the other hand, according to the results of the analyses, moral considerations that focused on welfare of the self or other people (i.e., egocentric – personal interest,

anthropocentric – welfare, respectively) and aesthetical pleasure derived from nature (i.e., egocentric – aesthetic) were observed to be the lowest motivating factors for the participants in deciding not to perform the environmentally damaging actions described in the scenarios. In Table 4.6, percentages (%) of the highest and the lowest motivating moral considerations of the PSTs are tabulated for each environmental scenario.

Table 4.6

The Highest and the Lowest Motivating Environmental Moral Considerations

Scenario	The highest motivating moral consideration	The lowest motivating moral consideration
Hiking	ecocentric – justice (21.4 %)	anthropocentric – welfare (1.4 %)
Picnicking	ecocentric – justice (20.8 %)	anthropocentric – welfare (1.3 %)
Fishing	ecocentric – justice (25.0 %)	egocentric – aesthetic (1.9 %)
Camping	ecocentric – justice (30.2 %)	egocentric – personal interest (2.4 %)

4.3 Path Analyses

Path analysis was the inferential analysis technique used for investigating relationships of the PSTs’ epistemological beliefs and values to their environmental moral reasoning patterns that they exhibited for the four environmental moral dilemma scenarios (i.e., hiking, picnicking, fishing, and camping). By this way, it was aimed to determine the extent of variances in the PSTs’ environmental moral reasoning patterns that were jointly predicted by their epistemological beliefs and values. For each environmental scenario a separate path analysis was conducted. As illustrated in Figure 4.2., exogenous variables (independent variables) of the analyses were the five epistemological belief dimensions (i.e., simple knowledge (SK), certain knowledge (CK), omniscient authority (OS), quick learning (QL), and

innate ability (IA)) and the three value categories (i.e., Self-transcendence – Tradition (ST_T), openness to change (OC), and self-enhancement (SE)). Endogenous variables (dependent variables) reflected the PSTs' foci of environmental moral reasoning about the four moral dilemma scenarios. Since factor analyses of the PSTs' environmental moral reasoning scores resulted in two-factor solutions for each scenario (see Section 3.4.3.1 for details), two endogenous variables were specified in each path model. In Figure 4.2 these variables are represented as environmental moral reasoning-1 (e.m.r.-1) and environmental moral reasoning-2 (e.m.r.-2).

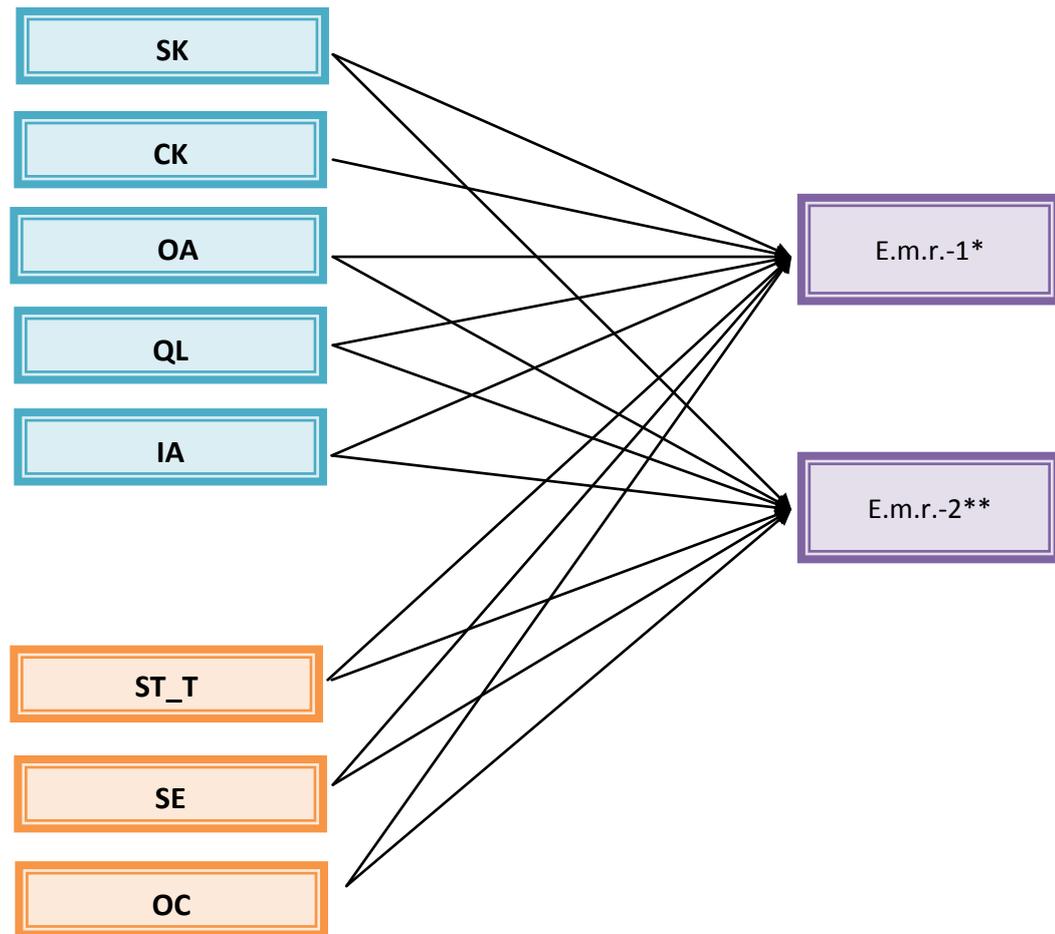


Figure 4.2. Visual representation of the variables and the hypothesized relationships. QL= quick learning, SK = simple knowledge, IA = innate ability, OA = omniscient authority, CK = certain knowledge; ST_T = self-transcendence – tradition, OC = openness to change, SE = self-enhancement. * Environmental moral reasoning 1 (e.m.r.-1): *utility of nature* for the hiking and picnicking scenarios; *ecojustice* for the fishing scenario; *humans* for the camping scenario. ** Environmental moral reasoning 2 (e.m.r.-2): *threats to human welfare* for the hiking and picnicking scenarios; *humans* for the fishing scenario, *nature* for the camping scenario

Maximum Likelihood (ML) was the estimation method used in the path analyses. The reason of choice of this estimation method was based on its advantages such as being theoretically-based (Byrne, 2001, 2010), providing more optimal statistical properties (Gallagher, Ting, & Palmer, 2008) and asymptotically unbiased, efficient, and consistent estimates (Kline, 2011, p. 155). Accordingly, ML estimation is the

most frequently used estimation approach in SEM literature (Kline, 2011; Tabachnick & Fidell, 2007). In the following sections, findings regarding the appropriateness of study data for path analysis are given first. Then, use of path analysis in the study and results of the tested path models are presented.

4.3.1 Requirements and Assumptions

Sample Size

Like other Structural Equation Modeling (SEM) techniques, estimates of parameters and significance tests in path analysis are very sensitive to sample size (Tabachnick & Fidell, 2007). Therefore, path analysis requires large samples (Gallagher et al., 2008; Hair et al., 2010; Kline, 2011). Kline (2011) suggests a minimum sample size of 200 cases for studies where SEM is used for analyses. Number of cases that were used in inferential analyses of the present study ($N=1502$) exceeds this value. Moreover, the study satisfies sample size requirement in terms of both response per parameter (5:1 ratio, Bentler & Chou, 1987; 10:1 ratio (ideally 20:1 ratio), Kline, 2011) and response per measured variable (15:1 ratio, Stevens, 2009) criteria.

Missing Data

Maximum likelihood (ML) estimation method used for estimating model parameters in the path analyses assumes that there are no missing values in the raw data files (Kline, 2011) and researchers performing SEM need complete data sets for their analyses (Gallagher et al., 2008). Accordingly, as explained in more detail in Section 4.1 of the chapter, all missing data points in the data of the study were determined. Maximum percentage of the missing values in the scale items that were used in the inferential analyses was 4%. In line with the suggestions of researchers (e.g., Hair et al., 2010; Kline, 2011; Tabachnick & Fidell, 2007), all these missing data points

were imputed by using *multiple imputation* method resulting in a data sheet with no missing values.

Absence of Multicollinearity

In order to test the absence of multicollinearity assumption, collinearity statistics (i.e., Tolerance and VIF values) and all bivariate correlation values (i.e., Pearson product-moment correlation) among the exogenous variables of the path models were examined. As tabulated in Table 4.7, none of the exogenous variables were highly correlated with each other (maximum correlation was $r = .46$). Moreover, minimum Tolerance value was .63 and maximum VIF value was 1.60, which supported the absence of multicollinearity in the study data (Hair et al., 2010; Pallant, 2007).

Table 4.7

Bivariate correlations among Exogenous Variables of the Path Models

	QL	SK	IA	OA	CK	ST_T	OC	SE
QL	1	.16**	.16**	-.01	.46**	-.13**	-.09**	.11**
SK	.16**	1	.20**	.12**	.11**	.01	.09**	.11**
IA	.16**	.20**	1	.10**	.08**	.03	.08**	.15**
OA	-.01	.12**	.10**	1	.10**	.22**	.04	.12**
CK	.46**	.11**	.08**	.10**	1	-.03	-.08**	.11**
ST_T	-.13**	.01	.03	.22**	-.03	1	.45**	.23**
OC	-.09**	.09**	.08**	.04	-.08**	.45**	1	.47**
SE	.11**	.11**	.15**	.12**	.11**	.23**	.47**	1

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

Note. QL= quick learning, SK = simple knowledge, IA = innate ability, OA = omniscient authority, CK = certain knowledge; ST_T = self-transcendence – tradition, OC = openness to change, SE = self-enhancement

Absence of Outliers

The variables that were used in the path analyses were inspected for both univariate and multivariate outliers. As explained in Section 4.1, univariate outlier check was performed as a part of preliminary data analyses by examining standardized values, boxplots, etc. For inspection of multivariate outliers, standardized residuals, Mahalanobis distances, centered Leverage values, and Cook's distances were examined. Examination of the calculated residuals and residual scatterplots revealed existence of a few outliers, which exceeded $|3.29|$ value. Nevertheless, as also stated by Tabachnick and Fidell (2007), considering the large sample size of the study this finding was quite expected and further analyses were required to determine whether they were influential data points or not. As another way for seeking multivariate outliers in the data sheet, Mahalanobis distances of each case to the centroid of all cases were computed. Calculated values were then compared with the critical chi-square (χ^2) value at the suggested alpha (α) level of .001 (Tabachnick & Fidell, 2007). Since there were eight exogenous variables (five epistemological belief dimensions, three value categories) in the analyses, this value was determined to be 26.13 for the present study. In the data sheet there were 15 cases with Mahalanobis distance values higher than this critical value.

In addition to comparisons made among the Mahalanobis distance of the variables with their critical value, centered Leverage values were used for checking potential multivariate outliers in the data sheet. Using the equation of $3(k+1) / N$ (N = number of observations, k = number of exogenous variables; Stevens, 2009), critical Leverage value for the study was determined to be .02. As tabulated in Table 4.8, Leverage values of none of the variables exceeded this value. Moreover, all of the Cook's distance values were below 1, which indicated that multivariate outliers identified through standardized residuals and Mahalanobis distances did not have undue influence on the results of the path analyses. Therefore, the researcher did not take any action for handling those outliers. See Table 4.8 for Minimum (*Min.*),

maximum (*Max.*), mean (*M*), and standard deviation (*SD*) values of Mahalanobis distance, centered Leverage, and Cook's distance values.

Table 4.8

Residual Statistics of the Path Analyses

	<i>Min.</i>	<i>Max.</i>	<i>M</i>	<i>SD</i>
Mahalanobis distance	.36	40.90	8.00	4.97
Centered Leverage value	.00	.02	.00	.00
Cook's distance	.00	.03	.01	.00

Normality

Multivariate normality is among the requirements that SEM methodology assumes for estimating parameters (Byrne, 2001). Since univariate normality is a prerequisite for multivariate normality, histograms and normality statistics (i.e., skewness kurtosis) of each of the study variables were examined. Screening of data revealed that all of the variables had a normal distribution (see Section 4.1). For assessing multivariate normality, multivariate kurtosis values were calculated via AMOS (Gallagher, 2008). Obtained values were below the critical values for each of the four path analysis. See Table 4.9 for the multivariate kurtosis statistics and their critical ratio.

Table 4.9

Multivariate Normality Statistics of the Path Analyses and Their Critical Ratios

	Multivariate Kurtosis	
	Statistic	Critical ratio
Hiking scenario	14.93	18.68
Picnicking scenario	13.42	16.79
Fishing scenario	12.81	16.02
Camping scenario	17.09	21.37

Linearity

Analyses conducted by SEM techniques examine only linear relationships (Gallagher et al., 2008; Tabachnick & Fidell, 2007). Therefore variables to be included in path analysis models should have linear relationships. Evaluation of this assumption in the context of the present study was realized by inspecting scatterplots and conducting curve estimation tests between pairs of the variables. Examinations showed that all relationships were sufficiently linear to be examined through path analyses.

Residuals

Residuals in SEM analyses are calculated in forms of residual covariances. Accordingly, covariance matrices obtained from the statistical tools are examined to check the appropriateness of data for SEM with regard to the required features of residuals (Tabachnick & Fidell, 2007). In this study, examination of the residual covariance matrices obtained from AMOS showed that residuals of the variables entered to the path analysis models were small, centered around zero, and symmetrically distributed as suggested.

Moreover, assumptions of multiple regression (i.e., normality, linearity, homoscedasticity, and independence of residuals) were also checked and addressed for the study data because path analysis is a multivariate data analysis method that uses application of several multiple regression equations where particular sets of independent (exogenous) variables are used to predict independent (endogenous) variables under consideration (Schumacker & Lomax, 2010). Graphical examination of Normal Probability Plots (P-P) and Scatterplots supported that residuals of the variables that were entered to the path analyses were normally distributed and had linear relationships. Moreover, variances of residuals were very similar for all predicted scores indicating their homoscedasticity (Hair et al., 2010; Tabachnick & Fidell, 2007). Furthermore, calculated values of Durbin-Watson statistics (ranged

from 2.00 to 2.08) indicated that residuals were independent from each other (Field, 2005).

4.3.2 Specified Path Models

After checking appropriateness of data for the path analyses, path models were specified in AMOS statistical package program. For model specification, AMOS Graphics was used as the mode of model input. As typically done, in the first steps of model specification covariances were added between all pairs of exogenous variables (Kline, 2011). Modification Index (MI) and Expected Parameter Change (EPC) values obtained from the tests of these path models indicated that allowing free estimation of the error covariances between endogenous variables (i.e., foci/categories of environmental moral reasoning) would substantially improve the model fits for all moral dilemma scenarios (i.e., hiking, picnicking, fishing, camping). Expecting relationships between environmental moral reasoning dimensions, especially when exhibited for the same moral dilemma scenario, was also theoretically plausible (Kortenkamp & Moore, 2001, 2009). Therefore, based on empirical and theoretical support, errors of the endogenous variables of the path models were allowed to covary freely (Byrne, 2010). Nevertheless, freeing these parameters (i.e., error covariances between the endogenous variables) resulted in just-identified models which were untestable as they had zero degrees of freedom (Byrne, 2010; Kline, 2011). Accordingly, covariances between epistemological belief-value pairs were removed from the path models. Path diagram given in Figure 4.3 illustrates the resulting path models that were analyzed via AMOS. As seen in the figure, endogenous variables (i.e., foci/categories of environmental moral reasoning) of the path models showed differences depending on the moral dilemma scenario that they were analyzed for. Findings of the analyses are reported in the subsequent paragraphs.

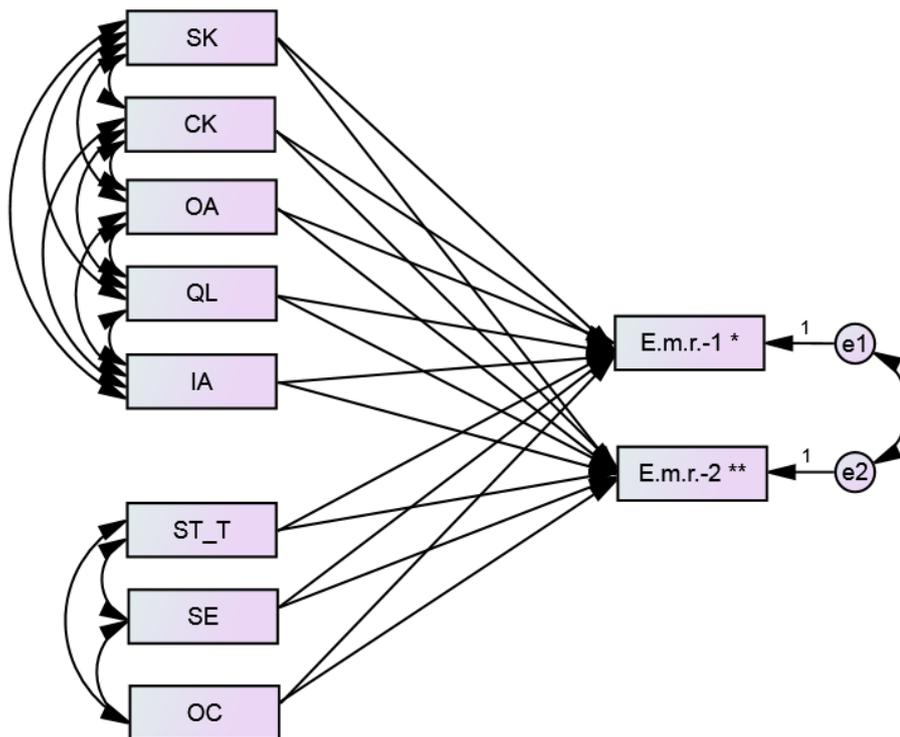


Figure 4.3. Representation of the path models analyzed for the four environmental moral dilemma scenarios QL= quick learning, SK = simple knowledge, IA = innate ability, OA = omniscient authority, CK = certain knowledge; ST_T = self-transcendence – tradition, OC = openness to change, SE = self-enhancement. * Environmental moral reasoning 1 (e.m.r.-1): *utility of nature* for the hiking and picnicking scenarios; *ecojustice* for the fishing scenario; *humans* for the camping scenario. ** Environmental moral reasoning 2 (e.m.r.-2): *threats to human welfare* for the hiking and picnicking scenarios; *humans* for the fishing scenario, *nature* for the camping scenario.

4.3.3 Findings

4.3.3.1 Hiking Scenario

Analysis of the path model specified for the hiking scenario resulted in the AMOS output given in Figure 4.4. To evaluate goodness-of-fit of the path model a number of model fit indices, which were explained in detail in Section 3.6 of the Method chapter, were used. Examination of the model fit indices ($\chi^2 = 230.58$, $df = 15$, $\chi^2/df = 15.37$, GFI = .97, AGFI = .89, CFI = .89, RMSEA = .10, RMR = .05, SRMR =

.06) revealed that all of the indices, except from the Normed Chi-square Fit Index (χ^2/df) were within the suggested ranges. In addition to Normed Chi-square Fit Index (χ^2/df), χ^2 statistics and its significance test resulted in undesired values (i.e., high χ^2 values and significant probability levels ($p < .001$), respectively). Nonetheless, values of GFI, AGFI, CFI, RMSEA, RMR, and SRMR were found to be sufficient to decide on the goodness of fit of the specified path model because use of model-fit indices that utilize χ^2 statistics may not be dependable for evaluating models which are tested with large samples (Blunch, 2008; Byrne, 2010; Hair et al., 2010; Kline, 2011; Schumacker & Lomax, 2010).

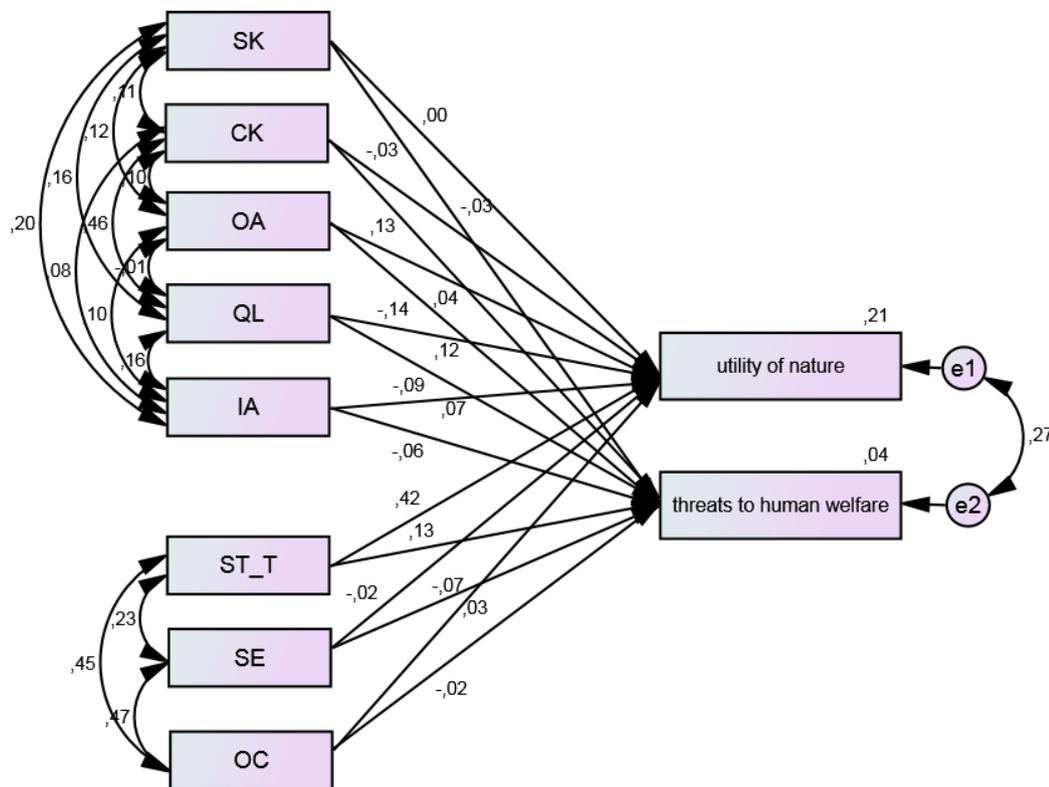


Figure 4.4. AMOS output with standardized estimates for the hiking scenario. SK = simple knowledge, CK = certain knowledge, OA = omniscient authority, QL= quick learning, IA = innate ability; ST_T = self-transcendence – tradition, SE = self-enhancement, OC = openness to change.

To determine the relationships among endogenous variables (i.e., environmental moral reasoning dimensions) and their predictors (i.e., dimensions of epistemological beliefs and values) in the path model, path coefficients were examined. Path coefficients correspond to regression coefficients in multiple regression analyses and their values are interpreted just as regression coefficients (Kline, 2011). In Table 4.10, standardized (β) and unstandardized (Estimate) path coefficients, their standard errors (SE), critical ratio (CR) and p values, which are used for evaluating significances of the corresponding path coefficients, are given. Standardized values of the path coefficients (β) were used for making comparisons among the strength of the hypothesized relationships and unique contribution of each exogenous variable to the explanation of the variances in the endogenous variables.

Table 4.10

Parameter Estimates of the Path Coefficients for the Hiking Scenario

Endogenous Variable	Exogenous Variable	β	Estimate	SE	CR	p
Utility of nature	QL	-.14	-.12	.02	-5.28	.00
	SK	.01	.00	.02	.21	.84
	IA	-.09	-.07	.02	-3.90	.00
	OA	.13	.09	.02	5.58	.00
	CK	-.03	-.03	.02	-1.25	.21
	ST_T	.42	.26	.02	16.38	.00
	OC	-.07	-.03	.01	-2.35	.02
	SE	-.02	-.01	.01	-.66	.51
Threats to human-welfare	QL	.07	.09	.04	2.29	.02
	SK	-.03	-.05	.04	-1.29	.20
	IA	-.06	-.08	.03	-2.36	.02
	OA	.12	.12	.03	4.50	.00
	CK	.04	.05	.04	1.43	.15
	ST_T	.13	.13	.03	4.49	.00
	OC	-.02	-.02	.02	-.69	.49
	SE	.03	.02	.02	1.19	.23

As tabulated in Table 4.10, path coefficients calculated for the SK and CK epistemological belief dimensions were not statistically significant. On the other hand, epistemological beliefs in QL, IA, and OA were found to have statistically significant path coefficients, which indicated the significance of their relationships with the PSTs' environmental moral reasoning. Direction of the relationships between beliefs in QL and environmental moral reasoning scores showed changes depending on the focus of the environmental moral reasoning exhibited for the scenario. More specifically, tendency to believe that learning is a quick process (i.e., higher scores in QL) was found to be negatively correlated with the PSTs' moral considerations that were focused on the utility of nature ($\beta = -.14$); whereas the relationship between this epistemological belief dimension (QL) and environmental moral reasoning that was focused on threats to human-welfare was positive ($\beta = .07$). Based on this finding, it can be concluded that, for this scenario, PSTs who had naïve beliefs in QL epistemological belief dimension tended to focus more on "threats to human-welfare" rather than "utility of nature". Directions of the relationships calculated between environmental moral reasoning dimensions and epistemological beliefs in IA and OA did not change depending on the focus of environmental moral reasoning. Beliefs in IA were negatively correlated with both of the environmental moral reasoning scores; whereas path coefficients calculated between OA and moral considerations exhibited for the environmental scenario were positive. Comparisons of the β values showed that beliefs in OA were generally more strongly correlated with the PSTs' environmental moral reasoning scores when compared with the relationships observed between environmental reasoning scores and other epistemological belief dimensions. In other words, OA epistemological belief dimension made higher amounts of unique contribution to the prediction of the PSTs' environmental moral reasoning scores. Only for predicting environmental moral reasoning that is focused on utility of nature, relative contribution of QL epistemological belief dimension score ($\beta = -.14$) was higher than that of OA ($\beta = .13$).

With regard to the relationships between environmental moral reasoning and values, it was observed that neither of the environmental moral reasoning dimensions had statistically significant relationships with SE values. Coefficients of OC values could reach statistical significance only when the variable (OC) was regressed on environmental moral reasoning that was focused on the utility of nature ($\beta = -.07$). The obtained coefficient indicated a negative correlation between this environmental moral reasoning dimension and OC values. On the other hand, ST_T values were found to be significantly related to moral considerations about the utility of nature ($\beta = .42$) and threats of human-welfare ($\beta = .13$). Directions of the relationships were positive in each case. In fact, as revealed by the standardized path coefficients (β), this value dimension had the strongest relationships with both of the environmental moral reasoning scores and made the highest unique contribution to the path equations.

To determine the amount of variances in the PSTs' environmental moral reasoning patterns that were jointly explained by their epistemological beliefs and values, Squared Multiple Correlation (SMC) values (also denoted as R^2) calculated by AMOS were used (Byrne, 2010; Tabachnick & Fidell, 2007). Basically, SMC (R^2) value indicates the proportion of variance in an endogenous variable that is explained by their predictors in the path model (Byrne, 2010). SMC (R^2) values calculated for the "utility of nature" and "threats to human-welfare" environmental moral reasoning dimensions were .21 and .04, respectively. In Cohen's (1988) standards, R^2 values ranging from .01 to .09 indicate small effect sizes and values between .09 and .25 are indicators of medium effect sizes. Therefore, based on Cohen's criteria, proportions of variances in environmental moral reasoning patterns that were jointly explained by epistemological beliefs and values had small (for "threats to human-welfare" environmental moral reasoning dimension) to medium (for "utility of nature" environmental moral reasoning dimension) effect sizes when the specified path model was tested for the hiking scenario.

4.3.3.2 Picnicking Scenario

The second path analysis that that was conducted to examine the relationships of epistemological beliefs and values to environmental moral reasoning patterns was employed with the data belonging to the picnicking scenario. As explained previously, the two factors representing environmental moral reasoning dimensions exhibited for the picnicking scenario (i.e., utility of nature, threats to human-welfare) were the same with the factors obtained for the hiking scenario (see Section 3.4.3.1 for details). In line with the purpose of the study, similar to the path model specified for the hiking scenario, these two environmental moral reasoning dimensions were entered to the path analysis as the endogenous variables, while dimensions of epistemological beliefs and values were the exogenous variables of the path model. Analysis of the data resulted in the AMOS graphical output given in Figure 4.5. Overall evaluation of the fit indices obtained from the analysis ($\chi^2 = 230.58$, $df = 15$, $\chi^2/df = 15.37$, $GFI = .97$, $AGFI = .89$, $CFI = .90$, $RMSEA = .10$, $RMR = .05$, $SRMR = .06$) indicated a good fit between the proposed model and the related data.

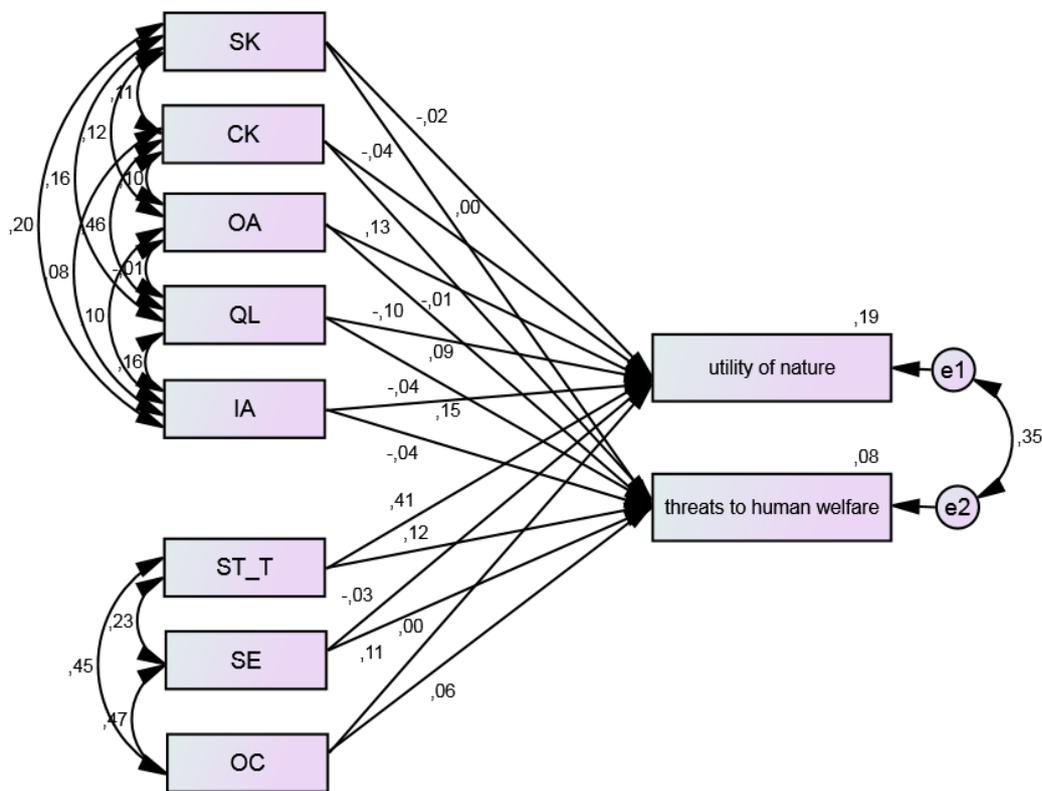


Figure 4.5. AMOS output with standardized estimates for the picnicking scenario. SK = simple knowledge, CK = certain knowledge, OA = omniscient authority, QL= quick learning, IA = innate ability; ST_T = self-transcendence – tradition, SE = self-enhancement, OC = openness to change.

