The Investigation of Environmental Risk Perception and Attitudes Towards the Environment in Secondary School Students

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ABSTRACT
In the study, secondary school students' perceptions of environmental risk perceptions and their attitudes towards the environment were investigated. The study was conducted on 1003 secondary school students from Ankara, Turkey. Survey method is used in this study which is a descriptive research. To determine state of students' environmental risk perception the Environmental Appraisal Inventory (EAI) was used. New Ecological Paradigm (NEP) scale was used to determine student attitudes towards the environment. Multivariate analysis (MANOVA) has been used to determine whether class, school type and gender makes a difference in the risk perceptions. The relationship between environmental risk perceptions and environmental approaches were determined the Pearson correlation coefficient. In the MANOVA test, it was determined that the genders, school type and class levels showed significant difference in terms of scores obtained from the EAI scale.

INTRODUCTION
The dominant social structure in the world creates and shapes new environmental problems. In the history of humanity, human intervention in nature has never reached as large a scale as it is now. Humans have now become a fundamental and decisive factor in the system of the earth. Human activities cause global environmental changes which humans suffer from. Hazards that affect the environment can be either human-induced, such as technological risks, or an act of nature, such as volcanic eruptions or meteorites. There are two types of human-induced global environmental changes. The first type can be directly effective on a global scale, for example, on oceans or the atmosphere. The second type involves the accumulation of regional changes that cause a global impact; for example, though it is local, the destruction of a forest area as a habitat for a large number of species can be effective on a global scale as it will cause a substantial portion of all species in the world to disappear (Turner et al., 1990). Certain environmental problems that are influential today generally include the greenhouse effect or global warming, the depletion of ozone layer, hazardous materials and wastes, the degradation of water resources and wetlands, the destruction of forests, urbanization, and population growth. Environmental problems that arise as human intervention in nature increases have brought about risks that threaten the life on earth. In this regard, risk can be considered a social structure of modern society. Risk perception that is the main component of risk analysis is most often used in the context of natural hazards and threats to the environment or health (WHO, 2013). According to Ulrich Beck who introduced the concept of risk society in 1992, modern societies have been occupied in identifying and managing risks for a long time (Zwick & Renn, 2002). Risk here refers to the likelihood of the undesired side effects of an action or an event (Renn, 2003). Risks are also associated with incidents that have undefined origins and signs (Karger & Wiedemann 1996). Unlike the point of view of science and technology, the perception of risks by non-experts is not objective (Karger & Wiedemann, 1996; Meili, 2005). Risk perception refers to the evaluation and adoption of sensory perceptions or information about risks and hazards in an individual's mind. Experts usually equate a risk with the expected average loss (damage) per unit of time. However, non-experts perceive risks as a complex, multidimensional phenomenon that has a decisive impact on the perceived risk size in case of risky situations and in which even the subjective expectation of loss (damage) plays a secondary role (Renn, 2003). The factors of risk perception for non-experts include the following (Slovic 1987; Renn, 2003; Bennet & Calman, 2010): the identification of risk sources and the causes of risk (natural or anthropogenic), the possibility of dominance and personal control, the familiarity with risk sources, the willingness to take risks, the likelihood of a risk source causing a disaster, the objective distribution effect of benefit and risk, the reversibility of risk results, personal experiences with technology and nature, and exposure. Sandman has formulated the risk perception as Perceived Risk (R) = Hazard (H) + Outrage (O). Risk perception is the subjective judgment of people about the features and intensity of a risk. It is composed of two components: hazard and outrage. Hazard (technically and scientifically) refers to the combination of the likelihood of a particular event (e.g. an increase in cancer rate, a catastrophic accident) and the