Although environmental moral reasoning dimensions obtained for the picnicking scenario were the same with those of the hiking scenario, examination of the path coefficients showed that there were some differences regarding the relationships of these environmental moral reasoning dimensions with epistemological beliefs and values. For instance, with respect to the epistemological belief – environmental moral reasoning relationships, path coefficients calculated for the IA epistemological belief dimension indicated a possible influence of moral dilemma context (environmental moral reasoning scenario). More specifically, while relationships between IA and environmental moral reasoning scores were

statistically significant (negatively) for the hiking scenario, path coefficients of this epistemological belief dimension (IA) could not reach statistical significance for the picnicking scenario. For the picnicking scenario, the only two epistemological belief dimensions that had statistically significant relationships with environmental moral reasoning scores were QL and OA. Beliefs in QL were negatively correlated with environmental moral considerations that were focused on utility of nature ($\beta = -.10$) but positively correlated with environmental moral considerations that were focused on threats to human-welfare ($\beta = .15$). These findings showed that the PSTs who had naïve beliefs in QL (demonstrated by higher scores in QL) tended to be more concerned about the moral issues regarding the threats of the environmentally damaging action (i.e., leaving garbage in the picnic area) to human welfare but less concerned about the moral issues that were related with utility of nature. On the other hand, signs of the path coefficients calculated for the OA epistemological belief dimension were positive for each of the two environmental moral reasoning scores ($\beta = .13$ for utility of nature and $\beta = .09$ for threats to human-welfare).

Examination of the path coefficients calculated for the value dimensions (i.e., ST_T, OC, and SE) indicated a possible influence of dilemma context on value – environmental moral reasoning relationships as well. To illustrate, while the PSTs’ moral considerations that were focused on threats to human-welfare had statistically significant relationship with only ST_T values for the hiking scenario (see Table 4.10), it was observed that all of the three value dimensions were statistically significant predictors of this environmental moral reasoning dimension for the picnicking scenario. Sign of the path coefficients were positive. That is, as the importance that the PSTs attributed to the ST_T, OC, and SE values increased, they tended to exhibit higher amounts of moral considerations about the possible influence of the environmentally damaging action described in the picnicking scenario on human-welfare (demonstrated by higher scores on “threats to human-welfare” environmental moral reasoning dimension). Strength of the observed relationships was larger for ST_T values ($\beta = .12$) than SE ($\beta = .11$) and OC ($\beta = .06$) values, respectively. On the other hand, moral considerations that were focused

on the utility of nature had statistically significant relationships with only ST_T values ($\beta = .41$). Absolute value of the standardized path coefficient (β) indicated that practical significance of this relationship was near to the upper end of the .30 to .49 range, which reflects medium effect size according to the widely accepted criteria of Cohen (1988). Parameter estimates of the path coefficients calculated for the relationships between endogenous and exogenous variables of the path model are tabulated in Table 4.11.

Table 4.11

Parameter Estimates of the Path Coefficients for the Picnicking Scenario

Endogenous Variable	Exogenous Variable	β	Estimate	SE	CR	p
Utility of nature	QL	-.10	-.08	.02	-3.74	.00
	SK	-.02	-.01	.02	-.65	.52
	IA	-.04	-.03	.02	-1.56	.12
	OA	.13	.08	.01	5.51	.00
	CK	-.04	-.03	.02	-1.41	.16
	ST_T	.41	.23	.02	15.72	.00
	OC	-.00	.00	.01	-.04	.97
	SE	-.03	-.01	.01	-1.11	.27
Threats to human-welfare	QL	.15	.20	.04	5.32	.00
	SK	-.00	-.00	.03	-.08	.94
	IA	-.04	-.05	.03	-1.72	.09
	OA	.09	.09	.03	3.57	.00
	CK	-.01	-.02	.03	-.45	.65
	ST_T	.12	.11	.03	4.24	.00
	OC	.06	.05	.02	2.08	.04
	SE	.11	.07	.02	3.73	.00

SMC (R^2) value showed that the path model as a whole explained 19% of the variance in the PSTs' environmental moral reasoning that was focused on utility of nature ($R^2 = .19$). Proportion of the variance that was jointly explained by the epistemological beliefs and values of the PSTs was smaller for the environmental

moral reasoning dimension that was focused on threats to human-welfare ($R^2 = .08$). These values corresponded to medium and small effect sizes, respectively (Cohen, 1988).

4.3.3.3 Fishing Scenario

Environmental moral reasoning patterns obtained for the fishing scenario (i.e., ecojustice, humans) were different than the ones obtained for the hiking and picnicking scenarios. That is, “utility of nature” and “threats to human welfare” were the two focal points that the PSTs based their environmental moral reasoning about the hiking and picnicking scenarios. However, factor analysis of the environmental moral reasoning data belonging to the fishing scenario revealed a different pattern: focus of the two environmental moral reasoning dimensions were “ecojustice” and “humans”. Accordingly, in line with the purpose of the study, these two environmental moral reasoning dimensions constituted the endogenous variables of the path model tested for the fishing scenario. As in other path analyses conducted throughout the study, exogenous variables of the path model were dimensions of epistemological beliefs and values. Analysis of the path model with these variables resulted in acceptable model fit indices ($\chi^2 = 230.58$, $df = 15$, $\chi^2/df = 15.37$, $GFI = .97$, $AGFI = .89$, $CFI = .90$, $RMSEA = .10$, $RMR = .05$, $SRMR = .06$) and suggested that, on the whole, the proposed path model fit the data well. AMOS output obtained from the analysis is given in Figure 4.6.

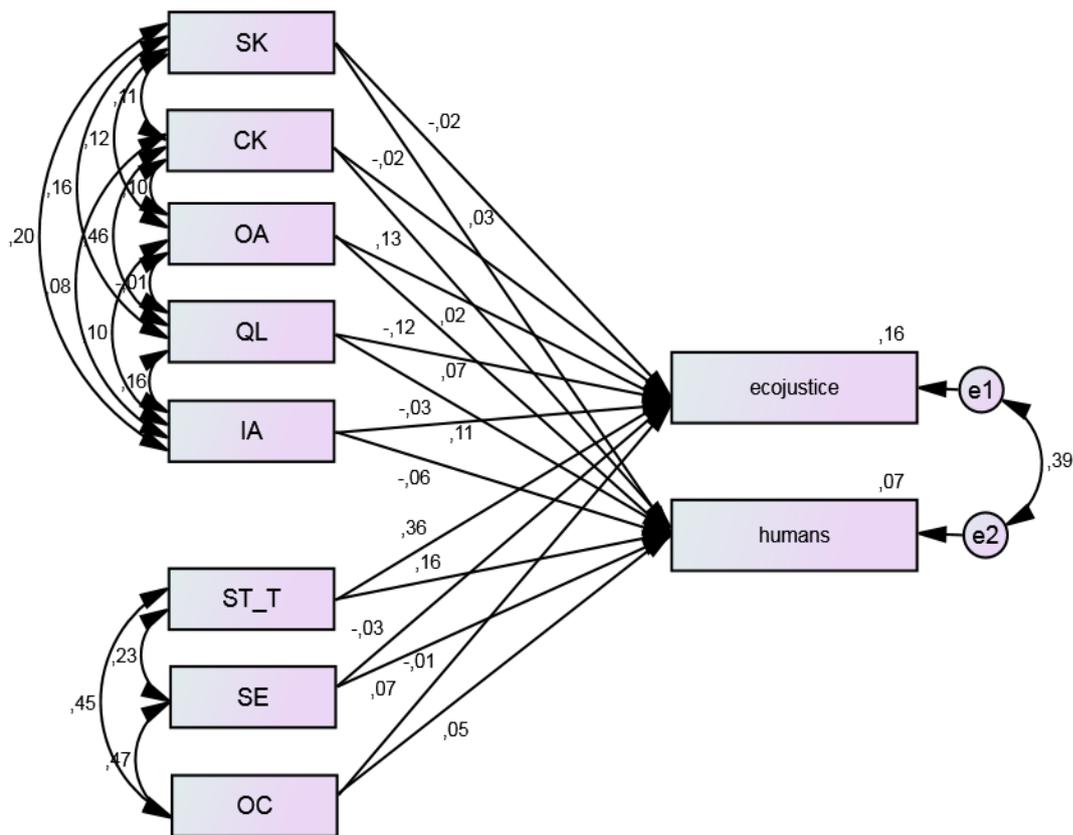


Figure 4.6. AMOS output with standardized estimates for the fishing scenario. SK = simple knowledge, CK = certain knowledge, OA = omniscient authority, QL= quick learning, IA = innate ability; ST_T = self-transcendence – tradition, SE = self-enhancement, OC = openness to change.

Relationships of epistemological beliefs and values to environmental moral reasoning exhibited for the fishing scenario were examined via parameter estimates obtained from the path analysis. These estimates including standardized (β) and unstandardized (Estimate) path coefficients, their standard errors (SE), critical ratio (CR) and p values are tabulated in Table 4.12.

Table 4.12

Parameter Estimates of the Path Coefficients for the Fishing Scenario

Endogenous Variable	Exogenous Variable	β	Estimate	SE	CR	p
Ecojustice	QL	-.12	-.11	.02	-4.46	.00
	SK	-.02	-.02	.02	-.73	.47
	IA	-.03	-.02	.02	-1.04	.30
	OA	.13	.09	.02	5.54	.00
	CK	-.02	-.01	.02	-.65	.52
	ST_T	.36	.23	.02	13.57	.00
	OC	-.01	-.01	.01	-.35	.73
	SE	-.03	-.01	.01	-1.15	.25
Humans	QL	.11	.14	.04	3.72	.00
	SK	.03	.04	.03	1.12	.26
	IA	-.06	-.06	.03	-2.20	.03
	OA	.07	.06	.02	2.59	.01
	CK	.02	.02	.03	.59	.56
	ST_T	.16	.14	.03	5.69	.00
	OC	.05	.04	.02	1.72	.09
	SE	.07	.04	.02	2.49	.01

According to these parameter estimates (Table 4.12), epistemological beliefs on SK and CK had statistically significant relationships with neither of the environmental moral reasoning dimensions. Moreover, significances of path coefficients calculated for IA changed depending on the environmental moral reasoning dimension it was regressed on. While no statistically significant relationship was observed between IA and environmental moral reasoning dimension of “ecojustice”, there was a statistically significant negative relationship between this epistemological belief dimension and environmental moral reasoning that was focused on humans ($\beta = -.06$). Similar to the other environmental moral dilemma scenarios, epistemological beliefs of QL and OA had statistically significant relationships with both of the environmental moral reasoning dimensions and contributed to the prediction of environmental moral reasoning patterns exhibited for the fishing scenario. Directions of the relationships observed between OA and the two environmental

moral reasoning dimensions were the same. There were positive relationships between beliefs in OA and environmental moral considerations that were focused ecojustice ($\beta = .13$) and humans ($\beta = .07$). On the other hand, focus of the moral considerations made a difference to the direction of the relationships observed between environmental moral reasoning dimensions and QL. When the focus of the environmental moral reasoning was on ecojustice, sign of the path coefficient was negative ($\beta = -.12$); when the environmental moral considerations were focused on humans, sign of the coefficient was positive ($\beta = .11$). That is to say, having naïve beliefs in QL (demonstrated by higher scores obtained for the QL variable) were positively correlated with human centered environmental moral reasoning but negatively correlated with ecojustice centered environmental moral reasoning.

When parameter estimates of the path model were examined for determining the relationships observed between environmental moral reasoning and values, it was found that OC values did not make any statistically significant unique contribution to the prediction of environmental moral reasoning patterns obtained for the fishing scenario (see Table 4.12). Conversely, level of importance given to the ST_T values by the participants of the study was observed to be significantly correlated to their environmental moral considerations focused on both ecojustice ($\beta = .36$) and humans ($\beta = .16$). Direction of the relationships was positive for each environmental moral reasoning dimension. Nonetheless, practical significance of the relationships was higher for the moral reasoning dimension that was focused on ecojustice. Relationships of environmental moral reasoning to SE values reached significance for only environmental moral reasoning dimension that was focused on humans ($\beta = .07$).

With regard to the proportion of the variances in the PSTs' environmental moral reasoning patterns that were explained by their epistemological beliefs and values, effect sizes of the SMC (R^2) values ranged from small to medium. The path model was able to explain 7% of the variance in environmental moral reasoning dimension

that was focused on humans ($R^2 = .07$) and 16% of the variance in environmental moral reasoning dimension that was focused on ecojustice ($R^2 = .16$).

4.3.3.4 *Camping Scenario*

The last scenario that was utilized to examine the predictability of the PSTs' environmental moral reasoning patterns by their epistemological beliefs and values was the camping scenario. As also illustrated in Figure 4.7, endogenous variables of the path model, which corresponded to the environmental moral reasoning dimensions obtained for the camping scenario, showed that participants' environmental moral considerations about this scenario were either focused on the self and other people (i.e., environmental moral reasoning dimension of "humans") or the environment/nature (i.e., environmental moral reasoning dimension of "nature"). As in the other path models, exogenous variables were representative of the epistemological belief and value dimensions. Model fit indices obtained from the path analysis ($\chi^2 = 230.58$, $df = 15$, $\chi^2/df = 15.37$, $GFI = .97$, $AGFI = .89$, $CFI = .91$, $RMSEA = .10$, $RMR = .05$, $SRMR = .06$) suggested that, on the whole, the proposed model fit the data well. AMOS graphical output of the analysis is given in Figure 4.7.

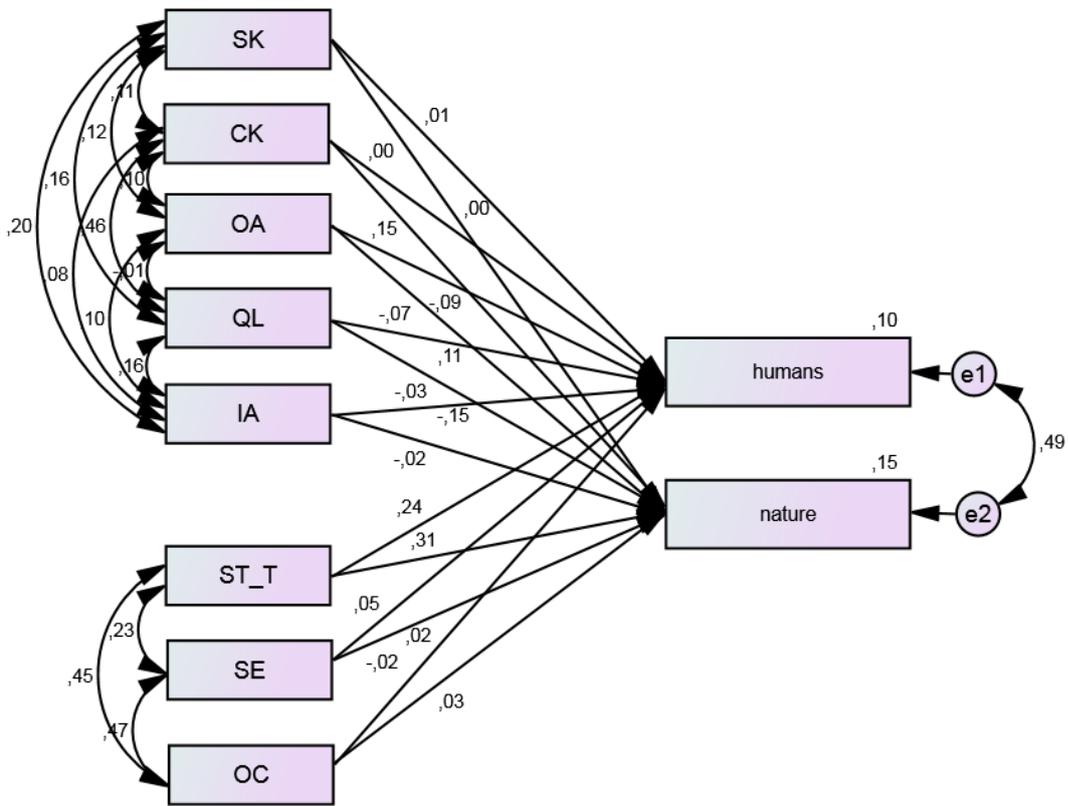


Figure 4.7. AMOS output with standardized estimates for the camping scenario. SK = simple knowledge, CK = certain knowledge, OA = omniscient authority, QL= quick learning, IA = innate ability; ST_T = self-transcendence – tradition, SE = self-enhancement, OC = openness to change.

Parameter estimates of the path coefficients were used for interpreting relationships of epistemological beliefs and values to environmental moral reasoning. In Table 4.13, standardized (β) and unstandardized (Estimate) values of these path coefficients as well as their standard error (SE), critical ratio (CR) and significance (p) values are tabulated.

Table 4.13

Parameter Estimates of the Path Coefficients for the Camping Scenario

Endogenous Variable	Exogenous Variable	β	Estimate	SE	CR	p
Humans	QL	-.07	-.06	.03	-2.35	.02
	SK	.01	.01	.02	.40	.69
	IA	-.03	-.03	.02	-1.22	.22
	OA	.15	.11	.02	6.07	.00
	CK	-.00	-.00	.02	-.15	.88
	ST_T	.24	.16	.02	8.70	.00
	OC	.02	.01	.02	.73	.47
	SE	.05	.02	.01	1.89	.06
Nature	QL	-.15	-.13	.02	-5.42	.00
	SK	.00	.00	.02	.15	.88
	IA	-.02	-.02	.02	-.97	.33
	OA	.11	.08	.02	4.65	.00
	CK	-.09	-.07	.02	-3.23	.00
	ST_T	.31	.20	.02	11.63	.00
	OC	.03	.01	.01	.88	.38
	SE	-.02	-.01	.01	-.85	.40

Parameter estimates calculated for environmental moral reasoning – epistemological belief relationships indicated that epistemological beliefs in QL and OA made statistically significant unique contributions to the prediction of the environmental moral reasoning patterns exhibited for the camping scenario. However, directions of the relationships were different for the two epistemological belief dimensions. While believing in QL was found to be negatively correlated to the PSTs’ environmental moral considerations that were focused on humans ($\beta = -.07$) and nature ($\beta = -.15$); a tendency to believe in OA was observed to be positively correlated to each of the environmental moral reasoning dimensions ($\beta = .11$ for environmental moral reasoning dimension that was focused on nature, $\beta = .15$ for environmental moral reasoning dimension that was focused on humans). Path coefficient calculated for the CK was only statistically significant (negatively) for nature centered environmental moral reasoning dimension ($\beta = -.09$). On the other hand, path

coefficients of SK and IA could not reach statistical significance for none of the environmental moral reasoning dimensions.

Among the three value dimensions of the path model (i.e., ST_T, SE, OC), the only one that significantly contributed to the prediction of the environmental moral reasoning patterns exhibited for the camping scenario was ST_T values. According to the path analysis results, the PSTs' who gave more importance to ST_T values exhibited higher levels of moral considerations for both humans ($\beta = .24$) and nature ($\beta = .31$). In fact, absolute value of the path coefficient observed between ST_T values and environmental moral reasoning that was focused on nature was the highest among the other path coefficients specified in the model indicating the strength of the relationship between these two constructs.

To determine the proportion of variance in environmental moral reasoning patterns that were jointly explained by the epistemological beliefs and values of the PST, SMC (R^2) values were interpreted. As also illustrated in Figure 4.7., R^2 value calculated for environmental moral reasoning dimension that was focused on nature ($R^2 = .15$) was slightly higher when compared to the R^2 value calculated for the environmental moral reasoning dimension that was focused on humans ($R^2 = .10$). Practical significances of the R^2 values corresponded medium effect sizes (Cohen, 1988).

4.3.3.5 General Conclusions

Examination of the findings obtained from the path analyses, which were conducted for the four environmental moral dilemma scenarios, also reveals some general conclusions about the relationships of epistemological beliefs and values to environmental moral reasoning patterns. To begin with, for some value categories and epistemological belief dimensions, signs of the path coefficients were consistent across all of the moral dilemma scenarios and types of environmental moral

reasoning. For example, path coefficients, thus, relationships between Self-transcendence – Tradition (ST_T) values and environmental moral reasoning scores were consistently positive regardless of the scenario context and focus of environmental moral consideration. Effect sizes of the corresponding path coefficients (ranged from .31 to .42) were medium (Cohen, 1988). The same consistent pattern was observed for the omniscient authority (OA) – environmental moral reasoning relationships as well. For each of the four moral dilemma scenarios, this epistemological belief dimension had statistically significant positive relationships with environmental moral reasoning of all types.

Findings also revealed a trend with regard to the possible influence of moral dilemma scenario context and focus of environmental moral consideration on the analyzed relationships. For instance, for three of the four scenarios (i.e., hiking, picnicking, fishing), naïve beliefs in quick learning (QL) epistemological belief dimension (demonstrated by higher scores in QL variable) had negative relationships with environmental moral reasoning dimensions that included ecocentric (nature-centered) items. On the other hand, relationships between QL and environmental moral considerations that were more focused on egocentric (self-centered) and anthropocentric (human-centered) concerns were positive. Although path coefficients calculated for SE were mostly statistically insignificant, directions of the relationships observed between this value dimension and environmental moral reasoning patterns also implied a general trend. PSTs who gave more importance to SE values were less likely to exhibit environmental moral reasoning that were focused on “utility of nature”, “ecojustice” or “nature” but were more likely to have concerns about “threats to human welfare” and “humans”.

4.4 Summary

After checking possible errors in the data sheet, preliminary analyses (data screening), descriptive analyses, and inferential analyses were conducted on the

study data. Data screening included general analysis of missing data, outliers, and normality. While missing data points in the categorical variables were left as missing, multiple imputation method was used for handling missing data in the continuous variables. Outlier analyses were employed for checking univariate and multivariate outliers. These analyses resulted in the exclusion of 22 cases from the data sheet. Examination of the skewness and kurtosis statistics and histograms of each variable did not indicate any problem regarding normality of the study variables.

Descriptive analyses were conducted to give an overall picture about the participant pre-service science teachers (PSTs) with regard to their responses to the data collection instruments that measured their epistemological beliefs, values, and environmental moral reasoning patterns. Analyses showed that, in general, the PSTs who participated in the study had naïve beliefs in simple knowledge, innate ability, and omniscient authority epistemological belief dimensions. Their beliefs about the nature and speed of knowledge acquisition (i.e., quick learning) and certainty of knowledge (i.e., certain knowledge) were more sophisticated. In fact, according to the descriptive statistics, participants were found to be aware that learning is not a quick and immediate process but requires ongoing effort. On the other hand, the PSTs had the most naïve epistemological beliefs about the source of knowledge; they seemed to believe that knowledge is something that is handed down by authority rather than a product of reasoning.

Descriptive analyses of the PSTs' responses to the value survey also resulted in important findings. Results showed the relative importance given by the participants to the self-enhancement (SE), openness to change (OC), and self-transcendence – tradition (ST_T) values as guiding principles in their lives. According to the findings, ST_T values were the most important guiding principles in the PSTs lives when compared to OC and SE values. Even the minimum score (*Min.*) obtained for the set of these ST_T values was 2.18, which is near to the scale anchor (3) “important”. Moreover, with a relatively low variability in the score distribution (*SD*

= .89), mean score calculated for this variable ($M = 5.75$) was the highest among the other three value categories. Conversely, self-enhancement values did not seem to receive support from the participant PSTs. Based on the minimum score calculated for the SE value category ($Min. = -1.00$), it is even possible to claim that some of the PSTs regarded the set of SE values as “opposed to their values”. Correspondingly, mean score of the SE value category ($M = 4.06$) was the lowest among the three value categories obtained from the study data.

Results of descriptive analyses with regard to participant PSTs’ environmental moral reasoning were examined both within and between the environmental dilemma scenarios. As explained in more detail in the Methods chapter, factor analyses of the data had resulted in two factors for each scenario. When mean scores of the obtained factors were examined, it was seen that, environmental moral reasoning that focused more on the nature-centered (ecocentric) moral aspects of the scenarios received higher support than the ones which were comparatively more human-centered (anthropocentric) or self-centered (egocentric). Correspondingly, environmental moral considerations that focused on “utility of nature” for the picnicking scenario ($M = 4.40$) and “nature” for the camping scenario ($M = 4.40$) had the highest mean scores. On the other hand, importance given to the environmental moral reasoning item statements that focused on “threats to human-welfare” about the picnicking scenario was relatively low ($M = 3.23$) when compared with other categories of environmental moral reasoning. In a similar manner, when specifically asked to identify the moral reasoning item that they agreed with most, for each scenario more than 20% of the participants indicated their support for ecocentric moral considerations which concentrated on issues of justice (i.e., ecocentric – justice). “Anthropocentric – welfare”, “egocentric – aesthetic”, and “egocentric – personal interest” moral considerations were found to have relatively low motivating influence on the PSTs for avoiding environmentally harmful actions described in the moral dilemma scenarios. Comparison of environmental moral reasoning mean scores between the scenarios showed that moral concerns of the participant PSTs

were highest for the camping scenario ($M_{\text{overall}} = 4.33$) and lowest for the hiking scenario ($M_{\text{overall}} = 3.75$).

Path analysis was the inferential analysis technique that was conducted to examine the hypothesized relationships of the PSTs' epistemological beliefs and values to their environmental moral reasoning patterns and, thus, determine the extent of the variances in these reasoning patterns through specified path models. Four separate path analyses were conducted for the four environmental moral reasoning scenarios. Before performing the analyses, study data was tested for its appropriateness in terms of the requirements and assumptions of path analysis. AMOS statistical package program was utilized to specify and test the path models. A number of goodness-of-fit statistics (i.e., Normed Chi-square Fit Index (χ^2/df), GFI, RMSEA, RMR, SRMR, CFI, and AGFI) were examined to evaluate goodness-of-fit of the models. Results indicated good-fit between the sample data and the path models tested for each environmental moral reasoning scenario. Variances in environmental moral reasoning scores that were explained by the path models, as indicated by SMC (R^2) statistics, mostly had medium effect sizes. As illustrated in Figure 4.8, statistical significance and direction of the tested relationships showed changes depending on the environmental moral dilemma scenario and the focus of moral consideration exhibited.

Scenario	Epistemological Beliefs	Values
Hiking	<ul style="list-style-type: none"> • Significant for QL, IA (-), OA (+) • Direction changed for QL <ul style="list-style-type: none"> ➤ (-) for “utility of nature”, (+) for “threats to human welfare” 	<ul style="list-style-type: none"> • Significant for ST_T (+) • Significance changed for OC <ul style="list-style-type: none"> ➤ signif. for “utility of nature”, insignf. for “threats to human welfare”
Picnicking	<ul style="list-style-type: none"> • Significant for QL, OA (+) • Direction changed for QL <ul style="list-style-type: none"> ➤ (-) for “utility of nature”, (+) for “threats to human welfare” 	<ul style="list-style-type: none"> • Significant for ST_T (+) • Significance changed for OC, SE <ul style="list-style-type: none"> ➤ insignf. for “utility of nature”, signif. for “threats to human welfare”
Fishing	<ul style="list-style-type: none"> • Significant for QL, OA (+) • Direction changed for QL <ul style="list-style-type: none"> ➤ (-) for “ecojustice”, + for “humans” • Significance changed for IA <ul style="list-style-type: none"> ➤ insignf. for “ecojustice”, signif. for “humans” 	<ul style="list-style-type: none"> • Significant for ST_T (+) • Significance changed for SE <ul style="list-style-type: none"> ➤ insignf. for “ecojustice”, signif. for “humans”
Camping	<ul style="list-style-type: none"> • Significant for QL (-), OA (+) • Significance changed for CK <ul style="list-style-type: none"> ➤ insignf. for “humans”, signif. for “nature” 	<ul style="list-style-type: none"> • Significant for ST_T (+)

Figure 4.8. Summary of the relationships tested through path analyses

Comparisons of the standardized path coefficients (β) showed that highest unique contribution to the path models belonged to ST_T value category. Variables of the study that were used in the inferential analyses and their types (dependent/endogenous or independent/exogenous) as entered to the path equations are tabulated in Table 4.14.

Table 4.14

Variables of the Inferential Analyses

Construct	Variable	Type of the variable in the path equations
Epistemological Belief	Quick Learning (QL)	Independent/exogenous
	Simple Knowledge (SK)	Independent/exogenous
	Innate Ability (IA)	Independent/exogenous
	Omniscient Authority (OA)	Independent/exogenous
	Certain Knowledge (CK)	Independent/exogenous
Value	Self-transcendence – Tradition (ST_T)	Independent/exogenous
	Openness to Change (OC)	Independent/exogenous
	Self-Enhancement (SE)	Independent/exogenous
Environmental Moral Reasoning	For the hiking scenario:	
	Utility of nature	Dependent/endogenous
	Threats to human-welfare	Dependent/endogenous
	For the picnicking scenario:	
	Utility of nature	Dependent/endogenous
	Threats to human-welfare	Dependent/endogenous
	For the fishing scenario:	
	Ecojustice	Dependent/endogenous
	Humans	Dependent/endogenous
	For the camping scenario:	
Humans	Dependent/endogenous	
Nature	Dependent/endogenous	

CHAPTER V

DISCUSSION

As revealed in the characteristics of educational programs that has emerged in many forms throughout the history (e.g., nature study, outdoor education, education for sustainable development, etc.), environmental education (EE) aims to meet the demands of and solve the problems related to the environment within the *zeitgeist* of their times. In this context, it would not be wrong to describe this last few decades as a time of re-awakening about the importance of ethics and morality in environmental conservation and protection. That is to say, it seems to have started to be acknowledged that efforts of simply increasing environmental knowledge and awareness or promoting positive environmental attitudes are not enough for fostering pro-environmental behaviors in the society (York & Becker, 2012). Many researchers (e.g., Eilam & Trop, 2010; Postma, 2006; York & Becker, 2012) highlight ethics as a key answer and call researchers and educators as well as politics to pay attention to cultivation of ethics in the society.