severity of its consequence. Outrage (the subjective component) focuses on an opposite situation of the risk dimension. This category includes the nature management of risk. The basic components of outrage factors include "the involuntary nature of the issue, the artificial (industrial) nature of the risk, the use of cover-up or silence, attempts to engage message recipients to persuade them about the issue, the occurrence of accidents, double truths around the issue, conflicts of interest, contradictory messages and inequitable distribution of risk". Anantho (2008) defines risk perception as the subjective judgment of individuals about the seriousness and characteristics of a risk. since the 1970s, research on risk perception has focused on why people perceive risks differently (Chauvin, Hermand & Mullet, 2007) and has been conducted on the basis of different approaches and models. Research based on a techno-scientific approach (Marks, Martin & Zadoroznyj, 2008) considers risks to be identifiable and measurable and associates risk perception with the visible, familiar, clear, controllable, forgettable, voluntary and rapidly observable nature of risks. The psychometric model also accepts that risk perception is determined by risk characteristics as it is suggested by the technoscientific approach and it also suggests that there may be other factors that affect risk perception (Slimak, & Dietz, 2006). According to the comprehensive personality model, personal attributes such as extroversion, compatibility, conscientiousness, emotional consistency and mental capacity are considered in assessing risk perception (Chauvin, Hermand & Mullet, 2007; Slovic, 2007). According to the value-belief-norm theory, sociodemographic and sociostructural properties and religious beliefs as well as personal values affect risk perception either directly or through the worldview (Stern, et. al., 1999). The risk society approach that became widespread in the 1990s suggests that risk has played an increasing role in life and the concept of risk is related to the social structure composed of historical, social and cultural content (Yalçınkaya & Özsoy, 2003). Risk and risk perception are evaluated differently by people in line with their own attitudes and moral values. People generally do not want to be informed about undefined risks; they prefer to ignore them when they feel they have no effective defense against threats (e.g. in case of unavoidable risks, WHO, 2013). The 1989 report of the U.S. National Research Council (NRC) noted that the perception level of technological risks changed with the economic level. Similarly, Riechard and McGarrity (1994) found that the risk perception among young people significantly differed by socioeconomic status; however, there was no general change in the level of risk perception between the low and high socioeconomic level groups as the difference was specific to the risk source. Risk perception, on the one hand, is influenced by people's moral values, on the other hand, shapes their behavior (Sandman, 2013). In general, psychologists have identified two ways of thinking since the 1980s. The first is characterized by a simple reasoning that focuses on the relevant information filtered by intuition. The second is characterized by a mature capacity and a conscious analytical way of thinking that evaluate a broad range of knowledge (including statistical data). The second way of thinking is a typical scientific assessment, while the first is the common way of thinking shared by many people (scientists are included in this group if they act as "ordinary people"). Communication based on reasoned arguments such as effective risk management practices, relevant safety statistics, etc. cannot affect those who have the first way of thinking (Bennet & Calman, 2010). These two ways of thinking highlight how to reframe information, among the greatest challenges of risk communication, in a manner to be understood by ordinary people. The results of a multinational GlobeScan survey in 2013 demonstrate the importance of these studies. According to the results of this survey, environmental concerns among people around the world have been in decrease since 2009 and have now dropped to the lowest level of twenty years. It should be noted that protective measures taken by health care institutions are more effective when the risk is perceived more clearly by the society (Sandman, 2013; World Health Organization, 2013). Research of two decades ago reported increased public awareness of ecological risks in parallel with the growing awareness of environmental degradation and sustainability (Dunlap & Merting, 1995; Slovic, 1996). The decline in environmental concern in recent years despite the increased environmental problems indicates the complex nature of the interaction of factors that influence risk perception.

The results of risk perception research based on different approaches and models are of key importance in guiding risk management and contributing to risk mitigation activities. Environmental risk analyses concerning public opinion focus on how people assess various technological and environmental risks and react to environmental risks, how these risks are presented and communicated, and how risks are organized in social processes. The identification of public perceptions of environmental risks forms a basis for an effective strategy of environmental risk management (Frewer, 2004). In line with these arguments, this study attempts to investigate secondary school students' environmental concerns as they will influence the future environmental policy of the nation. As risk perception can be regarded as a sign of concern, the study aims to identify participants' environmental risk perceptions. It is of major importance to understand risk perceptions and underlying processes in order to be more informed about the way how people evaluate.

METHOD

The study was conducted on 1003 students studying in secondary schools. Survey method is used in this study which is a descriptive research. A 26-item environmental risk perception scale, based on the Environmental Appraisal Inventory (EAI) developed by Daneshmandi and MacLachlan (2000), was used in the study. The 7-point Likert-type scale (1 = no danger, 7 = extremely dangerous), which includes items about technology and human-induced hazards, natural disasters and risks related to daily life, was translated into Turkish and used by the researchers. A 5-point Likert-type scale (New Ecological Paradigm), developed by Dunlap and Van Liere in 1978 and revised in 2000, was used to determine student attitudes towards the environment.

Data Analysis

Data obtained from both scales(NEP-EAI) describe as mean and standard deviation. A factor analysis was conducted for the 26 risk items for all 1003 respondents combined. To identify the loadings of the 26 risk items, Principal Axis Factoring was used with promax rotation method.