The present study was also based on and motivated by this rationale. Accordingly, environmental moral reasoning patterns of pre-service science teachers (PSTs) were examined together with their relationships with epistemological beliefs and values. By this way, it was aimed to shed some light to the understanding of individuals' moral perceptions about environmental issues and the variables that are correlated with environmental moral reasoning patterns. In the following paragraphs, findings of the study are interpreted first. These interpretations are organized into two sections. In the first section, findings related to the dimensions of epistemological

beliefs, values, and environmental moral reasoning are given place. In the second subsection, results of data analyses which were conducted for testing research questions of the study are interpreted. Then, implications of the study for educational policy and practice are discussed with an emphasis on environmental education. At this point, the reader is reminded that, as in other chapters of the dissertation, the term environmental education (EE) is used as a generic term rather than a specific type of educational program related to the environment. Discussions and conclusions made about the study should be interpreted within this context. Towards the end of the chapter, recommendations for further research are presented.

5.1 Discussion of the Findings

5.1.1 Dimensions of Epistemological Beliefs, Values, and Environmental Moral Reasoning

Adaptation of the data collection instruments was an important part of the study. In addition to providing reliable and valid data collection tools for measuring epistemological beliefs, values, and environmental moral reasoning to be used in future research, results of data analyses conducted throughout the adaptation procedures had important implications for educational research and practice. Dimensions (factors) obtained from the exploratory and confirmatory factor analyses revealed how these constructs (i.e., epistemological beliefs, values, environmental moral reasoning) were structured when studied within a sample of Turkish pre-service science teachers. Examination of the obtained factors made it possible to make comparisons about the content and structure of the variables with findings of previous research conducted with diverse samples. Inferences and interpretations about the subject characteristics with regard to the variables of the study are given below.

5.1.1.1 Dimensions of Epistemological Beliefs

Dimensions of epistemological beliefs as revealed by the results of factor analyses were in line with Schommer's (1990, 1994) epistemological beliefs model. Five factors, which were extracted by the exploratory factor analyses (EFA) and confirmed by confirmatory factor analyses (CFA), corresponded to the five epistemological belief dimensions (i.e., quick learning, simple knowledge, innate ability, omniscient authority, and certain knowledge). This finding of the study provided empirical evidence for the multi-faceted nature of epistemological beliefs, as proposed by Schommer and supporters of her personal epistemology model (e.g., Bendixen et al., 1998; Schraw et al. 1995, 2002). Moreover, examination of the mean scores calculated for the factors supported Schommer's contention that dimensions of epistemological beliefs may be more or less independent of each other. Participants of the study exhibited reasonably sophisticated beliefs about some epistemological dimensions (quick learning, certain knowledge). On the other hand, their beliefs about some other dimensions (omniscient authority, innate ability, simple knowledge) were quite naïve. Furthermore, except for the correlation between QL and CK ($r = .46$), all of the correlation coefficients calculated between the dimensions of epistemological beliefs were small (maximum $r = .20$).

Mean scores calculated for the five epistemological belief dimensions together with the items that loaded on these dimensions revealed sample specific characteristics of epistemological beliefs. These findings had implications for the cultural basis of epistemology (Hofer, 2008) as well. For example, PSTs who participated in the study were found to have the highest mean score ($M = 3.79$), thus exhibited the lowest level of sophistication, for omniscient authority (OA) epistemological belief dimension. Eastern culture of the country which favors respect and obedience to authority may be one of the reasons of this finding. Moreover, educational system of the country and traces of culture with regard to the perceptions about and attitudes towards authority in the educational settings may provide some explanations (Youn, 2000). That is to say, many of the PSTs who participated in the study most probably

were exposed to traditional teaching strategies (e.g., direct instruction) in their educational lives, at least before their university education (Yilmaz-Tuzun & Topcu, 2008). These teaching strategies are mostly teacher centered and expect students to follow the instructions of teachers who are perceived as “experts” and have the control over their students’ learning experiences (Youn, 2000). Accordingly, educational experiences of the PSTs when combined with the cultural tendency of perceiving authority as something that is omniscient may have caused them to view knowledge as handed down by authority rather than generated from reason.

Factor structure of the data including the items that fell into the particular factors may also be informative about respondents’ epistemological beliefs and the influence of culture on personal epistemology (Hofer, 2008; Tuncay-Yuksel et al. 2015; Youn, 2000). In the context of the present study, the example again comes from omniscient authority (OA) epistemological belief dimension. The two items in the Epistemic Belief Inventory (EBI) (“People shouldn’t question authority”, “When someone in authority tells me what to do, I usually do it”) were absorbed by the epistemological belief factor of quick learning (QL) although they are conceptually more consistent with OA epistemological belief dimension. That is, results showed that participants of the study perceived these two items as more representative of epistemological beliefs about speed of learning rather than source of knowledge. This finding is in line with what Youn (2000) observed in the factor structure of epistemological beliefs in a sample of Korean undergraduate and graduate students. Youn’s study was a cross-cultural study that aimed to investigate and compare factor structures of epistemological beliefs held by Korean and American college students. Results of the study showed that in contrary to the American sample, Korean students’ beliefs on omniscient authority factorized with items that reflected beliefs on learning rather than knowledge. This was interpreted as an indication that Korean students linked authority with learning, which was an expected result in the context of Korean culture and accompanying student and teacher roles in educational settings. More specifically, Youn stated that learning is a more “personal” process in Korea where student-teacher interactions are more binding and students are expected

to follow instructions of teachers to achieve “learning”; not obeying these pre-specified student roles are perceived as disloyalty to teachers or signs of unwillingness to learn. In a similar way, participants of the present study may have perceived “authority” figures in the above mentioned items as “experts” such as teachers and regarded obedience to them as a path for quick learning.

Nonetheless, mean score calculated for the Quick Learning (QL) epistemological belief dimension ($M_{QL}= 2.04$) showed that, on the whole, PSTs who participated in the study were more likely to agree that learning is a gradual process, not something that happens swiftly. One explanation to this finding may be the PSTs’ interpretation of learning that may be influenced by their culture. That is, as revealed by Hofer (2008) and Chan and Elliott (2004), in some cultures (e.g., Confucian cultures) the importance of effort and hard work in learning is highly associated with the process of learning itself, which may be regarded as a different interpretation of QL epistemological belief dimension. The situation in Turkey may also be attributable to the education system of the country. In Turkey students have to work very hard in order to achieve their courses and pass many nationwide exams. These exams create a very competitive environment among the students as well as their parents since they are regarded as overall indicators of success and keys to a more prestigious life such as access to a qualified college education and satisfying job opportunities (Tuncay-Yuksel et al., 2015). Furthermore, success of the schools and the teachers are usually evaluated based on the scores that their students get from the exams (Irez, 2006). Accordingly, students in Turkey are always preached that path for learning and success is not easy nor it happens quickly but it requires continuous effort and hard work.

5.1.1.2 Dimensions of Values

Another construct of the study which was investigated as a predictor of the participants’ environmental moral reasoning was values. Similar to the other

variables of the study, dimensions of values held by the participant PSTs were extracted via factor analyses. As explained in detail in the methods chapter (see section 3.4.2.1) series of exploratory and confirmatory factor analyses were conducted to investigate the factor structure of the related data. Results showed that values that belong to self-transcendence and tradition (conservation) value categories in Schwartz's (1992, 1994) value theory collapsed into a single factor, which was labeled as Self-transcendence – Tradition (ST_T). The remaining two value dimensions obtained through the factor analyses were representative of the value items that are identified in openness to change (OC) and self-enhancement (SE) value categories in Schwartz's (1992, 1994) value theory.

Structure of the relationships among the value types in Schwartz's (1992, 1994) value theory provide some explanations for the three-factor solution of the data collected on values held by the participants of the study. That is to say, according to Schwartz value theory the ten value types (i.e., power, achievement, hedonism, stimulation, self-direction, universalism, benevolence, tradition, conformity, and security) are arranged in a way that they form a continuum of a circular shape. In this circular shape (see Figure 2.1), values with similar underlying motivational goals are in close proximity to each other; whereas values with competing motivational goals are placed in opposite "slices" of the circle. As revealed in previous research (e.g., Davidov, Schmidt, & Schwartz, 2008; Schwartz & Boehnke, 2004; Schwartz & Rubel, 2005; Spini, 2003), depending on the characteristics of the sample (e.g., culture), values which share similar motivational goals may combine with each other and form fewer number of value dimensions than the ten value types or four value categories grouped by Schwartz. Combination of self-transcendence (ST) and tradition (T) value categories into a single value dimension (i.e., ST_T) in the present study was an example to this situation (See Figure 5.1).

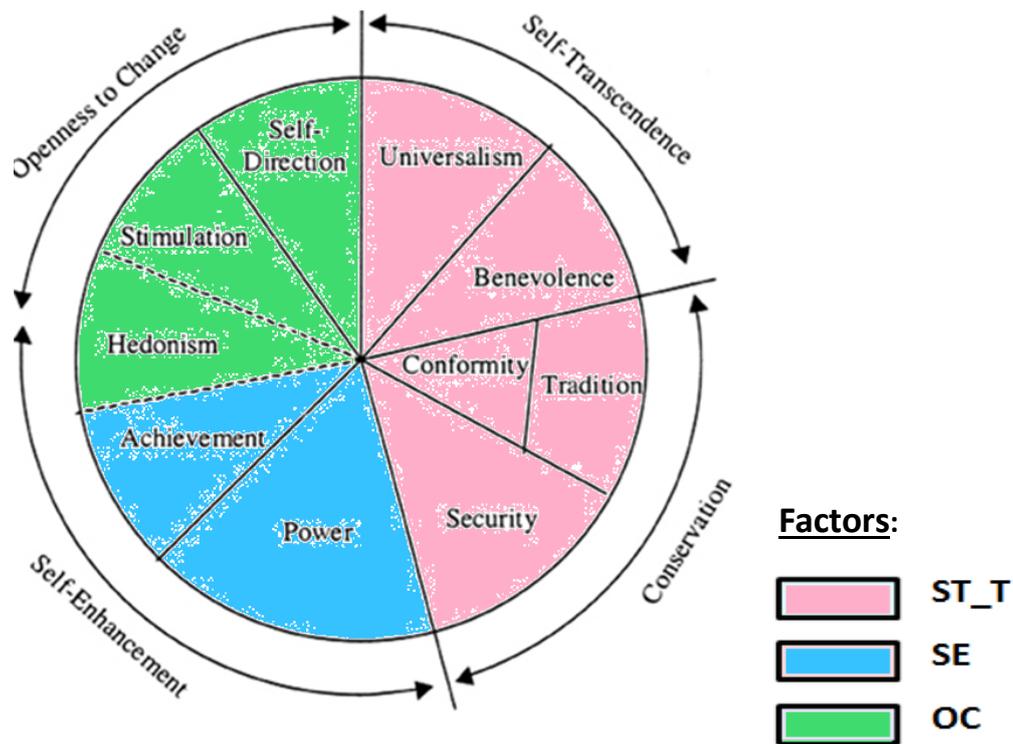


Figure 5.1. Schwartz's value theory and factors obtained from the factor analyses of the value survey

It seems that the PSTs who participated in the study construed values belonging to these two value categories as being very similar to each other in terms of the motivational goals they express (Struch, Schwartz, & van der Kloot, 2002). In fact, this finding is not surprising or unexpected for the sample of the present study because meanings of ST and T values are likely to be construed similarly on the context of Turkish culture.

Considering the influence of culture and social surroundings of individuals on their values and basic worldviews (Struch et al., 2002), the ST_T value dimension that emerged from the factor analyses of the study data was identified by the PSTs as the most important guiding principles in their lives. More specifically, this value dimension, which was comprised of universalism, benevolence, tradition,

conformity, and security motivational goals, was given the highest priority. Mean score ($M = 5.75$) calculated for the ST_T value dimension was very near to the scale anchor (6) – “very important”. Descriptive statistics of minimum score ($Min. = 2.18$) and standard deviation ($SD = .89$) also indicated similar conclusions about the priority of ST_T values for the PSTs. Mean scores calculated for the OC and SE value dimensions were lower than the mean score of the ST_T. In addition, minimum scores ($Min_{OC} = .60$, $Min_{SE} = -1.00$) implied that some of the PSTs regarded the values belonging to these factors (value dimensions) less than important as guiding principles in their lives. In fact, minimum score of -1.00 calculated for the variable SE shows that some of the PSTs considered SE value items in the value survey as “opposed to their values”(scale anchor (-1) – “opposed to my values”). Given the high priority attributed by the participants to the ST_T values, this finding seems reasonable. More specifically, as explained previously, according to Schwartz value theory values can be visualized on a hypothetical circular plane where their places on the plane are arranged based on the structure of the relationships with each other. In this circular plane self-transcendence versus self-enhancement and openness to change versus tradition (conformity) values constitute two bipolar dimensions. Hence, having high scores in one pole of the dimensions indicates low scores in the other one because motivational goals of values in the opposing poles are incompatible with each other.

5.1.1.3 Dimensions of Environmental Moral Reasoning

Analysis of environmental moral reasoning patterns of the PSTs were based on their responses to the four environmental moral dilemma scenarios developed on four outdoor recreation contexts (i.e., hiking, picnicking, fishing, and camping). Factor analyses of the data showed that PSTs’ responses to the environmental moral reasoning items grouped in different ways and resulted in different environmental moral reasoning dimensions (factors) across the scenarios. This finding was supportive of the contention that dilemma context is an influential factor for

individuals' moral reasoning (Kortenkamp & Moore, 2001; Rest, Narvaez, Bebeau, & Thoma, 1999; Rest, Narvaez, Thoma, & Bebeau, 2000; York & Becker, 2012). Dimensions of environmental moral reasoning observed for the four moral dilemma scenarios are illustrated in Figure 5.2. For ease of interpretation, clustering of the item statements is given in a single figure by using the environmental moral reasoning categories that they stand for. In the figure, different colors are used to indicate the two factors (environmental moral reasoning dimensions) obtained from the factor analyses, which were conducted separately for each scenario. For detailed information about the factors, including the items representing each environmental moral reasoning category, the reader is referred to Section 3.4.3.1.

Hiking scenario	Picnicking scenario	Fishing scenario	Camping scenario
ego.- personal interest anthro.- welfare	ego.- personal interest anthro.- welfare	ego.- personal interest anthro.- welfare	ego.- personal interest anthro.- welfare
ego.-aesthetic anthro.- aesthetic	ego.-aesthetic anthro.- aesthetic	ego.-aesthetic anthro.- aesthetic	ego.-aesthetic anthro.- aesthetic
ego.- justice anthro.-justice	ego.- justice anthro.-justice	ego.- justice anthro.-justice	ego.- justice anthro.-justice
eco.- justice eco.-harmony eco.- intrinsic	eco.- justice eco.-harmony eco.- intrinsic	eco.- justice eco.-harmony eco.- intrinsic	eco.- justice eco.-harmony eco.- intrinsic

Figure 5.2. Dimensions of environmental moral reasoning observed for the four environmental moral dilemma scenarios. ego. = egocentric, anthro. = anthropocentric, eco. = ecocentric

As seen in Figure 5.2, for the hiking and fishing scenarios, issues of aesthetic and justice seems to have brought egocentric and anthropocentric moral considerations together with the ecocentric ones into the same factor. For the fishing scenario, different from the hiking and picnicking scenarios, egocentric and anthropocentric

moral reasoning items that were based on aesthetical concerns departed from ecocentric moral considerations. Finally, for the camping scenario, PSTs' moral concerns about the nature itself (ecocentric moral reasoning) formed a separate environmental moral reasoning factor. Thus, for this scenario participants of the study regarded rights of nature (eco.-justice), its intrinsic value (eco.-intrinsic) and necessity of living in harmony with it (eco.-harmony) as independent from all of the self-centered (egocentric) and human-centered (anthropocentric) concerns. In their study, Stern and Dietz (1994) claimed that distinguishing between ecocentric and anthropocentric considerations might be an indication of individuals' environmental consciousness levels. Findings of the present study shows that distinguishing or not distinguishing between these two environmental moral reasoning patterns may also be related to situational variables (i.e., context of environmental issues that individuals reason about).

In addition to specific characteristics of each moral dilemma scenario, differences in environmental moral reasoning patterns of the PSTs observed across the scenarios may be attributed to their perceptions about naturalness of the environments described in the scenarios (Kortenkamp & Moore, 2001; Persing, 2006; Tuncay-Yuksel & Yilmaz-Tuzun, 2015). For instance, in the context of Turkey, camping is an outdoor recreation activity that is performed in more pristine environments such as forests. On the other hand, hiking and picnicking are outdoor recreation activities that can also take place in more "developed" environments, which can be described as environments that are more likely to have higher amounts of visitors and/or contain physical structures and facilities in them (Persing, 2006). In fact, research shows that many Turkish people generally associate hiking with walking, which is frequently done in urban parks as a way of losing weight and relaxing (Peters, Elands, & Buijs, 2010). Picnicking is a very traditional and cultural outdoor recreation activity which is often used to mean having a barbecue (Ozguner, 2011). Indeed, for Turkish people picnicking is more like a social activity that they come together and have food and drinks (te Kloeze, 2011). Therefore, participants of the present study might also have associated the dilemma contexts given for the hiking

and picnicking scenarios with more “developed” rather than pristine environments. This might, in turn, have caused their nature-centered considerations (i.e., ecocentric) to merge with the more human-centered (i.e., egocentric and anthropocentric) ones. In a similar vein, associating camping with more pristine environments and may have led them to separate ecocentric moral concerns from all other considerations, which resulted in the emergence of a purely nature-centered moral reasoning factor that had almost zero ($r = .01$) correlation between the other moral reasoning dimension obtained for this scenario.

5.1.2 Hypothesized Relationships and the Path Models

York and Becker (2012) define ethics as “the ability to define and realize *correct* or *good* action based upon some set of values or belief structure” (p. 2). Actually, this definition summarizes the foundational idea of the present study in which values and epistemological beliefs of the PSTs were used to explain their moral reasoning patterns about the environmental dilemmas presented in the context of four outdoor recreation contexts (i.e., hiking, picnicking, fishing, and camping). So as to test the significance of the hypothesized relationships of environmental moral reasoning to values and epistemological beliefs, series of path analyses were conducted for each individual environmental moral dilemma scenario. The choice of using environmental moral reasoning data separately for each scenario, rather than analyzing overall data at once, was based on research which shows that context of situations impact the structure of the relationships among variables (e.g., epistemology, ethics, aesthetics) that act in individuals’ reasoning about environmental issues (Garrison et al., 2015). Hence, with the help of the methodology utilized in the study the researcher was able to obtain more information about the dynamics of environmental moral reasoning and contribute to the explanation of its complex nature (Kronlid & Öhman, 2013).

Model fit (goodness-of-fit) indices calculated for the path analyses supported the validity of the specified path models where epistemological beliefs and values were proposed to explain the variances in PSTs' environmental moral reasoning patterns. Although validity of the path models did not change across the moral dilemma scenarios, detailed examination of the findings revealed some differences regarding the individual relationships included in the analyses.

5.1.2.1 Epistemological Beliefs and Environmental Moral Reasoning

Concerning the hypothesized relationships between epistemological beliefs and environmental moral reasoning, it was observed that PSTs' epistemological beliefs about the structure of knowledge (simple knowledge; SK) and certainty of knowledge (certain knowledge; CK) were not statistically significant correlates of their moral considerations about the environmental dilemmas presented in the scenarios. The only exception was for the correlation between CK and environmental moral reasoning dimension of 'nature' exhibited in response to the camping scenario (see Table 4.13). While relationships of quick learning (QL) with the dependent/endogenous variables were always statistically significant, statistical significance of the coefficients calculated for innate ability (IA) showed differences depending on the path equation they were calculated for. These findings imply that context of environmental moral dilemmas and focus of environmental moral considerations may be influential on the relationships between epistemological beliefs and environmental moral reasoning. The pattern of relationships between QL and environmental moral reasoning scores adds supporting evidence for this contention. More specifically, according to the findings of path analyses, the participants who had naïve beliefs in QL tended to be less concerned about nature-centered (ecocentric) aspects of the environmental dilemmas (except for the camping scenario). On the other hand, they showed a propensity to have higher levels of concerns about the more self-centered (egocentric) and human-centered

(anthropocentric) aspects of the environmental dilemma scenarios. This finding seems to be similar with that of Zeidler et al. (2013) in which ability of extending moral considerations from foreseeable and immediate concerns to more abstract and distant ones were interpreted as being related to sophistication of epistemological beliefs. That is to say, when item statements that the participants of the present study responded for each environmental moral dilemma scenario are examined, it will be noticed that egocentric (e.g., “If the picnic area is left dirty, I will not want to visit again; item p_a) and anthropocentric (e.g., “The field doesn’t have a trail through it and if people started hiking through the field they could fall and get hurt”; item y_c) moral reasoning item statements reflect more immediate, concrete, and foreseeable concerns when compared to the ecocentric ones (e.g., “The lake is a living thing with fish and plants and has a right to live and be healthy just like us; item g_c). Therefore, the PSTs who had naïve beliefs in QL epistemological belief dimension may have spent less time to fully comprehend the issues embedded in the environmental moral dilemma scenarios. This situation may in turn have caused them to be able to see just the egocentric and anthropocentric aspects of the environmental dilemmas rather than the ecocentric aspects, which were generally more abstract and likely to happen after a considerable amount of time (e.g., reactions of ecosystems to pollution and other kinds of environmental damages).

As have been stated previously, coefficients of QL which were calculated for its relationships with environmental moral reasoning dimensions revealed a different pattern for the camping scenario than the patterns observed for the other three scenarios. For this scenario, naïve beliefs in QL had negative correlations with both of the two environmental moral reasoning scores (i.e., humans, nature) obtained from the factor analyses of the related data. One possible explanation for this situation comes from the literature. Research shows that perceptions of damage severity are related to individuals’ environmental moral reasoning and awareness about and sensitivity to the potential harm of environmentally damaging actions (Dietz et al., 2005; Kortenkamp & Moore, 2009; Persing, 2006). In this regard, it may have been more difficult for the PSTs who had naïve beliefs in QL to realize

longer term outcomes of the action described in the camping scenario (i.e., washing dishes in a lake) not only on the environment/nature itself but also on themselves and other people. Therefore, these respondents may have underestimated the severity of the outcomes of the environmentally damaging action and could not realize any of the moral considerations that were implicit in the scenario.

Coefficients reflecting the relationships of omniscient authority (OA) with environmental moral reasoning were statistically significant for all of the path equations. Signs of these coefficients showed that correlations between beliefs in OA and amounts of moral considerations exhibited in response to the environmental dilemmas given in the scenarios were positive. In order to better interpret this finding and its implications, one needs to examine the items that were loaded on this epistemological belief dimension. As given in Table 3.3 in the Methods chapter, two items represented the respondents' beliefs on OA: "People should always obey the law" and "Parents should teach their children all there is to know about life". In this regard, it can be claimed that the PSTs who had higher scores on these items (i.e., exhibited naïve beliefs on OA) were more likely construe authority figures as sources of knowledge and important agents for social order. In a similar vein, they may have concluded that existence of authority was a necessary condition to prevent the possible consequences of environmentally damaging actions on themselves, other people, and the environment. Pye and Pye's (1985) study enlightens possible reasons of this situation. Based on their study which was conducted with individuals from different Asian countries, the researchers proposed that "For most Asians the acceptance of authority is not inherently bad but rather is an acceptable key to finding personal security" (p. x). Similarly, Pye and Pye stated that Asians attribute major responsibility to authority figures (e.g., leaders) for protecting the entire community. Accordingly, the participants of the present study who were more likely to perceive environmentally damaging actions as threats to security and more concerned about the potential harm of those actions may be more inclined to legitimate the authority for preventing those actions and/or solving their associated problems. Given that egocentric and anthropocentric considerations that were

reflected in the item statements were more likely to be perceived by the PSTs as more related to their personal security (when compared to ecocentric considerations), stronger correlations observed between beliefs in OA and environmental moral reasoning dimensions that were focused on more self-centered and human-centered considerations also provide supporting evidence for this notion.

5.1.2.2 Values and Environmental Moral Reasoning

With regard to the hypothesized relationships between environmental moral reasoning and values, it was observed that correlations between self-transcendence and tradition (ST_T) values and environmental moral reasoning scores were always statistically significant and positive regardless of the environmental moral dilemma scenario and focus of environmental moral reasoning. Moreover, magnitudes of the coefficients belonging to this value dimension were the largest when compared to the coefficients calculated for the other two value dimensions (i.e., openness to change, self-enhancement). A consistent pattern was observed concerning the relationships between importance attributed by the PSTs to the self-enhancement (SE) values and their environmental moral reasoning patterns. That is, without exception, environmental moral reasoning dimensions that included ecocentric moral reasoning items had negative relationships with SE values. On the other hand, there were positive relationships between SE values and moral considerations which were more focused on the self (egocentric) and other people (anthropocentric). Nonetheless, it should be cautiously stated that, with regard to the relationships of SE values and environmental moral reasoning patterns, even the statistically significant coefficients calculated through the path analyses had little practical significance due to small or less than small effect sizes. Coefficients calculated for openness to change (OC) values were mostly statistically insignificant. In fact, lack of correlation between OC values and moral reasoning about environmental issues is a common finding among research studies (e.g., Schultz et al., 2005, Stern & Dietz, 1994).

Other findings of the study were also consistent with what has been proposed and empirically found with regard to value – environmental moral reasoning relationships. For instance, as explained previously, in the present study self-transcendence and tradition (ST_T) value dimension had positive relationships with the PSTs' moral reasoning about the environmental scenarios regardless of their main focus of concerns (e.g., humans or nature). In the literature, there are many studies that found similar results. For example, confirmatory factor analyses conducted by de Groot and Steg (2007) supported their hypothesis which proposed self-transcendence (ST) values identified in Schwartz's (1992, 1994) value theory as a combination of altruistic (anthropocentric) and biospheric (ecocentric) value orientations. Moreover, in their study the researchers found that these two value orientations, thus ST values, were positively related to individuals' pro-environmental personal norms (i.e., feelings of moral obligation to act in pro-environmental ways). Likewise, ST values were found to be positively related to individuals' awareness about the consequences of environmental issues for the self, other people, and nonhuman species (Stern & Dietz, 1994) and their readiness to make sacrifices for the common good (Nordlund & Garvill, 2002), which imply positive relationships between ST values and environmental moral reasoning.

Findings of previous research that examined relationships between environmental moral reasoning and tradition (conservation/conservatism) values, which constituted the other component of ST_T value dimension found in the present study, does not provide a clear picture. Significance and direction of the relationships between this value category and environmental moral reasoning scores seem to be quite dependent on the sample they are tested for. For instance, in their study Stern and Dietz (1994) studied with a sample of American adults. Based on their findings, the researchers concluded that their participants who attributed high importance to values belonging to tradition value category were less likely to be egocentric or biocentric with regard to their beliefs about environmental ethics and environmental justice. On the other hand, the researchers did not find any significant relationships between tradition values and their participants' anthropocentric moral

considerations. Schultz et al. (2005) studied with samples from five different countries: Brazil, Czech Republic, Germany, India, New Zealand, and Russia. When the researchers measured main causes of their participants' concerns about environmental problems within a tripartite framework (i.e., egoistic, altruistic, biospheric) and examined their relationships to the importance attributed to tradition values, they could not find a consistent pattern. Some relationships were significant when tested for some countries but insignificant for the others. Moreover, direction of the relationships of tradition values with egoistic, altruistic, and biospheric considerations showed changes depending on the country of the participants. In fact, these differences are reasonable and even expected since 'tradition' is a very contextual construct that cannot be thought independent of cultures that individuals belong to. Merging of tradition (T) values with self-transcendence (ST) values into a single ST_T value dimension in the present study may also be attributed to this reason. Nevertheless, further research is necessary to support this contention and provide more robust explanations for the positive relationships obtained between ST_T value dimension and environmental moral reasoning of the PSTs that they exhibited in response to the environmental moral dilemmas.

As discussed previously, findings of this research revealed that the PSTs who attributed more importance to self-enhancement (SE) values were less likely to have nature-centered (ecocentric) moral considerations with regard to environmental issues; whereas they were inclined to be more concerned about environmental dilemmas' egocentric and anthropocentric moral aspects. In the literature, there seems to be an agreement about the directions of the relationships of SE values with ecocentric moral reasoning (negative) and egocentric moral reasoning (positive). Nevertheless, different conclusions are made about how SE values are related to individuals' moral considerations that are focused on other people (anthropocentric moral reasoning) (Schultz et al., 2005). These differences may stem from the unique characteristic of anthropocentrism which embodies both self-serving and social-altruistic considerations in it (Karpiak & Baril, 2008). That is to say, direction of the relationship between anthropocentric moral reasoning and SE values may be

influenced by the proportion of these two different concerns (i.e., self-serving, social-altruistic) in individuals' anthropocentric moral considerations. Accordingly, it will be more probable to observe positive relationships between anthropocentrism and SE scores for people who perceive anthropocentrism as a more self-serving construct. For others who perceive anthropocentrism as a reflection of more social-altruistic concerns, SE values will mostly probably have negative relationships with anthropocentrism.

5.1.2.3 Path Models

As tested through path analyses, when taken together epistemological beliefs and values successfully explained the variances in the PSTs' environmental moral reasoning patterns. All of the path models provided acceptable model fit indices for the environmental moral dilemma scenarios (i.e., hiking, picnicking, fishing, and camping) they were tested for. Proportions (amounts) of explained variances in the environmental moral reasoning patterns corresponded to small to medium effect sizes (R^2 range: .04 to .21). Comparison of the R^2 values revealed a similar pattern across the scenarios. Epistemological beliefs and values held by the participant PSTs jointly explained higher amounts of variance in their environmental moral considerations which were more focused on the nature-centered aspects of the moral dilemmas embedded in the scenarios. To put it more clearly, except for the camping scenario, R^2 values calculated for the environmental moral reasoning dimensions which included ecocentric moral reasoning items (i.e., utility of nature, ecojustice) indicated medium practical significance; whereas, R^2 values calculated for the environmental moral reasoning dimensions which did not include any ecocentric item but were comprised of egocentric and anthropocentric items (i.e., threats to human welfare, humans) indicated small practical significance. On the other hand, R^2 values of both of the environmental moral reasoning dimensions exhibited for the

camping scenario (i.e., $R^2_{\text{humans}} = .10$, $R^2_{\text{nature}} = .15$) corresponded to medium effect size (Cohen, 1988).

Based on this finding, it can be claimed that epistemological beliefs and values are more predictive of nature-centered moral considerations when compared to human-centered ones. One possible explanation to this situation may be relatively “consistent” feature of ecocentric moral considerations. That is to say, ecocentrism can be thought of as an ecological worldview that is conceptually similar to the construct New Environmental Paradigm (NEP), which is proposed as a measure of generalized beliefs about human-environment relationships (Dunlap et al., 2000; Schultz & Zelezny, 1999; Stern & Dietz, 1994; Stern et al., 1995a). Hence, it may be possible to explain higher amounts of variance in this worldview (i.e., ecocentrism) with a fewer number of other deeply rooted socio-psychological variables such as epistemological beliefs and values, as utilized in the present study. On the other hand, human-centered (including the self and other people) moral considerations are more heterogeneous and involve a mixture of various concerns (Nordlund & Garvill, 2002). Therefore, a more complex model with higher number of variables (e.g., demographic variables, situational factors) and/or interactions may be required to explain higher amounts of variance in human-centered environmental moral reasoning. For instance, owing to their socialization as caregivers and family nurturers, females are generally expected to have higher levels of moral considerations about the consequences of environmental problems on humans, especially when environmental problems are more local to them (Mohai, 1992). Therefore, including gender of individuals, locality of environmental issues, and their interaction effect may contribute to the explanatory power of a structural model that aims to reveal correlates of human-centered environmental moral reasoning.