Multivariate analysis (MANOVA) has been used to determine whether class, school type and gender made a difference in the risk perceptions and environmental approaches of the students. The relationship between environmental risk perceptions and environmental approaches were determined by calculating the Pearson correlation coefficient.

Sample

In terms of gender, 56% of the students were male and 44% were female. The age groups of the participants were between 15-16 years (63%) and 17-18 years (34%). Grade-level distribution was as follows: 70% of the students were in grade 9 and 10, 30% were in grade 11 and 12. In terms of schools, 43% of the students were attending Anatolian High School, and 57% were attending Technical High School.

FINDINGS

The data obtained from EAI scale describe mean and variance in Table 1. The mean and variance values are ranked from high to low.

Table1. Mean ranking of EAI items

Rank		Mean	Variance
1.	18. Impure drinking water	5,96	1,520
2.	19. Large fires	5,81	1,522
3.	11. Water shortage (e.g. drought, water depletion)	5,79	1,631
4.	15. Change to the ozone caused by pollution	5,68	1,600
5.	1. Water pollution	5,64	1,701
6.	4. Pollution from factories	5,63	1,542
7.	16. Earthquakes	5,63	1,620
8.	24. Chemical dumps	5,61	1,654
9.	22.Radioactive fallout	5,55	1,618
10.	17. Soil erosion	5,45	1,555
11.	14.Radioactivity in building materials	5,43	1,718
12.	7. Acid rain	5,39	1,726
13.	20. Floods or tidal waves	5,29	1,618
14.	21. Germs or micro-organisms	5,24	1,589
15.	3. Pollution from cars	5,16	1,660
16.	25. Video screen radiation	5,16	1,726
17.	5. Pollution from burning rubbish	5,01	1,668
18.	23. Fumes or fibers from synthetic materials	4,94	1,722
19.	6. Smoking in public buildings	4,93	1,865
20.	26. Pesticides and herbicides	4,93	1,790
21.	2. Storms (e.g. lightning, hurricanes, tornados, snow)	4,89	1,686
22.	12. Noise	4,56	1,848
23.	13.Visual pollution (e.g. billboards, ugly buildings)	4,50	1,928
24.	9. Number of people (e.g. crowding, population explosion)	4,35	1,877
25.	8. Pollution from office equipment	4,07	1,780
26.	10. Fluorescent lighting	3,54	1,954

When the table is examined can be noticed that impure drinking water' was the item given the highest mean rating, while the item `fluorescent lighting' was considered the least threatening by the sample.

The Barlett's Test of Sphericity was used to see whether or not data have a normal distribution with multiple variables. The results of the chi-square ($\chi 2$) test are found to be significant, showing that data have a normal distribution with multiple variables (Tabachnick & Fidel, 2005). The Kaiser-Meyer-Olkin (KMO) value is found to be 0.946, an acceptable level. The results of the Bartlett test are also significant ($\chi 2$ = 12740,23; p<0.00). In research articles, findings should be given here and the above-mentioned principles should be considered.

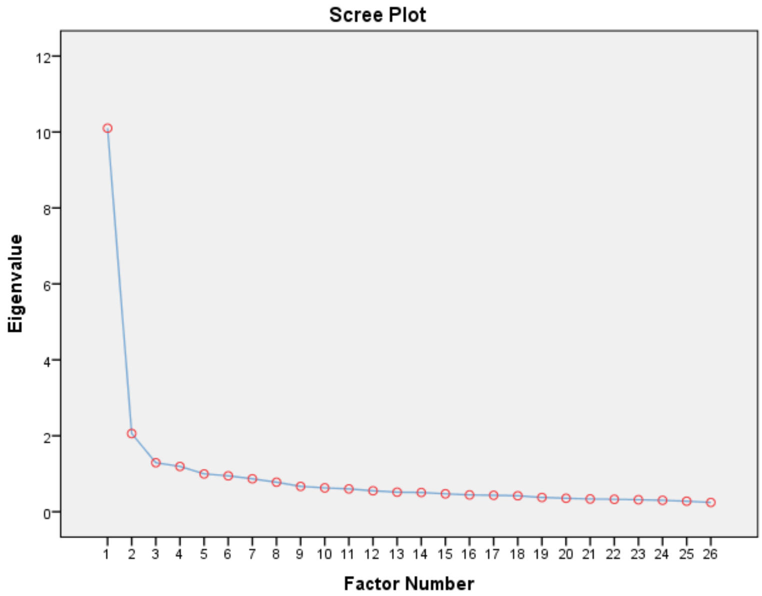

Figure 1. Scree plot for 26 item EAI scale.