5.2 Implications for Educational Policy and Practice

In Turkey, there is not a separate environmental education course given in elementary schools. Instead, environmental education is integrated into science education curriculum. To illustrate, science-technology-society-environment (STSE) relationships are listed among the dimensions of scientific literacy that is proposed in the country's elementary science education curriculum (Ministry of National Education [MoNE], 2005, 2013). In 2013 version of the curriculum, socioscientific issues (SSI) and their resolution are included among the STSE dimension of the proposed scientific literacy. Moreover, scientific and moral reasoning abilities are emphasized as the two requirements that should be developed for the resolution of STSE-related SSI (MoNE, 2013). In this context, with regard to its research questions and sample, the present study certainly has a unique importance for science and environmental education in Turkey. Nonetheless, mass of literature that includes many studies conducted in countries other than Turkey makes it evident that implications and contributions of the study are not limited to this country. For example, the constructs that were studied in this research (i.e., environmental moral reasoning, epistemological beliefs, and values) and the issues discussed while interpreting its findings (e.g., culture, context) show parallelism with the ones proposed in Zeidler and Keefer's (2003) functional scientific literacy framework. Accordingly, the present study has a place in the larger literature and conclusions drawn from its findings and their implications have significance for environmental and science education in general.

To begin with, findings obtained from the study showed once more that environmental moral reasoning is a complex construct that is related to both personal characteristics of the individuals and the issues that are under consideration. Epistemological beliefs and values were the personal characteristics that were explicitly examined and found to be correlated with environmental moral reasoning. Accordingly, as will be discussed in more detail in the following paragraphs, re-structuring educational programs that give more explicit place and

emphasis to epistemological beliefs and values have potential to develop environmental moral reasoning of their learners. In addition to epistemological beliefs and values, contexts of the issues were found to be related to individuals' ways of meaning making about the moral aspects embedded in them. More specifically, findings showed that moral dilemmas that took place in different outdoor recreation contexts (e.g., picnic area, lake, etc.) elicited different patterns of environmental moral reasoning by the participants of the study. Moreover, results of path analyses revealed some differences regarding the relationships of environmental moral reasoning patterns to epistemological beliefs and values when tested for different environmental moral dilemma scenarios. Accordingly, use of different dilemma cases may be a promising method to better investigate individuals' ways of reasoning and understand the factors that may interact with these reasoning patterns.

In a similar vein, educators are suggested to consider integrating analysis of dilemma scenarios or realistic (real-life) cases in educational programs and practices. In here, the term realistic is used to refer to cases that individuals are familiar with or likely to encounter in their daily lives. Research shows that use of these kinds of realistic examples move individuals' reasoning from theoretical modes of moral thinking (e.g., identifying theoretically based justice principles) to more challenging levels of moral deliberation (Keefer, 2003). In this regard, environmental moral dilemmas that were adapted and utilized in the present study or similar ones that are developed by considering specific characteristics (e.g., age, interests, etc.) of learner groups can be used. Use of local news related to environmental issues in the forms of newspaper articles or other media resources may provide very well contexts for these. Similarly, national environmental issues that the learners are familiar with and/or likely to obtain information about the various moral aspects may serve well for developing environmental moral reasoning levels.

As known for a long time, understanding a construct is a very important antecedent step for making modifications on it (Maloney & Ward, 1973). Therefore, in order to promote environmental moral reasoning of learners, educators should first carefully examine the processes that their students go through while trying to resolve moral issues related to the environment. As stated previously, findings of the present study supported the contention that epistemological beliefs and values are significant correlates of environmental moral reasoning patterns. In addition, results of the analyses showed that patterns of environmental moral reasoning and their relationships with epistemological beliefs and values had fluidity (i.e., showed changes depending on the environmental moral dilemma under consideration). Therefore, enriching curricula and educational practices with various authentic problems (e.g., case-based examples of environmental moral dilemmas,) will not only serve for understanding and developing environmental moral reasoning of learners. This educational approach will also help educators to learn more about and foster epistemological beliefs and values of their students since these constructs (i.e., epistemological beliefs and values) reveal themselves in many ways such as reflections of approaches to and interpretations about information that are explicitly given or implicitly implied in the dilemmas that they need to resolve (Hofer, 2002; Stern et al., 1995b).

Findings of the present study also make it possible to make some specific recommendations for improving education given in education faculties and elementary schools. For instance, as revealed by the descriptive analyses, the PSTs who participated in the study were found to have relatively naïve beliefs about source of knowledge, which indicates a predisposition to believe in the legitimacy of omniscient authority. Based on this finding, it can be argued that these teacher candidates may be more likely to perceive teachers as experts and teaching as a process of knowledge transmission from teachers to students. Considering the role of epistemological beliefs in one's pedagogical conceptions and practices (Cheng, Chan, Tang, & Cheng, 2009; Kang & Wallace, 2005), teacher educators in Turkey can be advised to place more importance to the development of this epistemological

belief through methods courses given in education faculties. Demonstration of successful application of student-centered teaching techniques in the method courses may be a good starting point for this. Then, teacher candidates can be given opportunities to practice these student-centered teaching techniques in their micro teaching applications in the faculties and student-teaching practices in schools. At this point, it is very important that the teacher candidate should take continuous support and feedback from the teacher educators. Similarly, self-reflection and peer reflection about how they can improve their epistemological beliefs and how their epistemological beliefs are reflected in their teaching are very important for achieving the desired changes.

In a similar vein, educators can benefit from a number of pedagogical principles and instructional techniques such as reflection (self-reflection or reflection by peers and/or the teacher), collaborative learning, and discussion to increase the efficiency of case-based approaches in science and environmental education (Keefer, 2003). That is to say, we should provide learners with multiple opportunities that they can freely share and discuss their viewpoints about environmental issues from various aspects in non-threatening learning environments. In addition to increasing learners' awareness about their own epistemological beliefs, values, and moral positions about environmental issues, these learning environments will help them to see, think about, and reflect on other viewpoints which may be different from and even contrary to theirs. In fact, findings of previous research imply that these learning environments are invaluable opportunities for students to develop their environmental moral reasoning. For instance, as revealed in a study of Zeidler and Schafer (1984), during discussions made on environmental dilemmas, students with higher levels of moral reasoning generally lead to positive changes in reasoning patterns of their peers who exhibit lower levels of moral reasoning. Therefore, discussions (peer, group, and/or classroom discussions) are promising instructional strategies that can be utilized for fostering desired changes in our students. Similarly, teachers may integrate argumentation, discourse, and other similar techniques in their teaching to reach their educational aims (Zeidler, 2003). At this

point, the critical role of teacher education programs becomes evident since it will be unrealistic to expect a teacher to successfully implement these pedagogical approaches in their teaching if they do not have the necessary competencies. For instance, we should first ensure that our teachers have learned how to frame their positions, built cases for their arguments, and show respect to opposing viewpoints, which are likely to be influenced by the culture they belong to (Zeidler & Keefer, 2003). Similarly, in teacher education programs we should show and teach our teachers/teacher candidates how to promote critical and creative reflection on epistemological beliefs, values, moral positions, and so on without indoctrinating the “desired” ones (Garrison et al., 2015).

One of the ways that should be followed for succeeding in these aims is restructuring courses given in education faculties both in content and context. For instance, research shows that “most people lack the vocabulary to articulate their ethical views except in terms of how they feel” (Poole et al., 2013, p.350), which implies the necessity of integrating ethics literacy in our educational programs. This point is especially important for environmental conservation and protection because many of the environmental decisions that are made collectively (e.g., environmental management decisions) are multidimensional in nature and should be handled from various aspects such as ecology, sociology, and culture. Therefore, cultivation of ethics literacy through courses will help students to gain the necessary vocabulary to articulate their ethical positions about environmental issues as well as associated values underlying the reasons of their decisions. In a similar vein, we should give explicit place to epistemological beliefs and values in our educational programs because ethics (including ethics embedded in science) and ethics literacy cannot be thought independent of epistemological and non-epistemological values (e.g., social values) (Poole et al., 2013).

This again brings us to the importance of experience that we should provide to learners - in our context, teacher candidates. For instance, from a virtue ethics perspective, cultivation of ethical virtues (excellent character traits or moral

excellence) requires ongoing internal reflection and external feedback, which can be achieved by continuously interacting with other individuals within communities (York & Becker, 2012). Accordingly, in addition to enriching teacher education programs with the pedagogical practices described in the previous paragraphs (e.g., case-based approaches, discussions, etc.), universities should also provide their students with multiple out-of-course opportunities to practice continuous interaction within diverse communities. Community service courses that are given in education faculties of Turkey may be good examples to those opportunities. In these courses teacher candidates conduct voluntary work in one of the non-governmental organization they like (Senler, 2011). These courses have potential to contribute a lot to the development of teacher candidates in many aspects including the variables that were studied in the present study. For example, in this study it was found that ST_T values had the largest positive correlations with higher levels of moral considerations about the environment. Thus, based on the values that loaded on this value dimension (e.g., helpful, honoring parents and elders, protecting the environment) it can be claimed that participating in community services will contribute to the cultivation of ST_T values and environmental moral reasoning of teacher candidates because activities performed in community services may provide excellent opportunities to interact with people with diverse characteristics such as the disabled, elderly people who cannot care for themselves, and environmental activists.

Nonetheless, in order to have a more vigorous view of environmental ethics, we should extend the concept of “community” so that it includes not only human beings but also nonhumans and the ecosystems as a whole (York & Becker, 2012). Therefore, necessity of practicing continuous interaction within the communities so as to contribute to the development of learners from many aspects (e.g., epistemological beliefs, values) and cultivate higher levels of environmental moral reasoning in learners implies the importance of direct experience with nature as well. This can be achieved by enriching already existing environment-related courses given in education faculties with environmental outdoor activities (e.g., field trips to

natural areas) or integrating some forms of outdoor education courses in the educational programs as have been applied throughout the history of environmental education. Alternatively, faculties and universities may provide in-campus or off-campus outdoor recreation activity opportunities to university students and encourage them to attend to these outdoor recreation activities where they can experience direct interaction with nature.

5.3 Recommendations for Further Research

As in any study, the present study has some limitations which can be addressed in further research. Sample selection method utilized in the study is an example of this type of limitation. In this study, selection of the participants was based on convenience sampling technique. Therefore, generalizability of the findings to the population of interest is limited. In this regard, further research studies which are carried out with samples selected via random sampling techniques will lead to more generalizable conclusions about environmental moral reasoning, epistemological beliefs, and values held by Turkish PSTs and the relationships hypothesized between these variables. These studies will also make it possible to test the adapted data collection instruments for additional reliability and validity evidences. Although exploratory and confirmatory factor analyses were applied on the pilot and main data of the current study, and statistics related to the reliability and validity of the obtained instruments were in the acceptable ranges, further studies conducted with new data sets are required to confirm the psychometric properties of the instruments. Replication of this study with diverse samples will serve well for this purpose and provide empirical evidence with regard to the replicability and generalizability of the findings obtained from the present study. In addition, studies that are performed with individuals who have different characteristics than the participants of the present study such as individuals from different age groups (e.g., elementary level students, children, adults, etc.), socioeconomic status, education level, culture, and so on would also be very beneficial to add to the further testing of the data collection

instruments. Maybe more important than that, these kinds of studies are highly desired to gain more understanding about the constructs that were studied in this study and the relationships hypothesized among them. For instance, Stern and Dietz (1994) claimed that distinguishing between ecocentric and anthropocentric moral considerations may be considered as an indication of environmental consciousness, which is not well developed in general public but can be observed among certain groups of individuals such as environmental activists. In future research, researchers can test this contention by studying with individuals belonging to such different groups and comparing their environmental moral reasoning patterns with each other.

Testing relationships are very valuable in research and this study provided important insights about the relationships of environmental moral reasoning to epistemological beliefs and values. Moreover, with the help of the performed path analyses it was possible to assess relative contribution of each of the epistemological belief and value dimension (obtained via factor analyses) to the prediction of variances in environmental moral reasoning patterns. In addition, indices obtained from the path analyses provided empirical evidence for the goodness of fit of the proposed models to the study data. Nevertheless, percentages of the variances explained in environmental moral reasoning patterns could not reach large effect sizes (maximum R^2 value was .21) suggesting the presence of other variables and/or relationships. Therefore, researchers may consider including additional variables (including mediator and moderator variables) to improve the path models and increase the amount of variance explained in environmental moral reasoning of individuals. For instance, research shows that for some individuals non-environmental issues (e.g., social rules, laws, etc.) may be more important than environmental considerations while reasoning about the morality of environmental dilemmas (cf. Kortenkamp & Moore, 2001; Tuncay & Yilmaz-Tuzun, 2010). Accordingly, researchers may consider investigating whether differences in approaches to and reasoning about the morality of environmental issues can be explained by differences in environmental concern levels about the issues under consideration.

At this point, it should be reminded that owing to the nature of correlational design, findings of the present study do not imply any causality. In order to make claims about whether changes in epistemological beliefs and/or values affect individuals' environmental moral reasoning, researchers are encouraged to make use of appropriate research methodologies (e.g., experimental research). Another recommendation for further research is to enrich type of data collected by applying different data collection methods. That is to say, the present study relied on quantitative data obtained from the participants' answers to close ended scale items (i.e., Likert type scales). This situation restricted the range of responses that could be elicited from the participants. This limitation can be overcome by utilizing data collection tools and methods which allow respondents to express themselves more freely in terms of the variables under study. For instance, instead of providing moral reasoning item statements to the respondents after each environmental moral dilemma scenario and asking them to indicate the importance of each item statement on a Likert type scale, respondents may be requested to write all of the moral issues that are important for them about the scenarios and state the reasons of their importance.

Furthermore, integration of qualitative research methods such as interviews and observations are suggested for further research so as to extend the range of questions that can be answered. For instance, in the present study the researcher explored factor structures of epistemological beliefs, values, and environmental moral reasoning of the PSTs. Moreover, data analyses gave information about the descriptive characteristics of the participants in terms of the study variables. However, it was not possible to answer "why" questions related to these findings. Similarly, findings of the study provided answers about the direction and magnitude of the hypothesized relationships but the obtained data was not capable of providing detailed information about the mechanisms underlying them or, in other words, "how", "why" or "in what ways" type of questions. Illuminating these unanswered questions and similar others would be very beneficial for the literature. In this regard, colleagues may consider utilizing mixed-method designs (e.g., triangulation

design, explanatory design, and exploratory design) in their studies where they can benefit from the advantages of both quantitative and qualitative data (Fraenkel et al., 2012).

Some other research methods may also be suggested to obtain more detailed information about the study variables. For instance, think-aloud protocols may be promising tools, which rely less on self-reported data. To utilize this method, participants may be given some texts (e.g., newspaper articles) that include real life environmental moral dilemmas and then they may be asked to resolve the dilemmas while thinking loudly. During or after the resolution processes, researchers may also ask some probing and prompting questions to the respondents to bring out more in-depth information with regard to their environmental moral reasoning patterns as well as epistemological beliefs and values. The way how respondents approach to and interpret the information presented in the texts and how they justify their moral resolutions may give important clues about their epistemological beliefs and values, and of course, their environmental moral reasoning patterns. In a similar way, group interviews have potential to provide detailed explanations about the variables of the study, which was not possible to be addressed in the present study.

When related literature is examined it will be noticed that number of research conducted with pre-service or in-service teachers are scarce. Participants are generally selected among undergraduate psychology students; maybe because most of the proposed theories about environmental perceptions, attitudes or behaviors are drawn from sub-disciplines of psychology (Vining & Ebreo, 2002). Nevertheless, in order to reach more effective conclusions about the implications of study findings with regard to educational research and practice, more place should be given to research that study with the main actors of education: teachers and students. Data obtained from classroom observations (e.g., during discussions conducted on moral aspects of environmental issues in general or during the resolution of specific environmental moral dilemmas similar to the ones utilized in the present study) may be very valuable in this respect. These kinds of data will not only reveal basic

characteristics of the students and/or teachers with respect to the studied variables but also provide important information about interrelationships of the variables and their development. These research studies may also help researchers to determine the qualifications that teachers should have for promoting cognitive and affective development of their students and reveal important implications for teacher education programs.

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APPENDICES

APPENDIX A

DATA COLLECTION INSTRUMENTS

EPİSTEMOLOJİK İNANÇLAR ENVANTERİ		Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum
Lütfen aşağıda verilen her bir ifadeye katılım durumunuzu gösteren seçeneklerden <u>birini</u> işaretleyiniz.						
1.	Doğru, farklı kişiler için farklı şeyler ifade eder.					
2.	Hızlı öğrenen öğrenciler, en başarılı olanlardır.					
3.	İnsanlar her zaman yasalara uymalıdır.					
4.	Bazı insanlar ne kadar çok çalışırlarsa çalışsınlar asla zeki olamazlar.					
5.	Kesin ahlaki doğrular yoktur.					
6.	Ebeveynler çocuklarına, hayata dair bilinmesi gereken her şeyi öğretmelidirler.					
7.	Gerçekten zeki olan öğrencilerin okulda başarılı olmaları için diğerleri kadar çok çalışmalarına gerek yoktur.					
8.	Bir kişi bir problemi anlamak için çok fazla uğraşırsa, büyük bir olasılıkla, sonunda kafası karışacaktır.					
9.	Çok fazla kuram/teori işleri yalnızca karmaşık hale getirir.					
10.	En iyi fikirler, genellikle en basit olanlardır.					
11.	İnsanlar ne kadar zeki oldukları konusunda çok fazla bir şey yapamazlar.					
12.	Öğretmenler kuramlar/teoriler yerine gerçeklere odaklanmalıdır.					
13.	Ben öğretmenlerin farklı kuramları aynı anda verip en iyi olanına öğrencilerinin karar vermesine olanak sağlayanını severim.					
14.	Okulda ne kadar başarılı olduğunuz ne kadar zeki olduğunuza bağlıdır.					
15.	Eğer bir şeyi çabucak öğrenemiyorsanız, hiçbir zaman öğrenemezsiniz.					

16.	Bazı insanlar doğuştan öğrenme becerisine sahip iken bazıları değildir.					
17.	Olgular çoğu üniversite hocasının sizi inandırdığından daha basittir.					
18.	İki kişi bir şey üzerinde tartışıyorsa, en az birisi hatalıdır.					
19.	Bir metni ilk okumada anlamadıysanız, başa dönüp tekrar okumanın bir yararı olmayacaktır.					
20.	Benim için geçerli olan ahlak kuralları herkes için geçerlidir.					
21.	Bugün için doğru olan yarın için de doğru olacaktır.					
22.	Zeki insanlar doğuştan zekidir.					
23.	Otorite konumundaki bir kişi bana ne yapacağımı söylediği zaman genellikle onu yaparım.					
24.	İnsanlar otoriteyi <u>sorgulamamalıdır</u> .					
25.	Çabuk çözümü olmayan bir problemle uğraşmak zaman kaybıdır.					
26.	Bazı insanlar özel yetenek ve becerilerle doğarlar.					

DEĞERLER ENVANTERİ

Lütfen aşağıda listelenmiş olan her bir değerın hayatınızı yönlendiren bir ilke olarak sizin için önemini değerlerin yanlarında verilmiş olan sayılardan **bir tanesini** daire içine alarak işaretleyiniz (Örn: ②) . İşaretlemiş olduğunuz sayı yükseldikçe(-1,0,1,2,3,4,5,6,7) o değerın sizin için, hayatınızdaki yönlendiriciliği bakımından, daha önemli olduğu anlaşılacaktır.

Lütfen bütün sayıları kullanarak değerlerin hayatınızdaki yönlendiricilikleri arasında mümkün olduğunca bir ayırım yapmaya çalışınız.

Değerler Listesi	Hayatımı yönlendiren bir ilke olarak bu değer:									
	İlkelerime ters düşer	Önemli değildir			Önemlidir			Çok önemlidir	En üst düzeyde önemlidir	
	-1	0	1	2	3	4	5	6	7	
1	Sosyal güç sahibi olmak	-1	0	1	2	3	4	5	6	7
2	Zevk	-1	0	1	2	3	4	5	6	7
3	Özgür olmak	-1	0	1	2	3	4	5	6	7
4	Toplumsal düzenin sürmesini istemek	-1	0	1	2	3	4	5	6	7
5	Heyecanlı bir yaşantı sahibi olmak	-1	0	1	2	3	4	5	6	7
6	Kibar olmak	-1	0	1	2	3	4	5	6	7
7	Zengin olmak	-1	0	1	2	3	4	5	6	7
8	Ulusal güvenlik	-1	0	1	2	3	4	5	6	7
9	Yaratıcı olmak	-1	0	1	2	3	4	5	6	7
10	Geleneklere saygılı olmak	-1	0	1	2	3	4	5	6	7
11	Kendini denetleyebilmek	-1	0	1	2	3	4	5	6	7
12	Aile güvenliği	-1	0	1	2	3	4	5	6	7
13	Doğayla bütünlük içinde olmak	-1	0	1	2	3	4	5	6	7
14	Değişken bir hayat yaşamak	-1	0	1	2	3	4	5	6	7

	Değerler Listesi	Hayatımı yönlendiren bir ilke olarak bu değer:								
		İlkelerime ters düşer	Önemli değildir			Önemlidir			Çok önemlidir	En üst düzeyde önemlidir
		-1	0	1	2	3	4	5	6	7
15	Otorite sahibi olmak	-1	0	1	2	3	4	5	6	7
16	Güzelliklerle dolu bir	-1	0	1	2	3	4	5	6	7
17	İlimli olmak	-1	0	1	2	3	4	5	6	7
18	Sadık olmak	-1	0	1	2	3	4	5	6	7
19	Hırslı olmak	-1	0	1	2	3	4	5	6	7
20	Açık fikirli olmak	-1	0	1	2	3	4	5	6	7
21	Alçak gönüllü olmak	-1	0	1	2	3	4	5	6	7
22	Cesur olmak	-1	0	1	2	3	4	5	6	7
23	Çevreyi korumak	-1	0	1	2	3	4	5	6	7
24	Sözünü geçen biri olmak	-1	0	1	2	3	4	5	6	7
25	Anne-babaya ve yaşlılara değer vermek	-1	0	1	2	3	4	5	6	7
26	Kendi amaçlarını seçebilmek	-1	0	1	2	3	4	5	6	7
27	Yetkin olmak	-1	0	1	2	3	4	5	6	7
28	Dürüst olmak	-1	0	1	2	3	4	5	6	7
29	Toplumdaki görüntümü koruyabilmek	-1	0	1	2	3	4	5	6	7
30	İtaatkâr olmak	-1	0	1	2	3	4	5	6	7
31	Yardımsöver olmak	-1	0	1	2	3	4	5	6	7
32	Hayattan tat almak	-1	0	1	2	3	4	5	6	7
33	Dindar olmak	-1	0	1	2	3	4	5	6	7
34	Merak duyabilmek	-1	0	1	2	3	4	5	6	7
35	Bağışlayıcı olmak	-1	0	1	2	3	4	5	6	7
36	Başarılı olmak	-1	0	1	2	3	4	5	6	7
37	Temiz olmak	-1	0	1	2	3	4	5	6	7

ÇEVRESEL DURUM HİKÂYELERİ

Yürüyüş

Düşünün ki bir patika boyunca yürüyüş yapıyorsunuz. Patikanın bulunduğu yer koruma altına alınmış bir milli park; yani devlete ait ve halkın kullanımına açık bir tabiat alanı. Yürürken karşınıza yabancı çiçeklerle ve uzun otlarla dolu bir çayır çıkıyor. Çayıra baktığınızda, birilerinin patikadan ayrılıp çayırın içinden yürümüş olduğunu fark ediyorsunuz. Çayırda bazı yabancı çiçekler ve otlar çiğnenmiş ve ezilmiş. Parkın içinde "Patikadan ayrılmayınız" yazan uyarı levhaları var. Ancak, yabancı çiçeklerin olduğu bu çayıra girmek eğlenceli olmuştur gibi görünüyor.

1. Bu durumda, patikadan ayrılarak çayırın içinden yürümenin doğru olacağına ne kadar katılıyorsunuz?

Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

2. Bazıları, çayırın içinden yürümenin sorun olmayacağını; çünkü çiçeklerin ve otların nasıl olsa tekrar büyüyeceğini söylüyor. Bu fikre ne kadar katılıyorsunuz?

Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

3. Gerçekten böyle bir durumun içinde olsaydınız ne yapardınız?

- Yabancı çiçeklerin olduğu çayırın içinden yürüdüm.
 Yabancı çiçeklerin olduğu çayırın içinden yürümezdim.

4. (Lütfen bu soruyu 3. soruya vermiş olduğunuz cevaptan bağımsız olarak düşünüp, boş bırakmadan yanıtlayınız.) Diyelim ki yabancı çiçeklerin olduğu çayırın içinden **yürümemeyi** düşünüyorsunuz. Aşağıdaki ifadeleri okuyunuz ve çayırın içinden yürümeme kararınızda her bir sebebin sizin için ne kadar önemli olduğunu gösteren kutucuğu işaretleyiniz.

		Hiç önemli değil	Önemsiz	Biraz önemli	Önemli	Oldukça önemli
	Yabancı çiçeklerin olduğu çayırın içinden yürümezdim; çünkü:					
a.	Yabancı çiçekler ve otlar zarar görürse yetkililer patikayı yürüyüşçülere kapatabilir ve ben oraya bir daha gidemem.					
b.	Doğanın bazı kısımları bozulmamalı ve olduğu gibi kalmalıdır.					
c.	Çayırda patika olmadığı için, insanlar orada yürüyüş yapmaya başlarsa düşüp yaralanabilirler.					
d.	Çayırda bulunan bütün bitki ve hayvanlar tıpkı bizim gibi birer canlı varlık ve çayırın içinden yürümek onlara zarar verebilir.					
e.	Çiçeklerin sayısı azalır onları görmekten eskisi kadar keyif almazsam...					
f.	Doğa ile denge içinde yaşamak ve ihtiyacımız dışında zarar vermemek önemlidir.					
g.	Başkalarının da görmekten keyif alabilmesi için çayırı güzel bir şekilde bırakmak isterim.					
h.	O yürüyüş yolu herkese ait ve onu bozmaya kimsenin hakkı yok.					
i.	Bulunmaktan keyif aldığım yerlere karşı sorumlu bir şekilde davranmalıyım ki keyif almaya devam edebileyim.					

5. Yukarıdaki sebeplerden en çok **hangisine** katılıyorsunuz? (Lütfen tek bir seçeneği işaretleyiniz): (a, b, c, d, e, f, g, h, i) _____

6. Yukarıdaki sebeplerden en çok katıldığınıza dayanarak **çayıra girmeyip patikada kalma** olasılığınız ne olurdu? Kesinlikle kalmazdım Kalmazdım Belki kalırdım Kalırdım Kesinlikle kalırdım

Piknik

Düşünün ki bir milli parkta ailenizle piknik yapıyorsunuz. Piknik bittiğinde bütün çöp tenekelerinin dolu olduğunu ve çöplerinizin bu çöp tenekelerine sığmayacağını fark ediyorsunuz. Pikniğe gelirken yanınıza hiç çöp poşeti almadınız ve başka birinin temizlemesi için çöplerinizi orada bırakmak en kolay çözüm olacak. Piknik alanında ne yaptığınızı görebilecek kimse yok.

1. Bu durumda, çöpleri piknik alanında bırakmanın doğru olacağına ne kadar katılıyorsunuz?

Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

2. Bazıları, çöpleri piknik alanında bırakmanın sorun olmayacağını; çünkü milli parkta çöpleri temizleyecek çalışanların olduğunu söylüyor. Bu fikre ne kadar katılıyorsunuz?

Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

3. Gerçekten böyle bir durumun içinde olsaydınız ne yapardınız?

Çöpleri piknik alanında bıraktırdım.

Çöpleri piknik alanında bırakmazdım.

4. (Lütfen bu soruyu 3. soruya vermiş olduğunuz cevaptan bağımsız olarak düşünüp, boş bırakmadan yanıtlayınız.)Diyelim ki çöpleri piknik alanında **bırakmamayı** düşünüyorsunuz. Aşağıdaki ifadeleri okuyunuz ve çöpleri piknik alanında bırakmama kararınızda her bir sebebin sizin için ne kadar önemli olduğunu gösteren kutucuğu işaretleyiniz.

		Hiç önemli değil	Önemsiz	Biraz önemli	Önemli	Oldukça önemli
	Çöpleri piknik alanında bırakmazdım; çünkü:					
a.	Eğer piknik alanı kirli kalırsa oraya tekrar gitmek istemem.					
b.	Piknik alanında bulunan bitki ve hayvanlar tıpkı bizim gibi birer canlı ve onların da tıpkı bizim gibi temiz bir ortamda yaşamaya hakları var.					
c.	Hiç kimsenin piknik alanını kirletmeye hakkı yok; orası herkesin keyif alması için var.					
d.	Piknik alanı doğanın bir parçası ve işte tam da bu nedenle korunmalı.					

e.	Bir sonraki gidişime kadar piknik alanının temiz kalmasını isterim.					
f.	Hiç kimse pikniğe gittiğinde etrafta çöp görmek istemez.					
g.	Doğa ile denge içinde yaşamak ve zorunlu olmadıkça ona zarar vermemek önemlidir.					
h.	Piknik alanı kirlenirse temizlenmesi için piknik alanını kullananlar para ödemek durumunda kalacaklardır.					
i.	Bulunmaktan keyif aldığım yerlere karşı sorumlu bir şekilde davranmalıyım ki keyif almaya devam edebileyim.					

5. Yukarıdaki sebeplerden en çok **hangisine** katılıyorsunuz? (Lütfen tek bir seçeneği işaretleyiniz): (a, b, c, d, e, f, g, h, i) _____

6. Yukarıdaki sebeplerden en çok katıldığınıza dayanarak çöplerinizi **piknik alanında bırakmayıp eve götürme** olasılığınız ne olurdu?

- Kesinlikle götürmezdim Götürmezdim Belki götürürdüm Götürürdüm
 Kesinlikle götürürdüm

Balık tutmak

Düşünün ki bir nehirde balık tutuyorsunuz. Nehir koruma altına alınmış ve halkın kullanımına açık bir devlet arazi üzerinde bulunuyor. Nehirde sadece "yakala-bırak" balıkçılığı yapılıyor, yani yakaladığınız hiçbir balığı götürüyorsunuz – zarar vermeden tekrar nehire bırakmanız gerekiyor. Ancak, az önce hayatınızın en büyük balığını yakaladınız ve onu bütün arkadaşlarınıza göstermek için eve götürmeyi çok istiyorsunuz.