The sample matrix developed by the promax rotation was analyzed using the principal axis factoring method Figure 1 shows scree profile of items. When the scree plot is evaluated it is determined that the factor structure of EAI scale fit three factorial solution.

Table 2. Results of rotated factor analysis on the EAI scales'items

	Factors		
	Industrial Risks	Natural Disasters	Everyday Life Risks
24. Chemical dumps	**0,880**	-0,047	-0,072
25. Video screen radiation	**0,695**	-0,089	0,145
14. Radioactivity in building materials	**0,674**	0,050	-0,002
22. Radioactive fallout	**0,627**	0,144	-0,063
15. Change to the ozone caused by pollution	**0,606**	0,242	-0,055
11. Water shortage	**0,522**	0,166	-0,061
23. Fumes or fibers from synthetic materials	**0,480**	0,044	0,232
26. Pesticides and herbicides	**0,454**	-0,154	0,211
1. Water pollution	**0,434**	0,183	0,016
4. Pollution from factories	**0,431**	0,234	0,086
17. Soil erosion	-0,048	**0,803**	0,065
19. Large fires	0,077	**0,775**	-0,038
16. Earthquakes	-0,009	**0,757**	-0,014
18. Impure drinking water	0,256	**0,688**	-0,175
20. Floods or tidal waves	-0,036	**0,592**	0,213
8. Pollution from office equipment	-0,212	0,106	**0,766**
10. Fluorescent lighting	-0,11	-0,058	**0,725**
13. Visual pollution (e.g. billboards, ugly buildings, litter)	0,203	-0,049	**0,529**
12. Noise	0,199	-0,062	**0,524**
9. Number of people (e.g. crowding, population explosion)	0,159	-0,059	**0,463**
5. Pollution from burning rubbish	0,127	0,208	**0,431**
6. Smoking in public buildings	0,000	0,211	**0,411**

In the initial factorial analysis, it was found that three items (Pollution from cars, Acid rain and Germs or

micro-organisms) are included under more than one factor. So these three items were omitted and the factorial analysis was repeated
The first factor includes those risks concerning industry originated issues, the second, natural threats, the last one, in daily life experienced problems. Therefore, the factors are called "industrial risks" (Cronbach's α = 0.88), "natural disasters" (Cronbach's α = 0.87), and "everyday life risks" (Cronbach's α = 0.79). The item analysis shows that the corrected item total correlation coefficients are above .20.
The mean and standard deviations values obtained from the EAI subscales are given in Table 3 along with students' class level.

Table 3. Means and Std. Deviation of EAI –subscales according students' class level

EAI Subscales	Class	N	Mean	Std. Deviation
Industrial risks	9	363	5,564	1,101
	10	338	5,365	1,158
	11	302	5,363	1,282
	Total	1003	5,436	1,180
Natural disasters	9	363	5,797	1,196
	10	338	5,591	1,194
	11	302	5,464	1,435
	Total	1003	5,627	1,278
Everyday life risks	9	363	4,394	1,237
	10	338	4,443	1,229
	11	302	4,440	1,266
	Total	1003	4,424	1,242

Table 3 shows that natural disasters are most risky perceived by participants. The mean values of industrial risks and natural disasters subscales tend to increase as the level of class decreases.

Table 4. Means and Std. Deviation of EAI –subscales according students' school types

EAI Subscales	School type	N	Mean	Std. Deviation
Industrial	High School	431	5,666	1,107
	Vocational High School	572	5,263	1,204
	Total	1003	5,436	1,18
Natural	High School	431	5,662	1,217
	Vocational High School	572	5,601	1,323
	Total	1003	5,627	1,278
Everyday life	High School	431	4,586	1,214
	Vocational High School	572	4,302	1,25
	Total	1003	4,424	1,242

The mean values of all types of subscales which high school students have, are higher than the mean values that vocational high schools' students have (Table 4).