1. Bu durumda, balığı nehire bırakmayıp eve götürmenin doğru olacağına ne kadar katılıyorsunuz?

- Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

2. Bazıları, nehirde daha birçok balık olduğunu, sadece tek bir balığı nehire bırakmayıp götürmenin sorun olmayacağını söylüyor. Bu fikre ne kadar katılıyorsunuz?

- Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

3. Gerçekten böyle bir durumun içinde olsaydınız ne yapardınız?

- Balığı nehire bırakmaz, eve götürürdüm.
 Balığı nehire bırakırdım.

4. (Lütfen bu soruyu 3. soruya vermiş olduğunuz cevaptan bağımsız olarak düşünüp, boş bırakmadan yanıtlayınız.) Diyelim ki balığı **eve götürmemeyi** düşünüyorsunuz. Aşağıdaki ifadeleri okuyunuz ve balığı eve götürmeme kararınızda her bir sebebin sizin için ne kadar önemli olduğunu gösteren kutucuğu işaretleyiniz.

		Hiç önemli değil	Önemsiz	Biraz önemli	Önemli	Oldukça önemli
	Balığı eve götürmezdim; çünkü:					
a.	İhtiyacımız olmayan balıkları nehirden almayarak doğa ile uyum içinde yaşayabiliriz.					
b.	Hiç kimsenin kuralları çiğnemeye hakkı yok; çünkü nehir herkes için var.					
c.	Nehirde çok sayıda büyük balık görmek isterim.					
d.	Balıklar nehire aittir ve nehir onların yuvasıdır.					
e.	İnsanlar balıklarla dolu bir nehir görmek isterler.					
f.	Balıklar, tıpkı bizim gibi, yaşama hakkına sahip canlı varlıklardır.					
g.	Nehire balık tutmaya gelen diğer insanlar da büyük balık yakalayabilmek isteyeceklerdir.					
h.	Eğer nehirdeki balıklar biterse, bir daha orada balık tutamam.					
i.	Bulunmaktan keyif aldığım yerlere karşı sorumlu bir şekilde davranmalıyım ki keyif almaya devam edebileyim.					

5. Yukarıdaki sebeplerden en çok **hangisine** katılıyorsunuz? (Lütfen tek bir seçeneği işaretleyiniz): (a, b, c, d, e, f, g, h, i) _____

6. Yukarıdaki sebeplerden en çok katıldığınıza dayanarak yakaladığınız balığı **tekrar nehire bırakma** olasılığınız ne olurdu?

Kesinlikle bırakmazdım Bırakmazdım Belki bırakırdım Bırakırdım Kesinlikle bırakırdım

Gölet
Düşünün ki arkadaşlarınızla birlikte bir milli parktaki gölet kıyısına kamp kurmaya ve yüzmeye gittiniz. Sıcak bir gün ve göletin kıyısında oturup yemeğinizi yediniz. Yemekten sonra bulaşıkları yıkamak istiyorsunuz ve gölet size çeşmelerin bulunduğu alandan daha yakın bir su kaynağı. Ancak, bulaşıkları yıkamak için kullanacağınız deterjanın gölete ve içinde yaşayan, yüzen tüm canlılara zararlı olabilecek kimyasallar içerdiği aklınıza geliyor.

1. Bu durumda, bulaşıkları gölette yıkamanın doğru olacağına ne kadar katılıyorsunuz?

Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

2. Bazıları bulaşıkları gölette yıkamanın gölette çok az bir kirlilik yaratacağı için sorun olmayacağını ve bunun bir mesele haline getirilmemesi gerektiğini söylüyor. Bu fikre ne kadar katılıyorsunuz?

Kesinlikle katılıyorum Katılıyorum Katılmıyorum Kesinlikle katılmıyorum

3. Gerçekten böyle bir durumun içinde olsaydınız ne yapardınız?

- Bulaşıkları gölette yıkardım
 Bulaşıkları gölette yıkamazdım

4. (Lütfen bu soruyu 3. soruya vermiş olduğunuz cevaptan bağımsız olarak düşünüp, boş bırakmadan yanıtlayınız.) Diyelim ki bulaşıkları gölette **yıkamamayı** düşünüyorsunuz. Aşağıdaki ifadeleri okuyunuz ve bulaşıkları gölette yıkamama kararınızda her bir sebebin sizin için ne kadar önemli olduğunu gösteren kutucuğu işaretleyiniz.

		Hiç önemli değil	Önemsiz	Biraz önemli	Önemli	Oldukça önemli
	Bulaşıkları gölette yıkamazdım; çünkü:					
a.	Gölet ve balıklar kendi başlarına bir değere sahiptir ve saygıyı hak ederler.					
b.	Eğer suyu kirletirsek bu durum orada yüzen insanların hastalanmasına sebep olabilir.					
c.	Gölet, içindeki balık ve bitkilerle yaşayan bir varlıktır ve tıpkı bizim gibi yaşamaya ve sağlıklı olmaya hakkı vardır.					
d.	İnsanlar yüzmeye gittiklerinde temiz bir su görmek isterler, kirli ve gri bir su değil.					
e.	Bizler doğanın bir parçasıyız ve bu nedenle doğa ile denge içinde yaşamayı öğrenmeliyiz.					
f.	Temiz bir suda yüzmek isterim.					
g.	Eğer gölet kirlenirse artık orada yüzemem.					
h.	Gölet herkesin keyif alması için var ve onu herkes için temiz tutmalıyız.					
i.	Bulunmaktan keyif aldığım yerlere karşı sorumlu bir şekilde davranmalıyım ki keyif almaya devam edebileyim.					

5. Yukarıdaki sebeplerden en çok **hangisine** katılıyorsunuz? (Lütfen tek bir seçeneği işaretleyiniz): (a, b, c, d, e, f, g, h, i) _____

6. Yukarıdaki sebeplerden en çok katıldığınıza dayanarak bulaşıkları **göletten başka bir yerde yıkama** olasılığınız ne olurdu?

- Kesinlikle başka bir yerde yıkamazdım Başka bir yerde yıkamazdım
 Belki başka bir yerde yıkardım Başka bir yerde yıkardım
 Kesinlikle başka bir yerde yıkardım

APPENDIX B

CFA MODEL OF THE EPISTEMIC BELIEFS INVENTORY (EBI) – AMOS OUTPUTS FOR SUBSAMPLE A AND SUBSAMPLE B

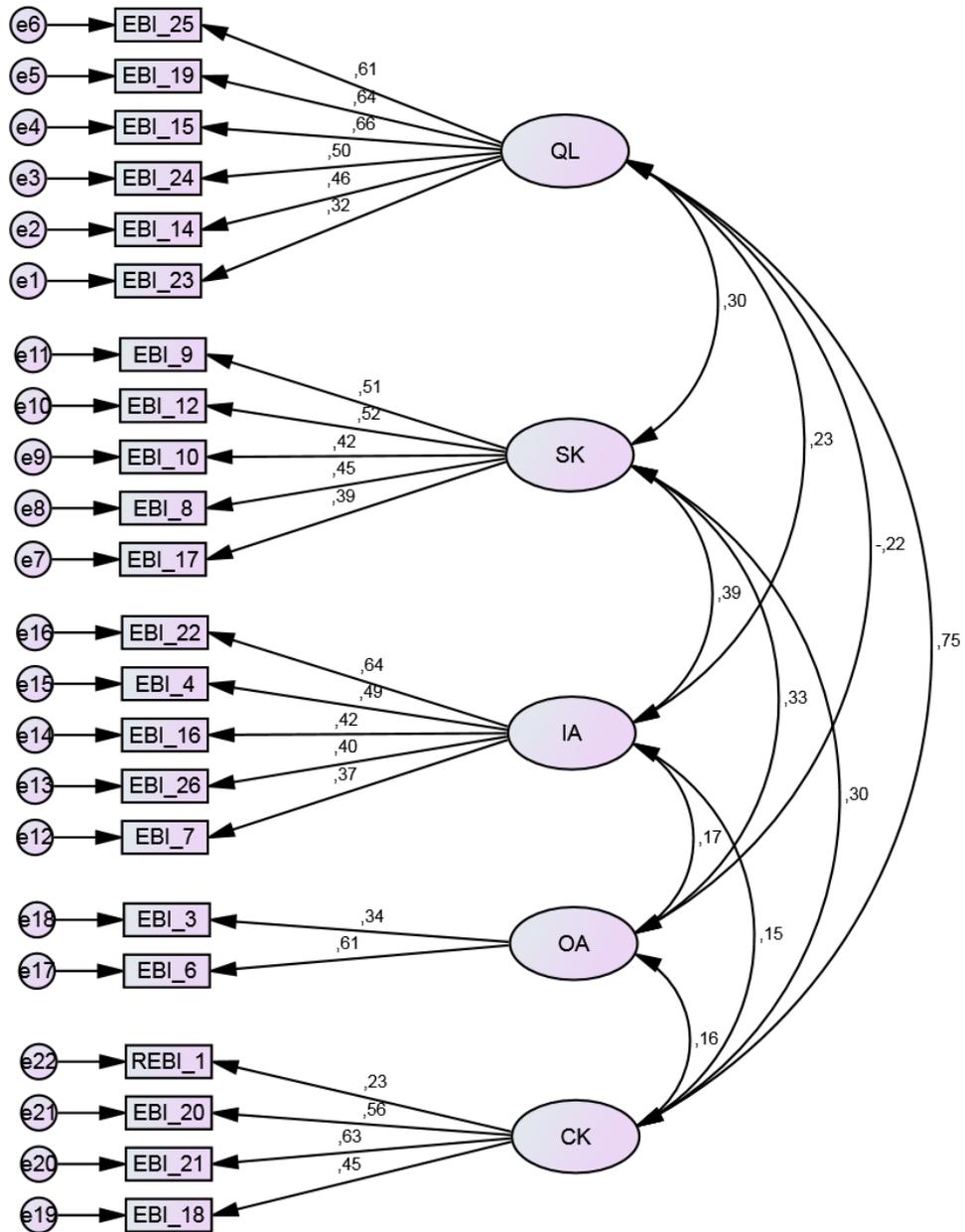


Figure B.1. EBI CFA model for Subsample A – AMOS output with standardized estimates (QL = Quick Learning, SK = Simple Knowledge, IA = Innate Ability, OA = Omniscient Authority, CK = Certain Knowledge)

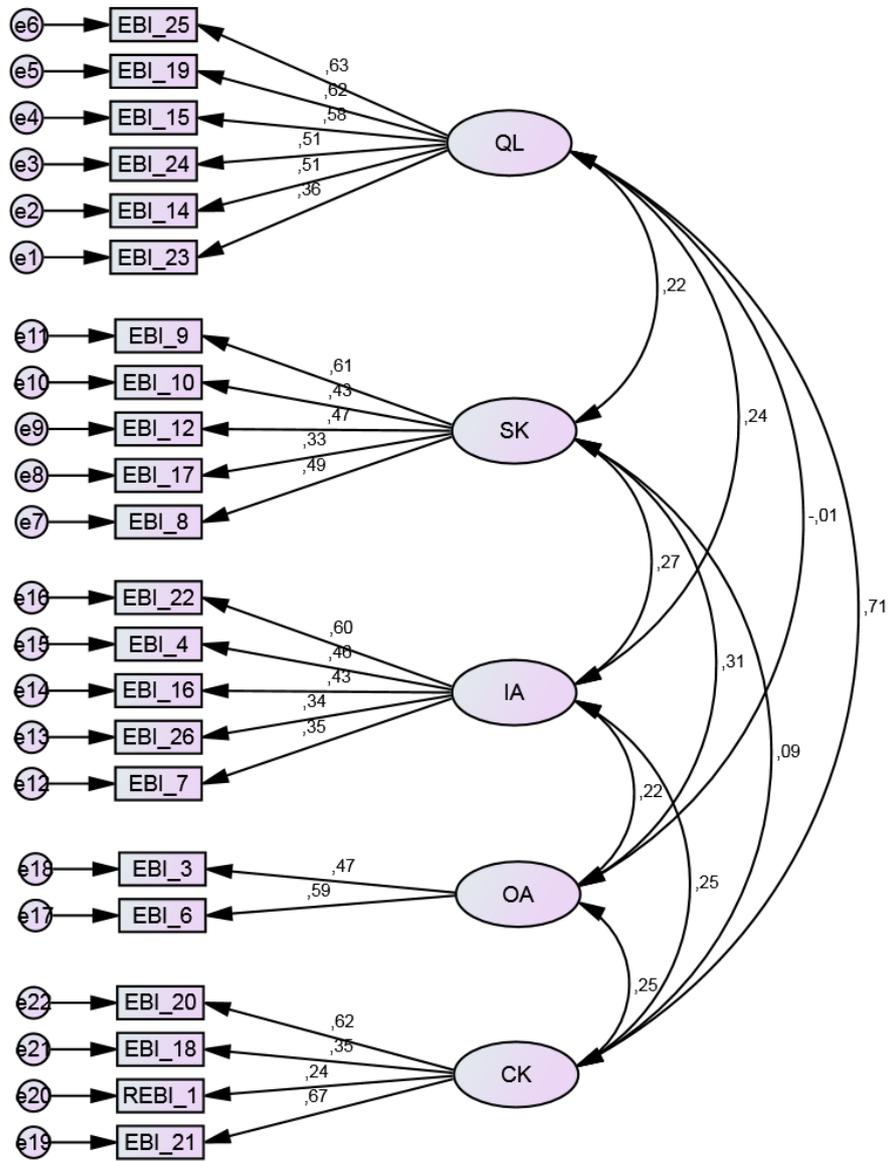


Figure B.2. EBI CFA model for Subsample B – AMOS output with standardized estimates (QL = Quick Learning, SK = Simple Knowledge, IA = Innate Ability, OA = Omniscient Authority, CK = Certain Knowledge)

APPENDIX C
INITIAL CFA MODELS OF THE VALUE SURVEY

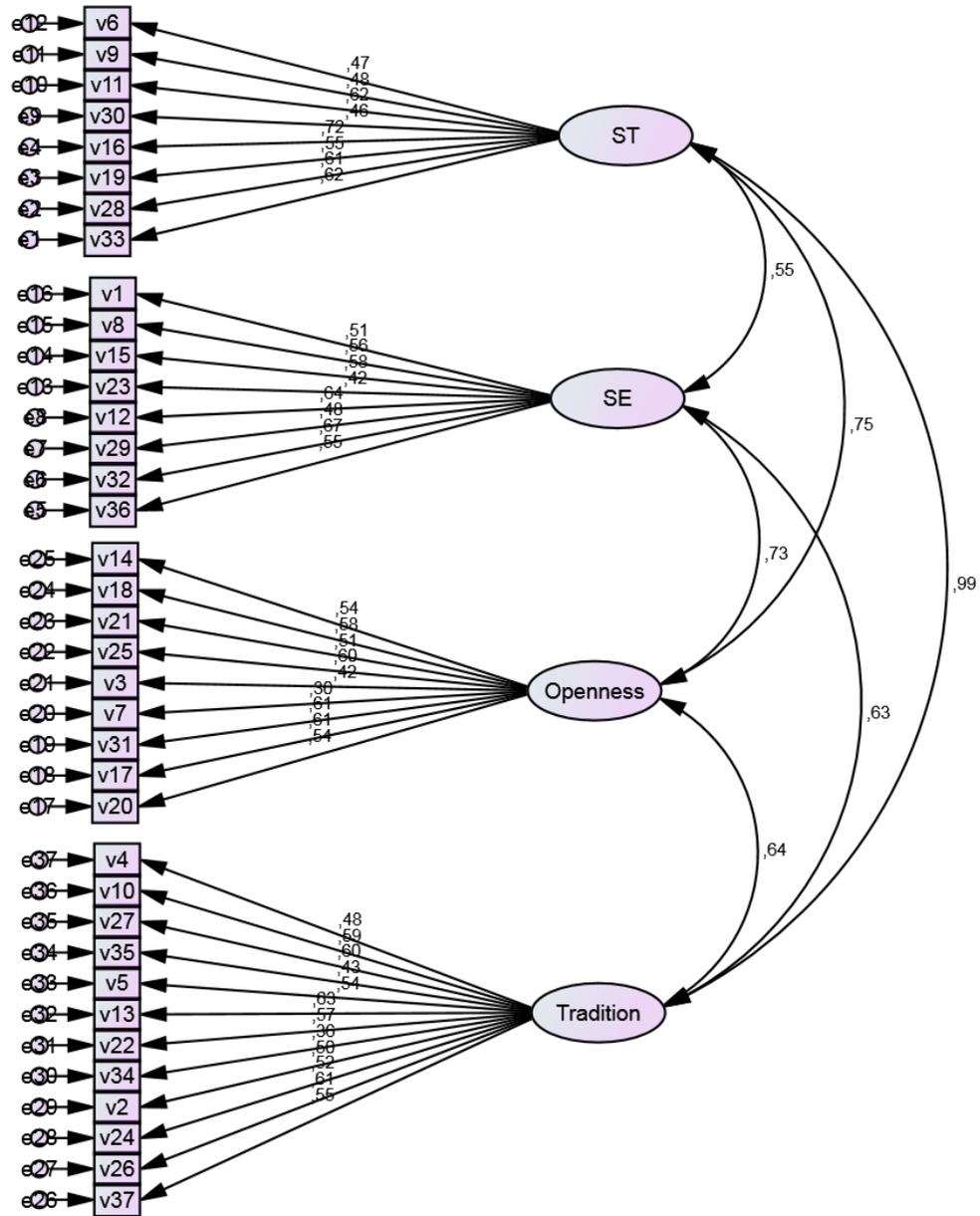


Figure C.1. Four-value category CFA model based on Schwartz value theory (covariance matrix is not positive definite) (ST = Self-transcendence, SE = Self-enhancement, Openness = Openness to change, Tradition = Tradition)

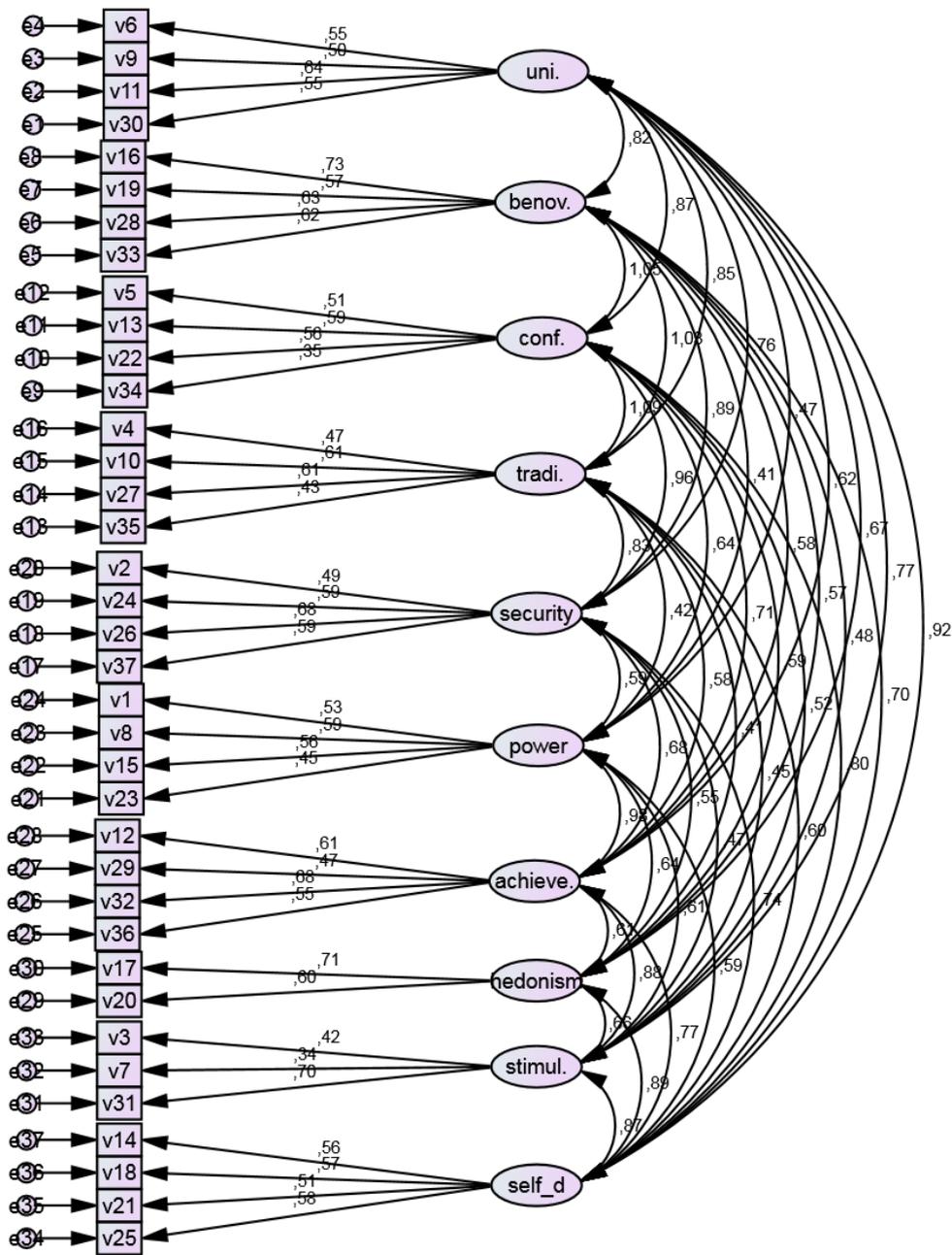


Figure C.2. 10-value type CFA model based on Schwartz value theory (covariance matrix is not positive definite) (uni. = universalism, benov. = benevolence, conf. = conformity, tradi. = tradition, security = security, power = power, achieve. = achievement, hedonism = hedonism, stimul. = stimulation, self_d = self-direction)

APPENDIX D

CFA MODEL OF THE VALUE SURVEY – AMOS OUTPUTS FOR SUBSAMPLE A AND SUBSAMPLE B

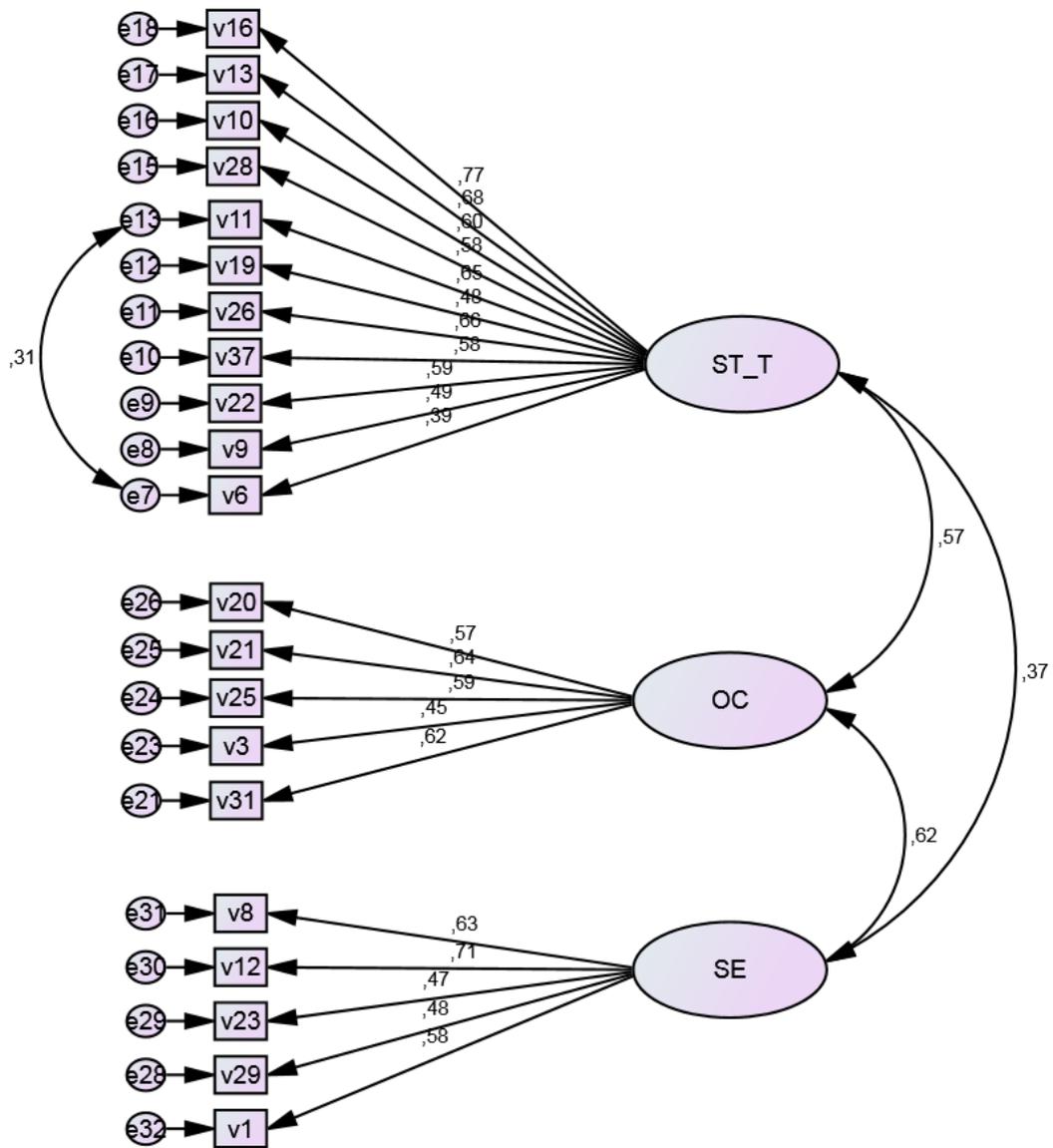


Figure D.1. Value Survey CFA model for Subsample A – AMOS output with standardized estimates (ST_T = Self-transcendence & Tradition, OC = Openness to Change, SE = Self-enhancement)

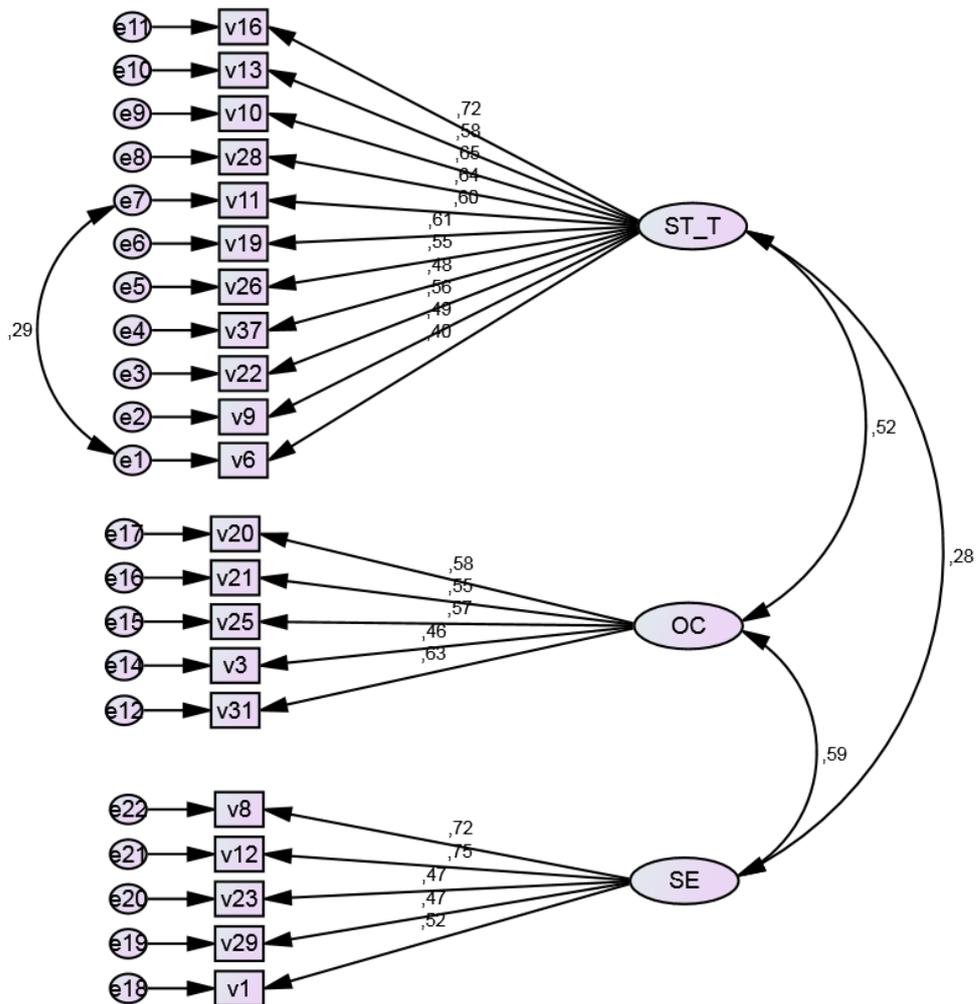


Figure D.2. Value Survey CFA model for Subsample B – AMOS output with standardized estimates (ST_T = Self-transcendence & Tradition, OC = Openness to Change, SE = Self-enhancement)

APPENDIX E

CFA MODELS OF THE ENVIRONMENTAL MORAL REASONING SCENARIOS – AMOS OUTPUTS FOR SUBSAMPLE A AND SUBSAMPLE B

Hiking Scenario

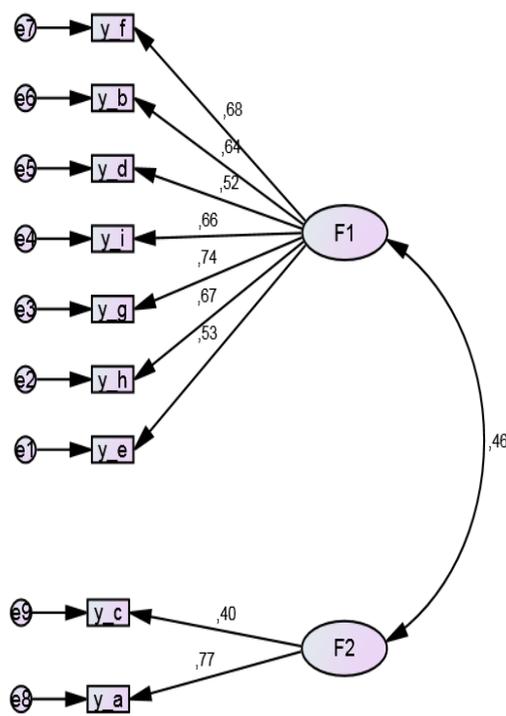


Figure E.1. Hiking scenario CFA model for Subsample A - AMOS output with standardized estimates (F1 (factor 1) includes ecocentric and egocentric/anthropocentric aesthetic/justice items; F2 (factor 2) includes egocentric –personal interest and anthropocentric-welfare items)

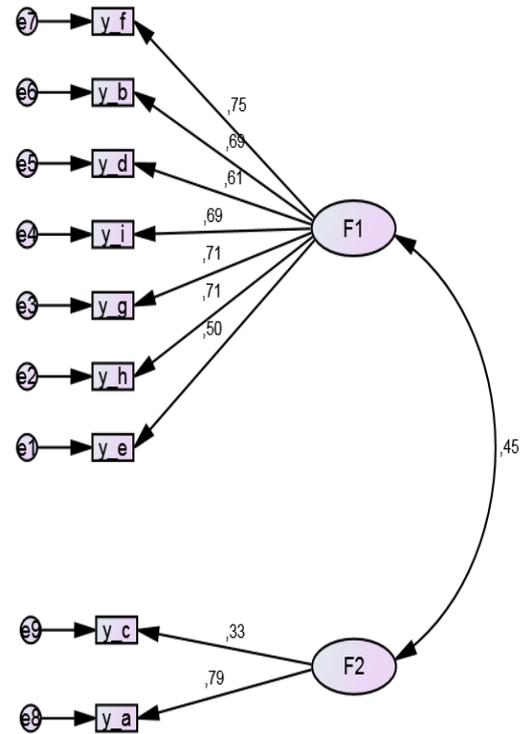


Figure E.2. Hiking scenario CFA model for Subsample B - AMOS output with standardized estimates (F1 (factor 1) includes ecocentric and egocentric/anthropocentric aesthetic/justice items; F2 (factor 2) includes egocentric –personal interest and anthropocentric-welfare items)

Picnicking Scenario

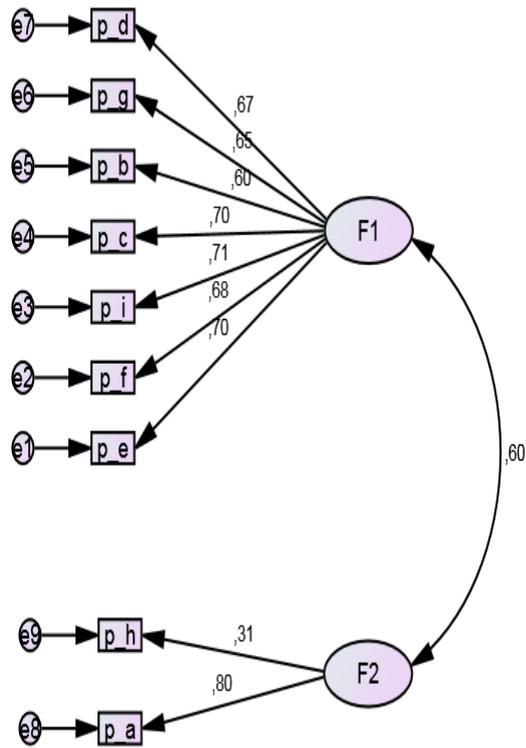


Figure E.3. Picnicking scenario CFA model for Subsample A - AMOS output with standardized estimates (F1 (factor 1) includes egocentric and egocentric/anthropocentric aesthetic/justice items; F2 (factor 2) includes egocentric –personal interest and anthropocentric-welfare items)

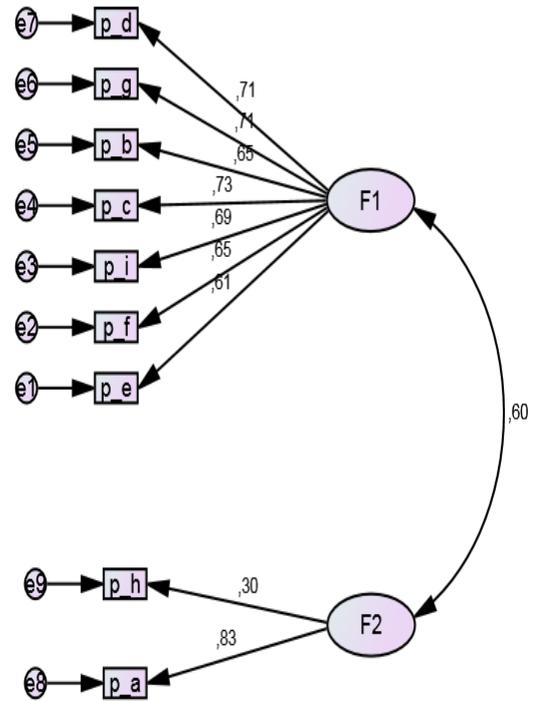


Figure E.4. Picnicking scenario CFA model for Subsample A - AMOS output with standardized estimates (F1 (factor 1) includes egocentric and egocentric/anthropocentric aesthetic/justice items; F2 (factor 2) includes egocentric –personal interest and anthropocentric-welfare items)

Fishing Scenario

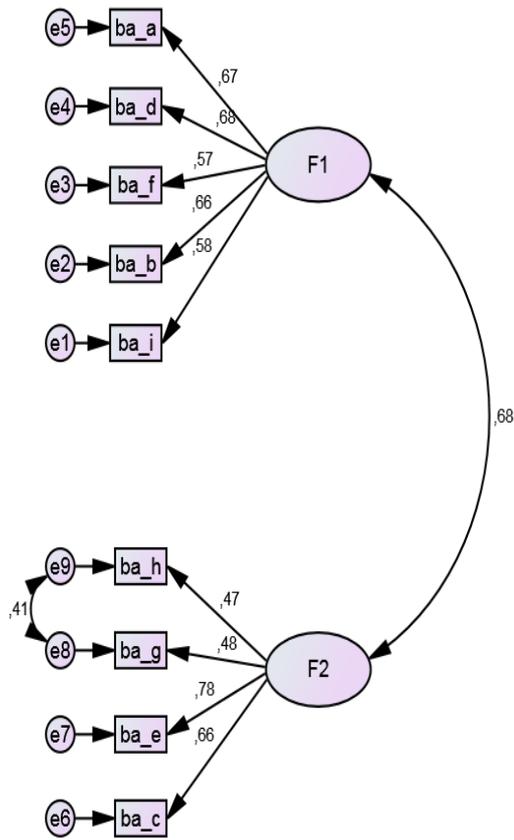


Figure E.5. Fishing scenario CFA model for Subsample A - AMOS output with standardized estimates (F1 (factor 1) includes ecocentric and egocentric/anthropocentric justice items; F2 (factor 2) includes egocentric/anthropocentric aesthetic, egocentric-personal interest, and anthropocentric-welfare items)

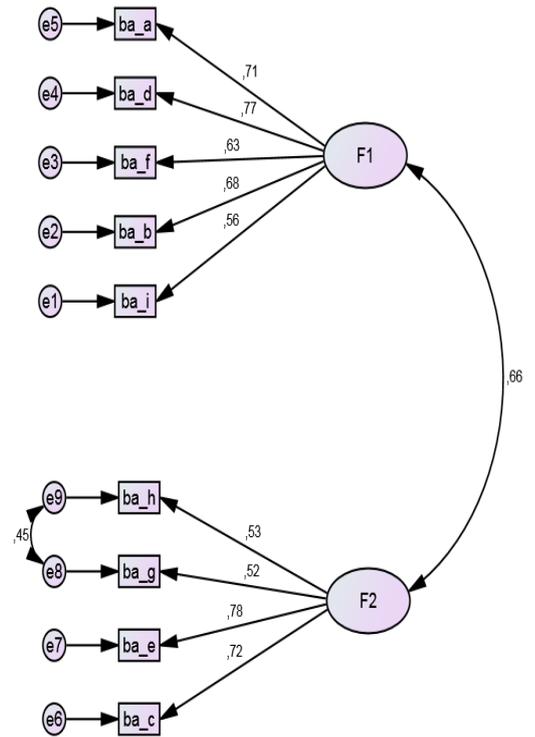


Figure E.6. Fishing scenario CFA model for Subsample B - AMOS output with standardized estimates (F1 (factor 1) includes ecocentric and egocentric/anthropocentric justice items; F2 (factor 2) includes egocentric/anthropocentric aesthetic, egocentric-personal interest, and anthropocentric-welfare items)

Camping Scenario

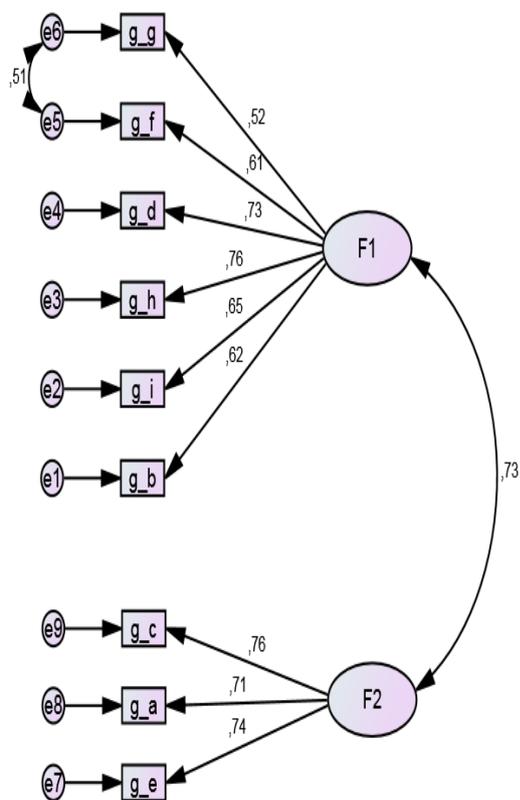


Figure E.7. Camping scenario CFA model for Subsample A - AMOS output with standardized estimates (F1 (factor 1) includes egocentric/anthropocentric justice/aesthetics, egocentric-personal interest, and anthropocentric-welfare items; F2 (factor 2) includes ecocentric items)

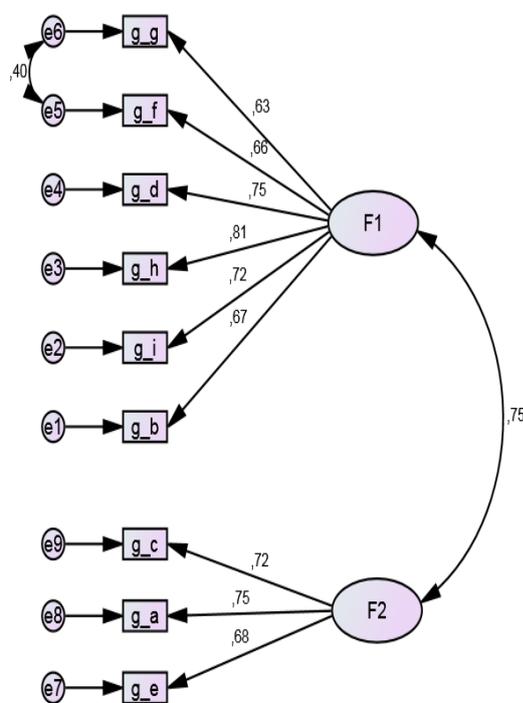


Figure E.8. Camping scenario CFA model for Subsample B - AMOS output with standardized estimates (F1 (factor 1) includes egocentric/anthropocentric justice/aesthetics, egocentric-personal interest, and anthropocentric-welfare items; F2 (factor 2) includes ecocentric items)

APPENDIX F

PERMISSION OF METU HUMAN SUBJECTS ETHICS COMMITTEE

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IAK Başkanı

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Danışmanlığını yapmış olduğunuz İlköğretim Bölümü doktora öğrencisi Büşra Tuncay'ın "Environmental Moral Reasoning Patterns of Pre-Service Science Teachers and their Relationships with Epistemological Beliefs and Values" isimli araştırması "İnsan Araştırmaları Komitesi" tarafından uygun görülerek gerekli onay verilmiştir.

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Uygundur

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APPENDIX G

TURKISH SUMMARY

(TÜRKÇE ÖZET)

FEN BİLGİSİ ÖĞRETMEN ADAYLARININ ÇEVRESEL AHLAKİ MUHAKEME ÖRÜNTÜLERİ VE BU ÖRÜNTÜLERİN EPİSTEMOLOJİK İNANÇLAR VE DEĞERLER İLE İLİŞKİSİ

Giriş

Geçmişten günümüze kadar çevre eğitimi, içerisinde bulunulan dönemlerin şartlarına ve ihtiyaçlarına paralel olarak, gerek odaklanılan konular gerekse uygulamada kullanılan yöntemler bakımından farklılıklar göstermiştir. Örneğin, 19. yüzyılın sonlarında ve 20. yüzyılın başlarında çevre eğitimi daha “romantik” sayılabilecek bir yaklaşıma sahip olmuştur ve özünde, çeşitli hikâyeler ve bu hikâyelerin içerisinde de vurgulanan etik ve ahlaki değerlere vurgu yapan tavsiyelerle, doğaya karşı bir hayranlık uyandırmayı hedeflemiştir (Cronon, 2015). İlerleyen zaman içerisinde, artan çevresel sorunlar çevre eğitiminin odak noktasını ve hedeflerini çevreyi korumak ve insanların çevre üzerindeki artan olumsuz etkilerini azaltmak yönünde yeniden şekillendirmiştir (Kopnina, 2012; McKeown & Hopkins, 2003). Günümüzde ise, çevre eğitiminin insan-çevre-kalkınma ilişkilerine odaklandığı söylenebilir. Bu vurguya “sürdürülebilir kalkınma” ve sürdürülebilir kalkınma için eğitim” gibi terimler ile birçok uluslararası konferans raporunda da

rastlamak mümkündür (örn., UNCSD 2001, 2012, UNESCO, 2014). Öte yandan, çevre eğitiminin farklı uygulamaları ve bu uygulamaların farklı odak noktaları olsa da, çevre eğitimi bir bütün olarak değerlendirilebilir (Orr, 1992). Bu bağlamda ele alındığında, çevre eğitiminin çevresel sorunların çözümünde değerlendirilmesi gereken çok önemli bir faktör olduğu literatürdeki birçok araştırmacının vurguladığı ortak bir konudur. Bu çalışmada da çevre eğitimi, çevresel sorunlar ve bu sorunların ele alınması için başvurulan eğitimsel yöntem ve yaklaşımların bütünü olarak değerlendirilmiş ve çevre eğitimi kavramı bu şekilde kullanılmıştır.

Literatüre bakıldığında, çevre eğitiminin başarılı olabilmesi için kişilerin çevre ile ilgili ilişkilerinin anlamlandırılmasının ve çevreye karşı bağlılık, sevgi, sorumluluk ve saygı gibi duyguların geliştirilmesinin çok önemli olduğu görülmektedir (Duan & Fortner, 2005; Littledyke, 2008). Çevre ile olan ilişkilerini bu tür prensipler ve duygular üzerine kurgulayan bireylerin daha çevreci davranışlar sergiledikleri ortaya konmuştur (Gurevitz, 2000). Çevre etiği, çok uzun yıllardır insan-çevre ilişkilerini bu çerçevede ele alan bir çevre psikolojisi dalıdır. Temel olarak çevre etiği, insanların doğanın bileşenleri ile nasıl ilişkiler kurabileceklerini ve kurmaları gerektiğini kapsar ve sorgular (Palmer, 2012). Buna ek olarak, çevre etiği, etik ve ahlak kavramlarının sadece insan-insan ilişkilerini değil, insan-çevre ilişkilerini de kapsayacak şekilde genişletilmesi gerektiğini savunur ve bu yönüyle çevreciliğin en öncül sosyolojik temellerinden biri olarak kabul edilir (Kortenkamp & Moore, 2001; Stern & Dietz, 1994). Çevre ve insan-çevre ilişkileri algılarında etiğe yer veren kişilerin çevreye karşı daha olumlu tutumlar ve davranışlar sergiledikleri yapılan çalışmalarla da ortaya konmuştur (Palmer, 1997; Tilbury, 1995). Buna paralel olarak, birçok araştırmacı çevre eğitiminde etik değerlere yer verilmesi ve çevresel konularda açık veya dolaylı olarak var olan etik konularının farkına vurdurulması için çaba gösterilmesi gerektiğini ifade etmektedir (Almeida, Vasconcelos, Strecht-Ribeiro, & Torres, 2011; Bonnett, 2002; Eilam & Trop, 2010; Kronlid & Ohman, 2013; Postma, 2006; York & Becker, 2012).

Önceki paragraflarda da ele alındığı gibi, yapılan çalışmalar kişilerin çevresel tutum ve davranışlarında etik ve ahlak algılarının etkili olabildiğini ortaya koymuştur. Buna ek olarak, kişilerin etik ve ahlak algılarındaki ve bu kavramları çevresel konulara ve insan-çevre ilişkileri bağlamında yorumlamalarındaki farklılıkların da çevresel tutum ve davranışları üzerinde (Bjerke & Kaltenborn, 1999; Thompson & Barton, 1994) ve çevresel problem durumları karşısındaki değerlendirme ve karar verme süreçlerinde (Seligman, Syne, & Gilchrist, 1994) belirleyici olabildiği görülmüştür.

Bu çalışmanın odak noktasını oluşturan ahlaki muhakeme (etik uslamlama) terimi bireylerin çevresel konular ve insan-çevre ilişkilerinde ahlak ve etik kavramlarına yönelik algılarını ve bu algılardaki farklılıkları incelemede kullanılan bir terimdir (Kortenamp & Moore, 2001). Ahlaki muhakeme, hem bilişsel hem de duyuşsal bileşenlerden oluşur (Greely, 2008; Persing, 2006; Tuncay ve ark., 2012). Bu yönüyle, diğer birçok konuda olduğu gibi (örn., sosyobilimsel konular) (Sadler & Zeidler, 2004; Zeidler & Sadler, 2008a, Zeidler & Sadler, 2008b), ahlaki muhakeme kişilerin çevresel konular ile ilgili algılarını ve insan-çevre ilişkilerine yönelik yaklaşımlarını bütüncül bir şekilde açıklayabilme potansiyeline sahiptir. Bu çalışmada katılımcıların çevresel ahlaki muhakemelerini incelemek için üçlü bir sınıflandırmadan faydalanılmıştır. Bu sınıflandırmaya göre kişilerin çevreye yönelik etik ve ahlak algıları üç ana gruba (ben-merkezci, insan-merkezci, çevre-merkezci) ayrılabilir. Çevre etiği bağlamında ben-merkezci yaklaşımları önde tutan kişilerin, insanların kişisel çıkarları için çevresel kaynakları istedikleri biçimde kullanabilecekleri görüşüne daha yakın olduklarını belirtilmiştir (Merchant, 1992). Çevresel konulara ve insan-çevre ilişkilerine daha insan-merkezci yaklaşımları benimseyen kişilerin ise, insan refahını bir bütün olarak ele almaya ve çevresel sorunlar ve bu sorunların çözümünde toplumun faydası veya toplumun görebileceği zararlara odaklanmaya daha meyilli oldukları söylenebilir. Öte yandan, çevre-merkezci ahlaki muhakeme yaklaşımında, insanlar çevrenin ve doğanın diğer bileşenlerinden ayrılmaz ve çevresel konular ekosistemdeki her şeyin eşit derecede

içsel bir değere sahip olduğu anlayışıyla değerlendirilir. Merchant (1992) dışındaki birçok araştırmacı da (e.g., De Groot & Steg, 2007; Stern & Dietz, 1994; Stern, Dietz, & Kalof, 1993; Stern, Dietz, Guagnano, 1995) kişilerin çevresel ahlaki muhakeme örüntülerini incelerken bu üçlü sınıflandırmadan faydalanmıştır.

Literatürde belirtilen bu üçlü sınıflandırmaya uygun olarak, bu çalışmada fen bilgisi öğretmen adaylarına dört farklı çevresel ikilem durum hikâyesi verilmiş ve katılımcıların bu ikilem durumlarını çözmeye çalışırken odaklandıkları noktalar incelenmiştir. Katılımcıların sağlıklı bir çevrenin kendilerine faydalarına veya çevreye zarar vermenin sonucu olarak görebilecekleri olumsuz etkilere odaklanan cevapları ben-merkezci (egocentric) ahlaki muhakemenin göstergeleri olarak değerlendirilmiştir. Katılımcıların cevapları, ve dolayısı ile ahlaki kaygıları, insan ve toplum üzerinde odaklanmış ise insan-merkezci (anthropocentric); insan dışındaki çevre bileşenlerine (örn., hayvanlar, bitkiler) ve bir bütün olarak ekosistemlere ve doğaya (örn., ekosistemlerin işleyişi, doğa ile bir bütün olarak yaşama gerekliliği) odaklanmış ise çevre-merkezci (ecocentric) ahlaki muhakemenin göstergeleri olarak ele alınmıştır. Bununla birlikte, ilgili literatür bireylerin her durum karşısında benzer ahlaki muhakeme örüntüleri göstermeyebileceğini ortaya koymaktadır (Zeidler vd., 2005). Bir başka deyişle, durumların içerik ve bağlamları, kişilerin ahlaki muhakeme örüntüleri üzerinde oldukça etkili olabilmektedir (Rest vd., 1999a, 2000). Sonuç olarak, kişiler farklı durumlar karşısında birbirleriyle örtüşmeyen ve hatta çakışan ahlaki muhakeme örüntüleri sergileyebilmektedirler (Kronlid & Ohman, 2013). Bu çalışma içerisinde incelenen çevresel ahlaki muhakeme bağlamında değerlendirildiğinde, bu durum bir çevresel ikilem durumuna karşı baskın bir şekilde çevre-merkezci ahlaki muhakeme örüntüsü sergileyen bir kişinin bir başka ikilem karşısında daha insan-merkezci ya da ben-merkezci ahlaki muhakeme örüntüsü sergileyebileceği anlamına gelmektedir. Buna ek olarak, ahlaki muhakeme örüntülerini birbirinden kesin bir şekilde ayırmak mümkün olmayacağından (Kronlid & Ohman, 2013), kişiler farklı durumlar karşısında salt ben-merkezci,

insan-merkezci, ya da çevre-merkezci olarak nitelendirilemeyecek ahlaki muhakeme örüntüleri de sergileyebilirler.

Çalışmada, öğretmen adaylarının kendilerine verilen çevresel ikilem durum hikâyeleri karşısında sergileyecekleri ahlaki muhakeme örüntülerinin, sahip oldukları epistemolojik inançlar ve değer yargıları ile ilişkili olabileceği düşünülmüştür. Varsayılan bu ilişkilerin incelenmesi amacı ile her bir durum hikâyesi için (yürüyüş, piknik, balık tutmak, gölet) yapısal modeller geliştirilmiş ve bu modeller yol analizi yöntemi ile test edilmiştir. Geliştirilen yapısal modellerde, epistemolojik inançlar ve değerler katılımcıların sergiledikleri ahlaki muhakeme örüntülerinin yordayıcıları olarak modellere dâhil edilmiştir. Epistemolojik inançların ve değerlerin modellerde yordayıcı değişken olarak yer almalarının temel sebebi, bu iki kavramın kişilerin, çevresel konular da dahil olmak üzere, durumlar ve olaylar karşısındaki düşünme süreçleri, yargıları ve kararları üzerinde etkili olabildiğini gösteren çalışma bulgularıdır (örn., Bendixen ve ark., 1998; Corraliza & Berenguer, 2000; Mintchick & Farmer, 2009; Stern ve ark., 1999; Topcu, 2011; Walker ve ark., 1991). Yol analizi, yapısal eşitlik modellemelerinin örtük değişken kullanılmadan uygulanan özel bir durumudur. Yol analizi yöntemi ile varsayılan yapısal modellerdeki yordayıcı değişkenlerin, bir bütün olarak, yordanan değişkenlerdeki varyansları ne ölçüde açıklayabildikleri eş zamanlı olarak incelenebilmektedir. Aynı zamanda, bu analiz yöntemi ile her bir yordayıcı ve yordanan değişken arasındaki ilişki hakkında bilgi sahibi olmak da mümkün olmaktadır (Tabachnick & Fidell, 2007). Aşağıdaki paragraflarda, test edilen yol analizi modellerinde yordayıcı değişken olarak yer alan epistemolojik inançların ve değerlerin mevcut çalışmada kullanılan işlemsel tanımları kısaca verilmiştir.

Epistemolojik inançlar, kısaca, kişilerin bilgi ve bilgi edinme/öğrenme ile ilgili inançları olarak tanımlanabilir (Hofer & Pintrich, 1997, 2002). Bu çalışmada, katılımcıların epistemolojik inançları Schommer (1990) tarafından geliştirilen epistemolojik inançlar modeli temel alınarak incelenmiştir. Epistemolojik inançlar

modelinde Schommer, epistemolojik inançların kişilerin bilginin kaynağı, kesinliği, yapısı, öğrenme üzerindeki denetim ve öğrenmenin hızı ile ilgili inançları olarak beş ana boyutta incelenebileceğini varsaymıştır (Schommer, 1990, 1994). Literatürdeki tek boyutlu modellerin (örn., King & Kitchener, 1994, Perry, 1970, 191) aksine, bu modelde epistemolojik inançlar çok boyutlu olarak ele alınmış ve her bir epistemolojik inanç boyutunun az ya da çok birbirinden bağımsız olabileceği savunulmuştur. Yani, bir kişinin bir epistemolojik boyuta dair inancının gelişmiş olması, aynı kişinin diğer epistemolojik inanç boyutlarına ilişkin inançlarının da gelişmiş olacağı anlamına gelmez; aynı kişi, bilginin ya da bilgi edinmenin/öğrenmenin başka bir boyutu bakımından gelişmemiş (naif) epistemolojik inançlara sahip olabilir. Çalışmada, katılımcıların epistemolojik inançlarını ölçmek için Schommer'ın çok boyutlu epistemolojik inançlar modelini temel alarak geliştirilmiş olan Epistemolojik İnançlar Envanteri (Bendixen, Schraw, & Dunkle, 1998) kullanılmıştır.

Çevresel ahlaki muhakeme örüntülerinin ilişkili olabileceği düşünülen ve bu bağlamda çalışmaya dâhil edilen bir diğer kavram olan değerler, temel olarak, bireylerin nesnelere, olgular, kavramlar, vb. gibi birçok şeye göreceli olarak verdikleri önem olarak tanımlanabilir (Hart, 2003). Değerler ve değerlerin kişiler için sahip oldukları önem sırası, kişilerin olayları, eylemleri, diğer insanları ve kendilerini yargılamada kullandıkları temel ölçütler olarak işlerler (Schwartz, 1992). Bu nedenle, değerler kişilerin hayatlarına kılavuzluk eden prensipler olarak da nitelendirilir (Schwartz, 1994). Bu çalışmada, literatürdeki birçok çalışmada da olduğu gibi, katılımcı fen bilgisi öğretmen adaylarının sahip olduğu değerleri incelemek için Schwartz'ın (1992, 1994) Değer Kuramından faydalanılmıştır. Schwartz Değer Kuramı, birçok farklı ülke ve kültürden toplanan verilere dayandığı için, insan değerleri ile ilgili literatürde bulunan en kapsamlı kuram olarak nitelendirilmektedir (de Groot & Steg, 2007; Corraliza & Berenguer, 2000; Schultz, Gouveia, Cameron, Tankha, Schmuck, & Franek, 2005). Schwartz değer kuramı ve buna bağlı olarak oluşturulan Schwartz değerler listesinde, tüm kültürlerde

rastlanma olasılığı en yüksek olan 56 adet değer belirlenmiştir. Bu değerler, güdüsel amaçlarına göre 10 temel değer tipi (güç, başarı, hazcılık, uyarılım, özyönelim, evrenselcilik, iyilikseverlik, geleneksellik, uyma, güvenlik), ve ikişer uçtan oluşan iki ana değer boyutu (yeniliğe açıklığa karşı muhafazacı yaklaşım; özaşkınlığa karşı özgenişletim) altında ele alınabilir (Kuşdil & Kağıtçıbaşı, 2000). Schwartz değer kuramındaki 56 değerın sınıflandırmaları ve değer tiplerinin ve ana değer boyutlarını oluşturan değer gruplarının arasındaki ilişkileri gösteren yapısal model tez içerisinde, sırasıyla, Tablo 1.1 ve Şekil 2.1 de verilmiştir. Yapılan çalışmada, Schwartz değer kuramını kullanan diğer birçok çalışmada olduğu gibi, katılımcıların sahip oldukları değerleri incelemek için kendilerine sunulan değer listesindeki her bir değerın hayatlarını yönlendiren bir ilke olarak kendileri için önemini -1 (ilkelerime ters düşer) ve 7 (en üst düzeyde önemlidir) arasında değişen bir ölçek üzerinde belirtmeleri istenmiştir.

Yöntem

Fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerini ve bu örüntülerin epistemolojik inançlar ve değerler ile ilişkisini incelemeyi amaçlayan bu çalışma nicel bir çalışma olup, çalışmanın verileri katılımcıların kendilerine verilen anketlere vermiş oldukları cevaplar yoluyla toplanmıştır. Araştırma deseni bakımından korelasyon araştırması olarak nitelendirilebilecek bu çalışmaya yön veren araştırma soruları aşağıdaki gibidir:

- Fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntüleri, epistemolojik inançları ve değerleri tarafından ne ölçüde tahmin edilebilir?
 - Fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntüleri ile epistemolojik inançları arasında nasıl bir ilişki vardır?

- Fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntüleri ile değerleri arasında nasıl bir ilişki vardır?

Evren ve Örneklem

Çalışmanın katılımcıları, Türkiye'nin İç Anadolu Bölgesindeki devlet üniversitelerinin birinci, ikinci, üçüncü ve dördüncü sınıflarında öğrenim görmekte olan fen bilgisi öğretmen adayları arasından seçilmiştir. Örneklem seçme yöntemi olarak küme örnekleme ve uygun örnekleme birlikte kullanılmıştır. İlk aşamada, küme örnekleme yoluyla İç Anadolu Bölgesi'nde fen bilgisi öğretmenliği bölümü bulunan üniversiteler belirlenmiştir. Daha sonra, bu bölümlerdeki fen bilgisi öğretmenliği bölümünde okuyan toplam öğrenci sayıları, üniversitelerin araştırmacının bulunduğu şehre uzaklığı ve dolayısı ile veri toplanması için gerekli olan zaman, enerji, maliyet vb. göz önünde bulundurulmuştur. Sonuç olarak, beş farklı şehirde bulunan altı adet devlet üniversitenin çalışmaya dâhil edilmesi kararlaştırılmıştır. Bu altı üniversitedeki toplam fen bilgisi öğretmen adayı sayısı 2722 iken, çalışma kapsamında bu öğretmen adaylarının 1524'üne (%56) ulaşılabilmektedir. Ulaşılan öğretmen adaylarının yaş ortalaması 20.51 olarak hesaplanmıştır. Tablo 1'de de gösterilmiş olduğu gibi, çalışmanın katılımcılarının 1248'ini kadın 255'ini erkek öğretmen adayları oluşturmuştur. Bu orantısız cinsiyet dağılımı, örneklem seçiminden ziyade Türkiye'deki fen bilgisi öğretmenliği bölümünde öğrenim görmekte olan öğrenci profilini yansıtmaktadır. Katılımcıların birinci öğretim ve ikinci öğretim programlarındaki dağılımları da benzer şekilde yorumlanmalıdır. Çalışmanın katılımcılarının cinsiyet, üniversite, sınıf seviyesi ve kayıtlı oldukları programlara (1.öğretim / 2.öğretim) göre dağılımları Tablo G.1'de sunulmuştur.

Tablo G.1

Katılımcıların Demografik Özellikleri

Değişken		Frekans (f)	Yüzde (%)
Cinsiyet	Erkek	255	16.7
	Kadın	1248	81.9
	Cevapsız	21	1.4
Üniversite	Üniversite 1	190	12.5
	Üniversite 2	439	28.8
	Üniversite 3	312	20.5
	Üniversite 4	103	6.8
	Üniversite 5	180	11.8
	Üniversite 6	300	19.7
Sınıf seviyesi	Birinci sınıf	292	19.2
	İkinci sınıf	326	21.4
	Üçüncü sınıf	462	30.3
	Dördüncü sınıf	438	28.7
	Cevapsız	6	.4
Program	Birinci öğretim	1117	73.3
	İkinci öğretim	358	23.5
	Cevapsız	49	3.2

Veri Toplama Araçları

Bu çalışmanın veri toplama araçları Epistemolojik İnançlar Envanteri (Bendixen ve ark., 1998), Schultz ve Zelezny (1998, 1999) tarafından geliştirilen 37 maddelik Schwartz Değerler Envanteri (1992, 1994) ve çevresel ahlaki muhakemeleri ölçmek

için kullanılan çevresel durum hikayeleri ve ilgili sorulardan oluşmuştur. Veri toplama araçlarının geliştirilmesi süreci birçok aşamadan oluşmuştur. İlk aşamada, çalışmanın kuramsal altyapısına, amacına, araştırma desenine ve veri analizinde kullanılacak yöntemlere uygun olan ve literatürde farklı çalışmalarda kullanılıp psikometrik özellikleri bakımından (örn., geçerlilik, güvenilirlik) kabul görmüş veri toplama araçları belirlenmiştir. Daha sonra, Orta Doğu Teknik Üniversitesi bünyesinde hizmet veren Akademik Yazım Merkezi danışmanlığında veri toplama araçlarının dil, yazım ve kültüre uygunluk bakımından mevcut çalışmaya adaptasyonu sağlanmıştır. Bu süreçte, 10 yıldan daha fazla deneyimi olan bir edebiyat öğretmeni de veri toplama araçlarının yazım ve dil bilgisi gibi konularda geliştirilmesine katkıda bulunmuştur. Veri toplama araçlarının çeviri ve adaptasyon süreçlerinin tamamlanmasının ardından, pilot çalışmalar uygulanmıştır. Pilot çalışmalar esnasında katılımcılardan alınan yazılı ve sözlü geri dönütler ve pilot çalışma verileri üzerinde yapılan faktör analizler sonucunda veri toplama araçları ana çalışmada kullanılmaya hazır hale getirilmiştir. Veri toplama araçlarının temel özellikleri ve pilot çalışmalar ve ana çalışmadan sonra elde edilen faktör yapıları aşağıdaki gibidir. Analizlerde kullanılan faktör puanları, katılımcıların faktörlere yüklenen her bir maddeye verdikleri cevapların puanlarının ortalaması alınarak hesaplanmıştır.

Epistemolojik İnançlar Envanteri. Epistemolojik inançlar envanteri (Bendixen ve ark., 1998) kuramsal olarak Schommer'ın (1990, 1994) epistemolojik inançlar modelini temel almıştır. Bu bağlamda, katılımcıların bilgi ve bilgi edinme/öğrenme ile ilgili inançlarını (bilginin kaynağı, kesinliği, yapısı/örgütlenmesi, öğrenme üzerindeki denetim, öğrenmenin hızı) ölçmeyi amaçlar (Aypay, 2011; Caglayan & Mehtap, 2010). Bu envantere katılımcılardan kendilerine sunulan bilgi ve bilgi edinme/öğrenme ile ilgili ifadelerle ne ölçüde katıldıklarını 5'li Likert tipi bir ölçeklendirme üzerinden belirtmeleri istenir (1 = kesinlikle katılmıyorum; 5 = kesinlikle katılıyorum). Envanterden elde edilen yüksek puanlar gelişmemiş (naif) epistemolojik inançların göstergesi olarak kabul edilirken, düşük puanlar

katılımcıların epistemolojik inançlar bakımından gelişmiş olduklarının bir işareti olarak yorumlanır.

Çalışmanın verileri üzerinde yapılan açımlayıcı faktör analizi sonucunda ölçekteki 22 madde, Schommer'ın (1990, 1994) epistemolojik inançlar modelinde öngördüğü gibi, beş alt boyutta (faktörde) toplanmıştır. Bu faktörler şu şekildedir: “öğrenme hemen gerçekleşir” (Quick Learning; QL), “bilgi basittir” (Simple Knowledge; SK), “öğrenme yeteneği doğuştandır” (Innate Ability; IA), “bilginin kaynağı her şeyi bilen otoritedir” (Omniscient Authority; OA) ve “bilgi kesindir” (Certain Knowledge; CK). Faktörlerin güvenilirlik hesaplamaları için Cronbach alfa değerlerinin yanında, ölçekteki madde sayısından bağımsız olan maddeler arası korelasyon ortalama değeri (mean inter-item correlation) kullanılmıştır (Briggs & Cheek, 1986; Pallant, 2007). Beklenildiği gibi, faktörlerdeki madde sayılarının az olmasından dolayı, faktörlerin Cronbach alfa değerleri istenilen değerlerden genelde düşük çıkmıştır (Cronbach alfa değer aralığı = .39 - .70). Öte yandan, hesaplanan maddeler arası korelasyon ortalama değerleri istenilen düzeydedir (.20 ile .28 arası). Açımlayıcı faktör analizi ile bulunan bu beş faktörlü yapının geçerliliği veri dosyasından rastgele elde edilen iki eş alt örneklem verisi üzerinde gerçekleştirilen doğrulayıcı faktör analizlerinin sonuçlarıyla desteklenmiştir. Doğrulayıcı faktör analizlerden elde edilen model uyum indekslerinin alt örneklem A için ($\chi^2 = 618.60$, $df = 199$, $\chi^2/df = 3.11$, GFI = .93, AGFI = .91, CFI = .81, RMSEA = .05, RMR = .07, SRMR = .06) ve alt örneklem B için ($\chi^2 = 605.85$, $df = 199$, $\chi^2/df = 3.04$, GFI = .93, AGFI = .91, CFI = .81, RMSEA = .05, RMR = .06, SRMR = .06) kabul edilebilir düzeyde olduğu görülmüştür.

Değerler Envanteri. Çalışmada kullanılan değerler envanterinin adaptasyonu sürecinde iki adet pilot çalışma yapılmıştır. İlk pilot çalışmada, çalışmanın değer kavramı konusunda kuramsal olarak temellendiği Schwartz (1992, 1994) değer kuramında belirlenmiş olan 56 değer tümünü içeren bir değer listesi katılımcılara sunulmuştur. Ancak, bu pilot çalışmadan elde edilen veriler Schwartz'ın (2009)

kılavuzunda belirttiği ölçütlere göre incelendiğinde, birçok katılımcının yanıtlarının sunulan 56 değerlerin kendileri için göreceli önemini belirtmesi açısından yeterince ayırt edici olmadığı görülmüştür. Ortaya çıkan durumun, ölçeğin uzunluğundan kaynaklanabileceği düşünülerek, bu ölçeğin 37-maddelik hali (Schultz & Zelezny, 1998, 1999) kullanılmıştır. Yapılan ikinci pilot çalışmanın verilerinin analizleri ilk pilot çalışmada ortaya çıkan sorunların aşıldığını göstermiştir. Ölçeğin puanlandırılması, katılımcıların kendilerine sunulan her bir değeri “hayatlarını yönlendiren bir ilke olarak” -1’den (-1 = ilkelerime ters düşer) 7’ye kadar (7 = en üst düzeyde önemlidir) değerlendirmeleri ile gerçekleştirilmiştir.

Ölçekten toplanan veriler üzerinde yapılan açımlayıcı ve doğrulayıcı faktör analizleri ölçekteki 21 değer maddesinin üç alt boyutta toplandığını göstermiştir. Faktörlerdeki maddeler incelendiğinde Schwartz (1992, 1994) değer kuramındaki özaşkınlık (Self-transcendence; ST) ve muhafazacı yaklaşım (Tradition; T) değerlerinin tek bir faktörde (ST_T) toplandığı görülmüştür. Schwartz değer kuramındaki yeniliğe açıklık (Openness to Change; OC) ve özgenişletim (Self-enhancement; SE) değerleri ise ayrı ayrı iki faktörde gruplaşmıştır. Bu üç faktörlü yapının geçerliliği uygulanan çapraz geçerleme (cross validation) yöntemi ile doğrulanmıştır. Bu yöntem uyarınca uygulanan doğrulayıcı faktör analizlerinden elde edilen model uyum indeksleri alt örneklem A için ($\chi^2 = 847.14$, $df = 185$, $\chi^2/df = 4.58$, GFI = .90, AGFI = .87, CFI = .86, RMSEA = .07, RMR = .18, SRMR = .06) ve alt örneklem B için ($\chi^2 = 899.14$, $df = 185$, $\chi^2/df = 4.86$, GFI = .89, AGFI = .87, CFI = .83, RMSEA = .07, RMR = .20, SRMR = .07) kabul edilebilir düzeylerde bulunmuştur. Faktörlerin güvenilirlik hesaplamaları için kullanılan maddeler arası korelasyon ortalama değerleri .32 - .34 aralığında, Cronbach alfa değerleri .70 - .84 aralığında çıkmıştır.

Çevresel Durum Hikâyeleri. Çalışmada fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerini incelemek amacıyla, orijinali Persing (2006) tarafından geliştirilmiş olan, dört farklı çevresel durum hikâyesi (yürüyüş, piknik,

balık tutmak, gölet) kullanılmıştır. Hikâyelerde, katılımcılardan kendilerini hikâyelerin ana kahramanı gibi düşünmeleri beklenerek, çevreye karşı zararlı olabilecek bir eylemi gerçekleştirip gerçekleştirilmemek üzerine yoğunlaşmış ikilem durumları sunulmuştur. Hikâyelerden sonra katılımcılara her biri farklı bir kaygı üzerine odaklanmış dokuz adet ifade verilmiş ve katılımcılardan bu ifadelerin hikâyelerde anlatılmış olan ikilem durumlarını çevreci bir şekilde çözmeleri için ne derecede önemli olduğunu 5’li Likert tipi bir ölçek üzerinden belirtmeleri istenmiştir (1 = hiç önemli değil; 5 = oldukça önemli). İfadelerin yansıttığı ahlaki muhakeme türü iki boyut üzerinden değendirilmiştir: kaygının odak noktası (ben-merkezci, insan-merkezci, çevre-merkezci) ve kaygının altında yatan sebep (doğanın içsel değerine olan inanç, doğa ile uyum içinde yaşama isteği, kişisel çıkar, refah, estetik ve adalet konuları). Ek olarak, katılımcılara hikâyelerle ilgili kendilerine sunulan ifadelerden en çok hangilerine katıldıkları (her bir hikâye için sadece bir seçenek) sorulmuştur.

Katılımcıların 5’li Likert ölçeğindeki sorulara verdikleri cevapların analizleri, her dört çevresel durum hikâyesi için iki faktörlü bir yapı ortaya koymuştur. Öte yandan, elde edilen faktörler içerikleri bakımından senaryodan senaryoya farklılık göstermiştir. Faktörlere genel olarak bakıldığında, katılımcıların ahlaki muhakeme örüntülerinde, ilgili kaygıların ben-merkezci, insan-merkezci veya çevre-merkezci olması kadar, bu kaygıların temelinde yatan sebeplerin de belirleyici olduğu gözlemlenmiştir. Örneğin, “balık tutmak” senaryosu için adalet kavramının ben-merkezci ve insan-merkezci kaygıları çevre-merkezci kaygılarla birleştirdiği saptanmıştır. Çevresel durum hikâyeleri için elde edilen faktör yapılarının özetlenmiş hali Şekil G.1’de verilmiştir.

Yürüyüş	Piknik	Balık tutmak	Gölet
ben m.- kişisel çıkar insan m.- refah	ben m.- kişisel çıkar insan m.- refah	ben m.- kişisel çıkar insan m.- refah	ben m.- kişisel çıkar insan m.- refah
ben m.-estetik insan m.- estetik	ben m.-estetik insan m.- estetik	ben m.-estetik insan m.- estetik	ben m.-estetik insan m.- estetik
ben m.- adalet insan m.- adalet	ben m.- adalet insan m.- adalet	ben m.- adalet insan m.- adalet	ben m.- adalet insan m.- adalet
çevre m.- adalet çevre m.- doğa ile uyum çevre m.- doğanın içsel değeri	çevre m.- adalet çevre m.- doğa ile uyum çevre m.- doğanın içsel değeri	çevre m.- adalet çevre m.- doğa ile uyum çevre m.- doğanın içsel değeri	çevre m.- adalet çevre m.- doğa ile uyum çevre m.- doğanın içsel değeri

Şekil G.1. Çevresel durum hikâyeleri için elde edilen faktör yapıları. ben m. = ben-merkezci, insan m. = insan-merkezci, çevre m. = çevre-merkezci.

Elde edilen faktörlerin güvenilirlik değer aralıkları (minimum ve maksimum değerler) maddeler arası korelasyon ortalama değeri için .25 - .48 , Cronbach alfa değeri için .39 - .85 olarak bulunmuştur. Diğer ölçeklerde olduğu gibi, açımlayıcı faktör analizi yolu ile bulunan faktör yapılarının geçerlilikleri çapraz geçерleme yöntemi ile test edilmiştir. Örnekleme içerisinde seçilen iki eş alt örnekleme (alt örnekleme A, alt örnekleme B) verisi üzerinde uygulanan doğrulayıcı faktör analizlerinden elde edilen model uyum indeksleri kabul edilebilir düzeyde bulunmuştur.

Verilerin Toplanması ve Analizi

Çalışmanın verilerinin toplanması 2012-2013 Bahar (pilot çalışmaların verilerinin toplanması için) ve 2013-2014 Güz (ana çalışmanın verilerinin toplanması için) eğitim-öğretim yarıyıllarında gerçekleştirilmiştir. Verilerin toplanmasından önce ODTÜ Uygulamalı Etik Araştırmaları Merkezi'nden ve verilerin toplanacağı üniversitelerden gerekli etik izinler alınmıştır. Takip edilen aşamalarda, araştırmacı

veri toplanacak üniversitedeki hocalar ile e-posta veya telefon yolu ile iletişim kurmuş ve anket uygulanması için araştırmacıya ayırabilecekleri ders saatleri konusunda gerekli ayarlamaları yapmıştır. Katılımcıların veri toplama araçlarını tamamlamaları yaklaşık olarak 30 dakika sürmüştür.

Verilerin analizi için, eksik ve aykırı değerlerin tespiti ve veri dağılımlarının normalliğinin kontrol edilmesi ve sağlanması gibi ön veri analizlerine ek olarak, betimsel ve çıkarımsal veri analizlerinden faydalanılmıştır. Ortalama, standart sapma, minimum ve maksimum değerleri, katılımcıların demografik özellikleri ve veri toplama araçlarının alt boyutlarından almış oldukları puanlar bakımından tanımlamak amacıyla kullanılmıştır. Veri toplama araçlarının alt boyutlarının belirlenmesinde ve ortaya çıkan faktör yapılarının geçerliliğinin test edilmesinde açıklayıcı ve doğrulayıcı faktör analizlerinden faydalanılmıştır. Her bir çevresel durum hikâyesi için ayrı ayrı uygulanan yol analizleri ise, çalışmanın araştırma sorularını cevaplamak için kullanılmıştır. Verilerin analizi için iki farklı istatistik paket programı kullanılmıştır. Ön veri analizleri, betimsel analizler ve açıklayıcı faktör analizleri için SPSS 21.0 kullanılırken, doğrulayıcı faktör analizleri ve yol analizleri için AMOS 21.0'den faydalanılmıştır.

Bulgular

Bu çalışmada, temel olarak, fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntüleri ve bu örüntülerin epistemolojik inançlar ve değerler ile ilişkisinin incelenmesi amaçlanmıştır. Bu bağlamda, ilgili kavramlara ait veriler nicel ölçekler üzerinden toplanmış ve araştırılmak istenilen ilişkiler öne sürülen yapısal eşitlik modelleri üzerinden test edilmiştir. Ön veri analizleri sonucunda, bazı katılımcıların ($N=22$) cevaplarının veri dosyasından çıkarılmasının veri dosyasını çıkarımsal analizlere daha uygun hale getireceği ve analizlerden elde edilen bulguların güvenilirliğini artıracığı görülmüştür. Dolayısıyla, araştırma sorularının

cevaplandırılması için uygulanan analizler 1502 öğretmen adayından toplanan veriler üzerinden yapılmıştır. Takip eden bölümlerde, katılımcıların veri toplama araçlarına vermiş oldukları cevapların betimsel ve çıkarımsal analiz sonuçları sunulmuştur.

Betimsel Analizler

Epistemolojik İnançlar. Katılımcıların epistemolojik inançlar envanterinin alt boyutlarına vermiş oldukları cevapların ortalama ve standart sapma değerleri incelendiğinde, çalışmaya katılan fen bilgisi öğretmen adaylarının bilginin kaynağı hakkındaki inançlarının diğer epistemolojik inançlara nazaran daha naif (az gelişmiş) olduğu görülmüştür ($Ort.OA = 3.79$, $SS_{OA} = .83$, $min.OA = 1.00$, $maks.OA = 5.00$). Bir başka deyişle, betimsel analizler katılımcıların bilginin kaynağını “her şeyi bilen otorite” olarak görmeye meyilli olduklarını göstermiştir. Katılımcıların bilginin yapısı/örgütlenmesi ile ilgili inançları ($Ort.SK = 3.25$, $SS_{SK} = .64$, $min.SK = 1.20$, $maks.SK = 5.00$) ve öğrenme üzerindeki denetim ile ilgili inançlarının da ($Ort.IA = 3.26$, $SS_{IA} = .71$, $min.IA = 1.00$, $maks.IA = 5.00$) istenilen düzeylerde olmadığı saptanmıştır. Öte yandan, katılımcıların bilginin kesinliği ($Ort.CK = 2.31$, $SS_{CK} = .71$, $min.CK = 1.00$, $maks.CK = 5.00$) ve öğrenmenin hızı ($Ort.QL = 2.04$, $SS_{QL} = .62$, $min.QL = 1.00$, $maks.QL = 4.33$) ile ilgili epistemolojik inançlarının görece daha gelişmiş olduğu görülmüştür.

Değerler. Betimsel analizler, çalışmaya katılan fen bilgisi öğretmen adaylarının “hayatlarını yönlendiren ilkeler olarak” en fazla önemi Schwartz’ın (1992, 1994) özaşkınlık ve muhafazacı yaklaşım değerlerine vermiş olduklarını göstermiştir ($Ort.ST_T = 5.75$, $SS_{ST_T} = .89$, $min.ST_T = 2.18$, $maks.ST_T = 7.00$). Öğretmen adaylarının yeniliğe açıklık (OC) değerlerine vermiş oldukları önemin ise özaşkınlık ve muhafazacı yaklaşım (ST_T) değerlerine verdikleri öneme oranla daha düşük, özgenişletim (SE) değerlerine vermiş oldukları öneme oranla daha yüksek olduğu saptanmıştır ($Ort.OC = 4.93$, $SS_{OC} = 1.18$, $min.OC = .60$, $maks.OC = 7.00$). Diğer taraftan, katılımcıların özgenişletim (SE) değerlerine yönelik verdikleri cevaplar

betimsel olarak incelendiğinde, öğretmen adaylarının genel olarak bu değerlere verdikleri önemin diğer değerlere görece daha az olmasının yanında ($Ort_{SE} = 4.06$, $SS_{OC} = 1.35$), bazı öğretmen adaylarının ilkelerine ters düştüğü ($min_{SE} = -1.00$, $maks_{SE} = 7.00$) gözlemlenmiştir.

Çevresel Ahlaki Muhakeme. Önceki bölümlerde belirtilmiş olduğu üzere, fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntüleri kendilerine sunulan dört farklı çevresel durum hikâyesi için ayrı ayrı incelenmiştir. Faktör analizleri her bir hikâye durumu için iki faktörlü bir yapı ortaya koymuştur. Elde edilen faktörler hikâyeden hikâyeye farklılıklar gösterse de, her bir hikâye için ortaya çıkan faktörlerden birinin diğerine göre daha çevre-merkezci sayılabileceği saptanmıştır. Faktörlerden alınan puanlar betimsel analizler yolu ile incelendiğinde, çalışmaya katılan fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerinin görece daha çok çevre-merkezci kaygılar üzerine yoğunlaşmış olduğu sonucuna varılabilir (Bk. Tablo G.2).

Tablo G.2

Çevresel Ahlaki Muhakeme Verilerinin Betimsel Analiz Sonuçları

Hikâye	Çevresel ahlaki muhakemenin odak	Ort.	SS	Min.	Maks.
Yürüyüş	Doğanın yararı	4.27	.56	1.57	5.00
	İnsan refahına yönelik tehditler	3.23	.89	1.00	5.00
Piknik	Doğanın yararı	4.40	.51	1.86	5.00
	İnsan refahına yönelik tehditler	3.57	.83	1.00	5.00
Balık tutmak	Ekolojik adalet	4.24	.57	2.00	5.00
	İnsanlar	3.66	.80	1.00	5.00
Gölet	Doğa	4.40	.57	1.67	5.00
	İnsanlar	4.26	.61	1.67	5.00

Not. Ort. = Ortalama değer, SS = Standart sapma, Min. = minimum değer, Maks. = maksimum değer

Benzer şekilde, katılımcıların her bir hikâye için “en çok katıldıkları” ifadeler incelendiğinde, adalet konusuna yoğunlaşmış olan çevre-merkezci ahlaki muhakeme türünün (çevre merkezci – adalet), bütün hikâyeler için en yüksek frekans değerinde sahip olduğu bulunmuştur (frekans aralığı: $f_{\text{piknik}} = 312$ (% 20.8) – $f_{\text{gölet}} = 453$ (%30.2)). Daha açık bir şekilde belirtmek gerekirse, çalışmaya katılan fen bilgisi öğretmen adayları hikâyelerde anlatılan ikilem durumlarını çevreci bir şekilde çözmeleri için kendilerini en çok motive edecek ahlaki hususun adalet konusu üzerine yoğunlaşmış çevre-merkezci endişeler olduğunu belirtmişlerdir.

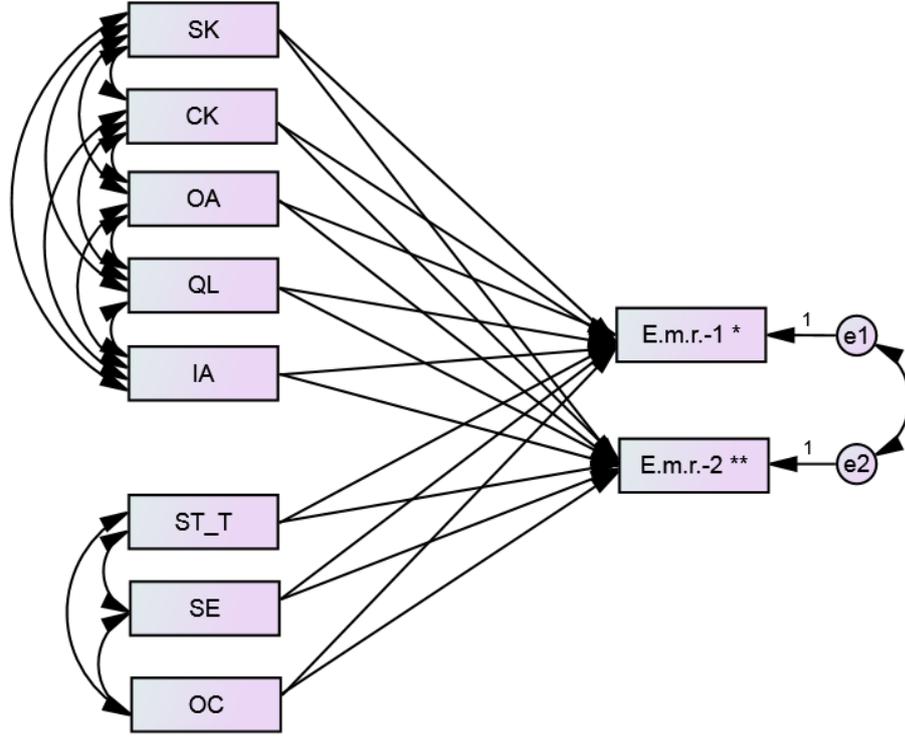
Çevresel durum hikâyelerine karşı sergilenen kaygılar bir bütün olarak ele alındığında, katılımcıların kaygı düzeylerinin “gölet” hikâyesi için en üst seviyede (Ort. = 4.33) olduğu görülmüştür. Katılımcıların diğer hikâyeler için sergilemiş oldukları ahlaki kaygıların ortalama değerleri “piknik” hikâyesi için 3.99, “balık tutmak” hikâyesi için 3.35 ve “yürüyüş” hikâyesi için 3.75 olarak hesaplanmıştır.

Yol Analizleri

Çalışmanın araştırma sorularının cevaplanması için kullanılan çıkarımsal analiz yöntemi olarak bir yapısal eşitleme modellemesi türü olan yol analizi kullanılmıştır. Bu yöntemle, hem her bir bağımsız değişken ve bağımlı değişken arasındaki ilişki karşılaştırmalı olarak incelenebilmiş, hem de bağımsız değişkenlerin, bir bütün olarak, bağımlı değişkenlerdeki varyansları ne ölçüde açıklayabildikleri analiz edilebilmiştir. Test edilen yapısal modeller, her bir çevresel ikilem durum hikâyesi için ayrı ayrı tanımlandığından, toplamda dört adet yol analizi uygulanmıştır. Analiz edilen modellerde bağımsız değişkenler (epistemolojik inanç ve değer boyutları) ortak iken, bağımlı değişkenler (çevresel ahlaki muhakeme boyutları) her hikâye için o hikâyeye ait veriler üzerinden tanımlanmıştır. Araştırmacılara sunduğu avantajlar nedeniyle (Byrne, 2001, 2010; Gallagher, Ting, & Palmer, 2008; Kline, 2011; Tabachnick & Fidell, 2007), model parametrelerinin tahmini için maksimum

benzerlik (maximum likelihood) yöntemi kullanılmıştır. Yol analizlerinin gerçekleştirilmesi için AMOS 21.0 istatistik paket programından faydalanılmıştır.

Çalışmada analiz edilecek yapısal modellerin tanımlanmasından önce, verilerin yol analizine uygunluğu test edilmiştir. Elde edilen sonuçlar, verilerin yol analizine uygun olduğunu, dolayısı ile elde edilecek sonuçların güvenilir şekilde yorumlanabileceğini göstermiştir. Modellerin AMOS programında tanımlanması aşamasında teorik uygunluğun yanında görgül/ampirik veriler (modifikasyon indeksleri (modification indices; MI) ve Beklenen Parametre Değişikliği (Expected Parameter Change; EPC) değerleri) temel alınmıştır. Bu aşamadan sonra elde edilen yapısal modeller Şekil G.2'deki gibidir. Şekilde de görüldüğü üzere, epistemolojik inançlar (SK, CK, OA, QL, IA) ve değerler (ST_T, SE, OC) katılımcıların çevresel ahlaki muhakeme örüntülerini tahmin etmek için modellere bağımsız değişkenler olarak dâhil edilmiştir. Şekildeki “E.m.r.-1” ve “E.m.r.-2” kısaltmaları, çevresel durum hikâyeleri için elde edilen çevresel ahlaki muhakeme boyutlarını simgelemektedir ve modellerin bağımlı değişkenlerini oluşturmuştur.



Şekil G.2. Çevresel durum hikâyeleri için analiz edilen yapısal modeller. * E.m.r. - 1 = çevresel ahlaki muhakeme 1, ** E.m.r. - 2 = çevresel ahlaki muhakeme 2.

Yol analizlerinden elde edilen uyum indeksleri, çalışmada öngörülmüş olan yapısal modellerin her bir çevresel durum hikâyesinin verileri ile iyi düzeyde uyum gösterdiğini ortaya koymuştur. Diğer bir deyişle, epistemolojik inançlar ve değerler çalışmaya katılan fen bilgisi öğretmen adaylarının kendilerine sunulan çevresel durum hikâyeleri karşısında sergiledikleri çevresel ahlaki muhakeme örüntülerini başarılı bir şekilde tahmin etmiştir. Analizlerden elde edilen model uyum indeksleri Tablo G.3 'de sunulmuştur.

Tablo G.3

Yol Analizlerinden Elde Edilen Model Uyum İndeksleri

Hikâye	χ^2	df	χ^2/df	GFI	AGFI	CFI	RMSEA	RMR	SRMR
Yürüyüş	230.58	15	15.37	.97	.89	.89	.10	.05	.06
Piknik	230.58	15	15.37	.97	.89	.90	.10	.05	.06
Balık tutmak	230.58	15	15.37	.97	.89	.90	.10	.05	.06
Gölet	230.58	15	15.37	.97	.89	.91	.10	.05	.06
Eşik değeri	-	-	≤ 5	\geq	$\geq .90$	\geq	$\leq .10$	$\leq .10$	$\leq .10$

Çevresel ahlaki muhakeme değişkenlerinin modeller tarafından açıklanan varyanslarına (R^2) bakıldığında, bu değerlerin % 4 ile %21 arasında değiştiği görülmüştür. Bu değer aralıkları etki büyüklüğü (effect size) bakımından açıklanan varyansların küçük ile orta derecede olduğunu göstermektedir (Cohen, 1988). R^2 değerleri daha yakından incelendiğinde, modellerin daha çevre-merkezci kaygılar içeren ahlaki muhakeme değişkenlerindeki (Doğanın yararı, Ekolojik adalet, Doğa) varyansları daha yüksek oranda açıklamış oldukları görülmüştür. Bu değişkenlerin açıklanan varyansları en düşük %10, en yüksek %21 olarak hesaplanmıştır. Modellerin bağımlı değişkenlerde açıkladıkları varyanslar (R^2) Tablo G.4'te verilmiştir.

Tablo G.4

Modellerin Bağımlı Değişkenlerde Açıkladıkları Varyans Değerleri

Hikâye	Bağımlı Değişken	R^2
Yürüyüş	Doğanın yararı	.21
	İnsan refahına yönelik tehditler	.04
Piknik	Doğanın yararı	.19
	İnsan refahına yönelik tehditler	.08
Balık tutmak	Ekolojik adalet	.16
	İnsanlar	.07
Gölet	İnsanlar	.10
	Doğa	.15

Modellerde bağımlı değişkenler ile bağımsız değişkenler arasındaki ilişkiler beta katsayıları (β) üzerinden yorumlanmıştır. Elde edilen bulgular, çevresel ahlaki muhakeme örüntülerinin epistemolojik inanç ve değer boyutları ile ilişkilerinin istatistiksel olarak anlamlılık, yön (pozitif veya negatif yönde ilişkiler) ve büyüklük bakımından yol analizinin yapıldığı çevresel ikilem durum hikâyesine bağlı olarak değişebildiğini göstermiştir. Ek olarak, katılımcıların kaygılarının odak noktalarının da (modellerin bağımlı değişkenleri) bu ilişkiler üzerinde etkili olabildiği gözlemlenmiştir. Örneğin, özgenişletim değerleri (SE) ve öğrenmenin hemen gerçekleşeceğine yönelik epistemolojik inançların (QL) çevre-merkezci kaygılar içeren çevresel ahlaki muhakeme değişkenleri ile ilişkileri eksi yönlü (negatif) iken, aynı değer ve epistemolojik inançlar katılımcıların kendileri ve diğer insanlar üzerine yoğunlaşmış olan kaygıları ile pozitif yönde ilişkili bulunmuştur. Diğer taraftan, özaşkınlık ve muhafazacı yaklaşım değerlerinin toplanmış olduğu değer değişkeni (ST_T) ve bilginin kaynağını otorite olarak görmeye yönelik epistemolojik inanç değişkeni (OA), modelin test edildiği çevresel durum hikâyesinden bağımsız olarak, bütün çevresel ahlaki muhakeme örüntüleri ile istatistiksel olarak anlamlı ve pozitif yönde ilişki sergilemiştir. Yol analizleri üzerinden hesaplanan beta katsayıları (β) karşılaştırmalı olarak incelendiğinde, çalışmaya katılan fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerinin açıklanmasına en büyük katkıyı ST_T değerlerinin yapmış olduğu görülmüştür.

Tartışma

Bu çalışmadan elde edilen bulgular temel olarak, (i) epistemolojik inanç, değer ve çevresel ahlaki muhakeme örüntülerinin alt boyutları, (ii) çalışmaya katılan fen bilgisi öğretmen adaylarının bu alt boyutlar bağlamında betimlenmesi, (iii) çevresel ahlaki muhakeme örüntülerinin epistemolojik inançlar ve değerler ile ilişkileri ve öne sürülen yol analizi modellerinin fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerini tahmin etmedeki başarısı şeklinde incelenebilir. İlerideki

paragraflarda, çalışmanın bulguları bu bağlamda yorumlanacak ve bulguların eğitim araştırmaları ve uygulamalarına yönelik olası katkıları tartışılacaktır.

Çalışmada kullanılan ölçeklerin adaptasyonu, çalışmanın önemli bir kısmını oluşturmuştur. Uygulanan açımlayıcı ve doğrulayıcı faktör analizlerinin de katkılarıyla, Türkiye’de bundan sonraki çalışmalarda kullanılabilir, güvenilirliği ve geçerliliği test edilmiş veri toplama araçları geliştirilmeye çalışılmıştır. Ancak, elde edilen ölçeklerin psikometrik özelliklerinin farklı örneklemelerden toplanan veriler üzerinden test edilmesi için daha fazla çalışmaya ihtiyaç vardır. Bununla birlikte, bu çalışma sonucunda ortaya çıkan bulgular fen bilgisi öğretmen adaylarının epistemolojik inançları, değerleri ve çevresel ahlaki muhakeme örüntülerinin yapılanması ile ilgili önemli ipuçları ortaya koymuştur. Böylelikle, fen bilgisi öğretmen adayları çalışmada araştırılan kavramlar bakımından betimlenebilmiştir.

Faktör analizleri, çalışmaya katılan fen bilgisi öğretmen adaylarının bilgi ve bilgi edinme (öğrenme) ile ilgili inançlarının Schommer’in (1990, 1994) epistemolojik inançlar modelinde öne sürüldüğü gibi beş boyut altında yapılandığını göstermiştir. Bu boyutlar, kişilerin bilginin kaynağı, kesinliği, yapısı, öğrenme üzerindeki denetim ve öğrenmenin hızı ile ilgili inançları olarak özetlenebilir. Katılımcıların, Epistemolojik İnançlar Envanterine vermiş oldukları cevaplar incelendiğinde, çalışmanın örneklemini oluşturan fen bilgisi öğretmen adaylarının epistemolojik olarak en gelişmiş inançlarının öğrenmenin hızı ile ilgili olduğu görülmüştür ($Ort_{QL} = 2.04$). Diğer bir deyişle, katılımcılar, öğrenmeyi hemen gerçekleştiren bir eylem olarak görmemiş; belli bir çaba gerektiren bir süreç olarak algılamışlardır. Betimsel analizlerden elde edilen sonuçlar, çalışmaya katılan öğretmen adaylarının epistemolojik olarak en zayıf oldukları boyutların ise bilginin kaynağı ile ilgili olduğunu ortaya koymuştur ($Ort_{OA} = 3.79$). Bu bulgu, çalışmaya katılan öğretmen adaylarının bilginin edinilmesi ve öğrenmenin gerçekleşebilmesi için bir otoriteye ihtiyaç duyduklarının göstergesi olarak yorumlanabilir. Elde edilen veriler, kişilerin deneyimledikleri eğitim süreçlerinin ve buldukları toplum yapısının epistemolojik

inançlara olan etkisini gösteren çalışmaları destekler niteliktedir. Örneğin, öğretmen adaylarının öğrencilik yıllarında deneyimlemiş oldukları öğretmen-merkezci eğitim, onların bilginin kaynağının otorite (örn., öğretmen) olarak algılamaları yolunda etkili olmuş olabilir (Yılmaz-Tüzün & Topçu, 2008). Katılımcıların bilgi edinmenin hızı ile ilgili inançlarını da buldukları toplumun eğitim sistemi ve kültürü ile açıklamak mümkün görünmektedir. Hofer (2008) ve Chan ve Elliot (2004), öğrenmenin gerçekleşmesi için gereken çabanın ve yoğun çalışmanın bazı kültürlerde öğrenme sürecinin kendisi ile bağdaştırıldığını dile getirmişlerdir. Türkiye'nin sınava dayalı eğitim sistemi ve bu istem içerisinde başarılı olabilmek için gerekli olan yoğun çaba da göz önüne alındığında, araştırmacıların bahsettikleri durumun bu çalışmanın katılımcıları için de geçerli olabileceği düşünülmektedir.

Katılımcıların değerler ölçeğine vermiş oldukları cevapların faktör analizleri sonucunda kendilerine sunulan değerler listesinin üç boyutta yapılandığı görülmüştür. Buna göre, çalışmaya katılan öğretmen adayları Schwartz (1992, 1994) değer kuramındaki özaşkınlık ve muhafazacı yaklaşım değerlerini aynı boyut içerisinde değerlendirmiş; yeniliğe açıklık ve özgenişletim değerlerini ise bu değerlerden ayrı olarak iki farklı boyut içerisinde ele almışlardır. Faktör analizler sonucunda elde edilen bu bulgu, Schwartz'ın kuramında öne sürdüğü değerler arası ilişkiyi destekler niteliktedir. Daha önce de belirtildiği gibi, Schwartz değer kuramında değerler arasındaki ilişkiler dairesel bir yapı üzerinde betimlenmiştir. Bu yapı içerisinde, birbirleriyle benzer motivasyona sahip olan değerler birbirlerine yakın; birbirleriyle örtüşmeyen veya karşıt motivasyona sahip olan değerler ise dairesel yapının farklı uçlarında konumlandırılmıştır. Şekil 2.1'de görüldüğü gibi özaşkınlık ve muhafazacı yaklaşım değerlerinin aynı faktör içerisinde toplanması, değerlerin altında yatan motivasyonlar bakımından beklenebilecek bir durumdur. Çalışmaya katılan fen bilgisi öğretmen adayları, elde edilen üç değer buy-tundan almış oldukları puanların ortalama değerleri incelendiğinde, hayatlarını yönlendiren ilkeler olarak en fazla değeri özaşkınlık ve muhafazacı yaklaşım değerlerinin birleştiği değer boyutuna ($Ort_{ST_T} = 5.75$), en az değeri ise özgenişletim ($Ort_{SE} =$

4.06) deęerlerine vermiř oldukları grlmřtr. alıřmada ortaya ıkan faktr yapılanması ve katılımcıların bu deęerlere verdikleri nem, bireylerin iinde buldukları kltrn ve sosyal evrenin deęerler zerindeki olası etkisi (Struch ve ark., 2002) erevesinde yorumlanabilecek olsa da, bu konu ile ilgili daha geerli ve gvenilir yorumların yapılabilmesi iin alıřmalara ihtiya vardır.

Epistemolojik inanlar ve deęerler gibi, evresel ahlaki muhakeme rntlerine ynelik toplanan veriler de aımlayıcı ve doęrulamayı faktr analizleri ile incelenmiřtir. Elde edilen sonular, her bir evresel durum hikyesi (yryř, piknik, balık tutmak, glet) iin iki faktrl bir yapı ortaya koymuřtur. Ancak, elde edilen faktr yapılarının ierikleri hikyeden hikyeye farklılık gstermiřtir. řyle ki, yryř ve piknik senaryolarında kiřisel ıkar ve insan refahı zerinde yoęunlařan kaygılar tek bir faktrde toplanmıřtır. Balık tutmak senaryosunda, bu faktre estetik kaygılar da dhil olmuřtur. te yandan, alıřmanın katılımcıları, glet senaryosu iin evre-merkezci kaygıları dięer btn kaygılardan ayrı tutmuřtur ve bu hikye iin ben-merkezci ve insan-merkezci kaygılar, altında yatan sebeplerden baęımsız olarak, tek bir faktrde toplanmıřtır. Bu durum, kiřilerin karřılařtıkları ikilem durumlarının ieriklerinin bu durumlar karřısında sergiledikleri ahlaki muhakeme rntleri zerinde etkili olduęunu gsteren farklı alıřmaları (rn., Kortenkamp & Moore, 2001; Rest ve ark., 1999, 2000) destekler niteliktedir. Ek olarak, hikyeler karřısında sergilenen ahlak muhakeme rntlerindeki farklılıklar, katılımcıların hikyelerin getięi ortamların ne kadar doęal olduklarına ynelik algılarındaki farklılıklardan da kaynaklanmış olabilir (Persing, 2006). rneęin, alıřmaya katılan fen bilgisi ęretmen adayları glet hikyesinde tasvir edilen kamp alanını daha el deęmemiř, doęal bir ortam olarak algıladıkları iin, bu hikyeye ynelik evre-merkezci ahlaki kaygıları dięer kaygılardan ayrılmıř ve tek bařına tek bir faktrde toplanmıř olabilir. te yandan, piknik senaryosunda tasvir edilen piknik alanı katılımcılara ok da doęal olmayan bir ortam olarak gelmiř ve katılımcıların bu hikyeye ynelik evre-merkezci kaygıları dięer ahlaki kaygıları arasında yer bulmuř olabilir.

Çalışmada öngörülen çevresel ahlaki muhakeme örüntüleri ile epistemolojik inançlar ve değerler arasındaki ilişkilere bakıldığında, çevresel surum hikâyelerinin içeriklerinin öngörülen bu ilişkiler üzerinde de etkili olduğu sonucuna varılabilir. Örneğin, öğrenme üzerindeki denetim (IA) ile ilgili epistemolojik inançların çevresel ahlaki kaygılar ile ilgili ilişkileri yürüyüş hikâyesi için istatistiksel olarak anlamlıyken, piknik senaryosu için istatistiksel olarak anlamsız bulunmuştur. Benzer durumlar, yeniliğe açıklık (OC) ve özgenişletim (SE) ile çevresel ahlaki muhakeme örüntüleri arasındaki ilişkilerde de gözlemlenmiştir. Bu bulgular, çalışmaya katılan fen bilgisi öğretmen adaylarının her bir çevresel durum hikâyesini kendi içerisinde değerlendirmiş oldukları şeklinde yorumlanabilir. Bu durumda, öğretmen adaylarının ahlaki muhakeme süreçlerinde, kendilerine sunulan ikilem durumuna bağlı olarak, farklı epistemolojik inançlar ve değerler daha baskın çıkmış olabilir.

Ek olarak, çevresel durum hikâyeleri karşısında sergilenmiş olan çevresel ahlaki muhakeme örüntülerinin odağını oluşturan kaygıların da çalışmanın değişkenleri arasında öngörülen ilişkileri etkilemiş olduğu görülmüştür. Analiz edilen yol modellerinde, özgenişletim değerleri (SE) ve öğrenmenin hızı ile ilgili epistemolojik inançlar (QL) için hesaplanan standartlaştırılmış yol katsayıları bu durumu örneklendirmektedir. Sözü edilen değişkenlerin çevreye odaklanan ahlaki kaygılar ile ilişkileri (beta katsayıları) eksi yönlü iken, aynı değişkenler ben-merkezci ve insan-merkezci ahlaki kaygılar ile artı yönde bir ilişki sergilemiştir. Diğer bir deyişle, öğrenmenin hemen gerçekleştiğine inanan ve güç ve başarı gibi özgenişletim değerlerine daha fazla önem veren fen bilgisi öğretmen adayları, çevresel ahlaki muhakeme örüntüleri bakımından çevre-merkezci olmaktan ziyade ben-merkezci veya insan-merkezci olmaya yatkın bulunmuşlardır. Öte taraftan, özaşkınlık ve muhafazacı yaklaşım değerleri (ST_T) ile bilginin kaynağına yönelik epistemolojik inançlar (OA), çevresel ikilem durum hikâyesinden bağımsız olarak bütün çevresel ahlaki muhakeme değişkenleri ile pozitif yönlü ilişkili bulunmuştur. Çevresel ahlaki muhakeme örüntüleri ile epistemolojik inançlar ve değerler arasındaki ilişkilerin dinamik yapısını ortaya koyan bu bulgular, eğitim araştırmaları

ve uygulamalarında farklı örneklerin kullanılmasının önemini ortaya koymaktadır. Araştırma ve uygulamalarda farklı örneklerin kullanılması, kişilerin çevresel durumların içerisinde doğrudan veya dolaylı olarak var olan ahlaki ikilem durumları çok yönlü bir şekilde inceleyebilmelerine olanak sağlayacaktır. Araştırmacılar ve eğitimciler açısından bu durum çevresel ikilem durumlarının çözümlenmesinde etkili olabilecek etmenlerin anlaşılması ve geliştirilmesi için önemli fırsatlar yaratacaktır.

Bu çalışmada, araştırmacı tarafından öngörülen ve yol analizleri ile test edilen modeller fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerini başarılı bir şekilde tahmin etmiştir. Ancak, bağımlı değişkenlerin (çevresel ahlaki muhakeme örüntüleri) modeller tarafından açıklanabilen toplam varyanslarının (R^2) etki büyüklüğü (effect size/practical significance) bakımından küçük veya orta düzeyde olduğu saptanmıştır (Cohen, 1998). Bu durum, kişilerin çevresel ahlaki muhakeme örüntülerinde açıklanabilen varyansın epistemolojik inançlar ve değerlere ek olarak başka değişkenlere ve/veya ilişkilere bağlı olarak artırılabilceğini ortaya koymaktadır. Dolayısıyla ileriki çalışmalarda araştırmacılara bu yönde geliştirilmiş yeni modeller öngörmeleri ve öngörülen modelleri farklı örneklemelerden toplanan veriler ile test etmeleri tavsiye edilmektedir.

Çevre eğitimi bakımından ele alındığında, bu çalışma etik ve ahlak kavramlarının eğitim program ve uygulamalarının önemli bir kısmını oluşturması gerektiği vurgusu üzerinde kurgulanmıştır. Türkiye’de okullarda öğrencilere sunulan çevre eğitimi adı altında ayrı bir ders olmadığı ve çevre ile ilgili konuların yoğun olarak fen bilgisi eğitimi müfredatında yer bulduğu durumundan (MEB, 2003, 2013) yola çıkarak, çalışmanın örneklemini ileride fen bilgisi eğitimi programlarının asıl uygulayıcıları olacak olan fen bilgisi öğretmen adayları oluşturmuştur. 2013 yılında revize edilen fen bilgisi eğitim programı incelendiğinde, bu çalışmanın odak noktasını oluşturan ahlaki muhakeme kavramının fen okuryazarlığı için gerekli olan alt boyutların altında yer bulduğu görülmektedir (Fen-teknoloji-toplum-çevre

ilişkileri öğrenme alanı, sosyobilimsel konular alt alanı, MEB, 2013, syf. vi). Bu durumda, fen bilgisi öğretmen adaylarının çevresel ahlaki muhakeme örüntülerini ve bu örüntülerin ilişkili olduğu değişkenleri incelemek küresel ölçekte literatüre katkıda bulunmasının yanı sıra, ülkemiz için ayrı bir öneme sahiptir.

Bu bağlamda ele alındığında, yapılan çalışma çevre ile ilgili eğitim program ve uygulamalarında kişilerin çevresel ahlaki muhakeme örüntüleri ile ilişkili olduğu bulunan epistemolojik inançların ve değerlerin ilgili programlarda açık bir şekilde ele alınması gerektiğini ortaya koymuştur. Bunu gerçekleştirebilmek için, öğretmenlerin öğrencilere olabildiğince farklı çevresel durumlar sunmaları ve öğrencilerin çevresel durumların içerisinde açık veya gizli şekillerde var olan ahlaki ikilem durumlarını fark etmeleri için gerekli eğitim ortamlarını sağlamaları gerekmektedir. Ek olarak, öğretmenler öğrencilerin çevresel konular içerisinde var olan ikilem durumlarının çözümüne yönelik farklı yaklaşımlar olabileceğini ve bu ikilem durumlarının çözümü ile ilişkili olabilecek çok yönlü değişkenleri uygun eğitim yöntemleri ile (örn., akran ve sınıf tartışmaları, probleme dayalı öğrenme, vb.) deneyimleyerek fark etmelerini sağlamalıdır. Öğretmenlerin, eğitim programlarının genel başarındaki önemleri göz önünde bulundurulduğunda, bahsedilen yöntemlerin başarıya ulaşılabilmesi için bu uygulamalara öğretmen eğitiminden başlanması doğru olacaktır. Bu çalışmanın bulguları, ilgili uygulamalar için yön gösterici olabilecek niteliktedir.

APPENDIX H

TEZ FOTOKOPİSİ İZİN FORMU

ENSTİTÜ

Fen Bilimleri Enstitüsü	<input type="checkbox"/>
Sosyal Bilimler Enstitüsü	<input checked="" type="checkbox"/>
Uygulamalı Matematik Enstitüsü	<input type="checkbox"/>
Enformatik Enstitüsü	<input type="checkbox"/>
Deniz Bilimleri Enstitüsü	<input type="checkbox"/>

YAZARIN

Soyadı : Tuncay Yüksel
Adı : Büşra
Bölümü : İlköğretim

TEZİN ADI (İngilizce) : Environmental moral reasoning patterns of pre-service science teachers and their relationships to epistemological beliefs and values

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 bir (1) yıl süreyle fotokopi alınamaz.

TEZİN KÜTÜPHANEYE TESLİM TARİHİ:

APPENDIX I

CURRICULUM VITAE

PERSONAL INFORMATION

Surname, Name: Tuncay-Yüksel, Büşra

Nationality: Turkish (TC)

Date and Place of Birth: October 18, 1984; Ankara

Marital Status: Married

Phone: +90 312 210 7508

e-mail: busratuncay84@hotmail.com

EDUCATION

2010 - 2016

Doctorate:

Middle east Technical University,
Department of Elementary Education
CCPA: 4.00 / 4.00

2007- 2010

Master's Degree:

Middle East Technical University,
Department of Elementary Science and Mathematics
Education CCPA: 3.94 / 4.00

2002-2007

B.S.-Major:

Middle East Technical University,
Elementary Science Education
CCPA: 3.66 / 4.00 (Ranking the second)

2004-2007

B.S.-Minor:

Middle East Technical University
Biological Sciences Department,
Biology Program
CCPA:3.73/4.00

WORK EXPERIENCE

- 2013 - 2014 Visiting scholar at University of South Florida, Department of Teaching and Learning (Invited by Prof. Dr. Dana L. Zeidler)
- 2010 - present NARST (National Association for Research in Science Teaching) proposal assessor
- 2010 - 2012 Co-editor of the International Electronic Journal of Environmental Education (IEJEE-Green)
- 2008 - present Research Assistant in Education Faculty of Middle East Technical University
- 2005 - 2007 Voluntary teacher in 'Gönüllü Eğitim' Project organized by METU Alumni Association to give education for poor children

FOREIGN LANGUAGES

Advanced English

AWARDS & SCHOLARSHIPS

- Council of Higher Education (YOK) – Visiting Scholar scholarship (December, 2013 – December, 2014)
- Scientific and Technological Research Council of Turkey (TUBITAK) – Publication Incentive Award (July, 2012)
- European Educational Research Association (EERA) – ECER 2012 Conference Bursary for Emerging Researchers
- National Association for Research in Science Teaching (NARST) – NARST 2011 International Committee Scholarship
- Middle East Technical University Foundation of Prof. Dr. Mustafa Parlar, Thesis of the Year Award (For the thesis: Tuncay, B. (2010). *Moral reasoning of pre-service science teachers toward local and non-local environmental problems*. Unpublished master's thesis, Middle East Technical University, Ankara, Turkey)
- Scientific and Technological Research Council of Turkey (TUBITAK) – Scholarships for Master's and Doctorate degrees (2007 to present)
- Turkish Government Scholarship for Higher Education
- Dean's High Honor List at minor and major programs

PROJECTS

- 2008 – 2009 Environmental Moral Reasoning Patterns of University students
[Üniversite Öğrencilerinin Çevresel Konular Üzerindeki Etik
Uslamlama Örüntüleri]. Middle East Technical University. (Grant
no.: BAP-05-06-2009-04)

COURSES ASSISTED

- ELE221 Instructional Principles and Methods
- ELE224 Instructional Planning and Evaluation
- ELE225 Measurement and Assessment
- ELE310 Community Service
- ELE331 Laboratory Applications in Science I
- ELE 332 Laboratory Applications in Science II
- ELE420 Practice Teaching in Elementary Education
- ELE440 Science, Technology, and Society
- ELE464 Learning and Teaching of Ecology Concepts
- ELE477 Laboratory Applications in Environmental Education
- ELE603 Advanced Educational Research
- ESME509 Educational Inquiry

ACADEMIC EVENTS ATTENDED

- “Socioscientific Issues in Science Education – Teaching and Teacher Education” Half-day Symposium [Fen Eğitiminde Sosyobilimsel Konular – Öğretim ve Öğretmen Eğitimi]. December 18, 2015. Bogazici University, Istanbul.

PUBLICATIONS

- Tuncay-Yuksel, B., Yılmaz-Tuzun, O., & Teksoz, G. (2015). Effects of gender and grade level on environmental moral reasoning patterns. *Hacettepe University Journal of Education*, 30(2), 137-150.
- Tuncay, B. (2013). Environmental education teaching self-efficacy. *Mediterranean Journal of Educational Research*, 14a, 396-401.
- Tuncay, B., Yılmaz-Tüzün, Ö., & Tuncer Teksoz, G. (2012). Moral reasoning patterns and influential factors in the context of environmental problems. *Environmental Education Research*, 18(4), 485-505. doi: 10.1080/13504622.2011.630576
- Tuncay, B., Yılmaz-Tuzun, O., & Tuncer-Teksoz, G. (2011). The relationship between environmental moral reasoning and environmental attitudes of pre-service science teachers. *International Electronic Journal of Environmental Education*, 1(3), 167-178.
- Tuncay, B., & Yılmaz-Tüzün, Ö. (2011). İlköğretim fen ve teknoloji öğretmen adaylarının çevresel kaygı düzeyleri [Environmental concern levels of pre-service science teachers]. *E-Journal of New World Sciences Academy*, 6(1), 778-782.
- Tuncay, B., & Yılmaz-Tuzun, O. (2010). University students' moral reasoning patterns toward environmental moral dilemmas. In G. Cakmakci & M. F. Tasar (Eds.), *Contemporary science education research: Scientific literacy and social aspects of science* (pp. 185–189). Ankara, Turkey: Pegem Akademi.
- Tuncay, B., Yılmaz-Tüzün, O., & Teksoz, G. (2010). Moral reasoning patterns of pre-service science teachers toward local and non-local environmental problems. In S. Dolinsek, & T. Lyons (Eds.), *The XIV International Organization for Science and Technology Education Symposium (IOSTE) Conference Proceedings* (pp.1161-1167), Bled, Slovenia: IRI UL, Institute for Innovation and Development of University of Ljubljana

PAPERS PRESENTED AT NATIONAL & INTERNATIONAL CONFERENCES

- Tuncay-Yuksel, B., & Yılmaz- Tuzun, O. (2015, April). *Environmental moral reasoning in outdoor recreation contexts*. Paper presented at IOSTE Eurasia Regional Symposium & Brokerage Event Horizon 2020, Istanbul, Turkey, pp.85-86 (ISBN: 978-605-355-391-5)
- Tuncay-Yuksel, B., Yılmaz-Tuzun, O., & Zeidler, D. L. (2015, April). *An adaptation study of the epistemic beliefs inventory with Turkish pre-service*

- science teachers*. Paper presented at NARST: A Worldwide Organization for Improving Science Teaching and Learning through Research, Chicago, IL, USA, pp. 466-467.
- Tuncay, B., Yılmaz-Tuzun, O., & Teksoz, G. (2013, April). *Environmental moral reasoning patterns of pre-service science teachers and correlated factors*. Paper presented at NARST: A Worldwide Organization for Improving Science Teaching and Learning through Research, Rio Grande, Puerto Rico, USA, p. 112.
- Tuncay, B. (2012, September). *Environmental education teaching self-efficacy*. Poster presented at New Trends on Global Education Conference (p.69), Kyrenia, North Cyprus.
- Tuncay, B. (2012, September). *The relationship between fears of and attitudes toward stray dogs in a university campus*. Paper presented at the European Conference on Educational Research (p.46), Cádiz, Spain.
- Tuncay, B., Yılmaz-Tüzün, Ö., & Teksöz, G. (2012, September). *Views of Pre-Service Science Teachers on Environmental Uses*. Paper presented at Applied Education Congress (p.99), Ankara, Turkey.
- Tuncay, B., & Kahraman, C. G. (2011, September). *Perceived needs of research assistants regarding their working conditions*. Paper presented at the European Conference on Educational Research, Berlin, Germany. Retrieved from http://www.eera.de/ecer-programmes/conference/ecer-2011/contribution/1736/?no_cache=1&cHash=c7571f3fa2
- Tuncay, B., Yılmaz-Tuzun, O., & Tuncer-Teksoz, G. (2011, April). *How do pre-service science teachers perceive local and non-local environmental problems?* Paper presented at the National Association for Research in Science Teaching (NARST) Annual International Conference (pp.98-99).Orlando,Florida, USA.
- Tuncay, B. & Yılmaz-Tüzün, Ö. (2010, September). *İlköğretim fen ve teknoloji öğretmen adaylarının çevresel kaygı düzeyleri [Environmental concern levels of pre-service science teachers]*. Paper presented at 19.Ulusal Eğitim Bilimleri Kurultayı, Nicosia, North Cyprus, pp.217-218.
- Tuncay, B., Yılmaz-Tüzün, Ö., & Teksöz, G. (2010, September). *Fen bilgisi öğretmen adaylarının çevreye yönelik tutumları ile etik usamlama örüntüleri arasındaki ilişki [The relationship between pre-service science teachers' environmental attitudes and moral reasoning patterns]*. Paper presented at the IX. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Buca, İzmir, Turkey, p. 145.

- Tuncay, B., Yılmaz-Tüzün, Ö., & Teksöz, G. (2010, June). Moral reasoning patterns of pre-service science teachers toward local and non-local environmental problems. Paper presented at the *XIV International Organization for Science and Technology Education Symposium (IOSTE)* (pp.1161-1167). Bled, Slovenia.
- Adibelli, E., Cihangir, C. G., Tuncay, B., & Yılmaz-Tüzün, Ö. (2009, November). Fen ve teknoloji öğretmen adaylarının genel ve özel çevresel kaygılarının karşılaştırılması: Bir araç olarak bilişim teknolojileri [Comparison of science and technology teachers' general and specific environmental concerns: Information technology as a tool]. Paper presented at *Fen ve Çevre Eğitiminde Son Gelişmeler Sempozyumu*, Giresun, Turkey, p.70.
- Tuncay, B., Yılmaz-Tuzun, O., & Cihangir, G. C. (2009, April). *An investigation of gender effect on university students' environmental reasoning patterns toward environmental moral dilemmas*. Paper presented at the National Association for Research in Science Teaching (NARST) Annual International Conference (p. 303). California, USA.
- Tuncay, B., & Yılmaz-Tuzun, O. (2009, August). *University students' moral reasoning patterns toward environmental moral dilemmas*. Paper presented at European Science Education Research Association Conference (ESERA), Istanbul, Turkey, p.211.
- Tuncay, B., Yılmaz-Tuzun, O., & Teksoz, G. (2009, July). *Pre-service teachers' moral reasoning toward environmental dilemmas: Effect of dilemma topic and information enhancement*. Paper presented at the Sixteenth International Conference on Learning, Barcelona, Spain.
- Cihangir, C. G., Tuncay, B., Teksoz-Tuncer, G., Yılmaz-Tuzun, O., Ozturk, G., & Adibelli, E. (2008, September). *Pre-service teachers' understanding about global warming and ozone layer depletion: A concept map exercise*. Paper presented at XIII. International Organization for Science and Technology Education Symposium (IOSTE), İzmir, Turkey, pp.1218-1227. (ISBN 978-605-5829-16-2)
- Ozturk, G., Adibelli, E., Teksoz-Tuncer, G., Yılmaz-Tuzun, O., Cihangir, C. G., & Tuncay, B. (2008, September). *The relationships between pre-service science teachers' environmental attitude and behavior and epistemological beliefs*. Paper presented at XIII. International Organization for Science and Technology Education Symposium (IOSTE), İzmir, Turkey, pp.161-170. (ISBN 978-605-5829-16-2)

Tuncay, B., Cihangir, C. G., Adıbelli, E., Yılmaz-Tüzün, Ö., & Teksöz-Tuncer, G. (2008, August). *Fen ve teknoloji dersi öğretmen adaylarının bilişim teknolojisi ve çevre ilişkisine yönelik görüşlerinin belirlenmesi [Investigating pre-service science and technology teachers' views on the relationship between information technology and environment]*. Paper presented at the VIII. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi, Bolu, Turkey, p.80. (ISBN 978-605-5829-16-2)