Table 5. The means and std. Deviation of EAI –subscales according students' gender

EAI Subscales	Gender	N	Mean	Std. Deviation
Industrial risks	Male	558	5,195	1,245
	Female	444	5,738	1,016
	Total	1002	5,435	1,180
Natural disasters	Male	558	5,445	1,357
	Female	444	5,853	1,133
	Total	1002	5,626	1,278
Everyday life risks	Male	558	4,224	1,269
	Female	444	4,674	1,163
	Total	1002	4,424	1,243

The female students have higher mean values in all subscales than those male have.

Table 6. MANOVA results

Variables	Wilks Lambda	F	df	Error df	p	η2
Level of class	0,972	2,372	12	2609,002	0,005	0,010
School type	0,966	11,711	3	986	0,000	0,034
Gender	0,953	16,324	3	986	0,000	0,047

To detect the effects of level of class, type of school and gender on the students' environmental risk perception multivariate analysis of variance was conducted. The Wilkis Lambda values indicate multivariate significance. According to η2 value for gender it points out 4.7 % of variance of the dependent variables. In addition, η2 values of .034 and .010 for type of school and level of class respectively indicate explained variance between 3.4 % and 1 % (Table 6).

Table 7. Flow up test results

	EAI Subscales	Type III Sum of Squares	df	Mean Square	F	Sig.	η2
Level of Class	Industrial	16,748	4	4,187	3,274	0,011	0,013
	Natural	19,743	4	4,936	3,166	0,013	0,013
	Everyday life	11,644	4	2,911	1,967	0,097	0,000
School type	Industrial	24,103	1	24,103	18,845	0,000	0,019
	Natural	0,001	1	0,001	0,001	0,979	0,000
	Everyday life	9,168	1	9,168	6,196	0,013	0,006
Gender	Industrial	59,269	1	59,269	46,339	0,000	0,045
	Natural	43,923	1	43,923	28,174	0,000	0,028
	Everyday life	39,53	1	39,53	26,714	0,000	0,026

The ANOVA results show that level of class led to a significant effect in the subscales of industrial risks and natural disasters and their η2 values state that it can account for only 1.3% of the variance, indicating that it has a small-size effect. Gender, on the other hand, led to significant effects in all subscales and their η2 values indicates that it accounts for 4.5 % of the variance for the industrial risks, for 2,8 % of the variance for natural disasters and for 2.6 of variance for the everyday life risks. The other independent variable, the type of school, have significant effect on subscales of industrial risks and everyday life risks.

Table 8 point out the Pearson correlation coefficients between EIA subscales and NEP subscales. The Pearson correlation coefficients (r=.429) between NEP subscale and Industrial risks subscales indicates moderate positive association. Furthermore, the correlation coefficients between Natural disasters subscale (r=.367) and everyday life risks (r= .254) indicate that the strength of association between the variables is weak.

Table 8. Pearson correlation coefficients between EAI-subscales and NEP subscales

	Industrial risks	Natural disasters	Everyday life risks
	,429**	,367**	,254**
	0,000	0,000	0,000
DSP	,079*	-0,016	-,072*
	0,012	0,612	0,022

** p<.001 * p<.005

While correlation coefficients between NEP subscale and all three EAI subscales each are significant at p value of .001, DSP subscale have quite weak association between Industrial risks subscale and also Everyday life risks.

CONCLUSIONS

In the study, environmental risk perception was analyzed in term of salience. For this sake, items are ranked from high to less risky perceived. It is remarkable that the items related with water locate among the high risky perceived items, for instance "impure drinking water", "water shortage" and water pollution". This result can be expected since the high media attention afforded to this issue in recent times. In addition, since issues regarding to water can bring forth potential health problems, students have perceived these water related items in EAI-scale most risky. In addition to this conclusion, it is expected that the students' risk perception regarding water issues were pessimistic when limited water sources of Turkey are taken into consideration. In the present study, mean values of items ranged between 5.96 and 3.54 while in another study which was conducted by Atav & Altunoğlu (2010) before seven years with the same scale, it was detected that mean values of items ranged between 6.58 and 3.98. It can be concluded that as time passes, the students are more optimistic in term of environmental risk perception.

In the current study, it was attempt to define the students' perception patterns in scope of environmental issues. For this purpose, obtained data by EAI scale was evaluated by factor analysis. According to these analysis, EAI-scale have three factors. The first factor was entitled as industrial risk since its items were mainly related with human activities which had adverse effect for environment and nature. The items of second factor represented natural threats and of this reason, it was named as natural disaster. The last factor which was named as everyday life risks consisted of the items related with people's usual daily experiences. The results of factor analyses indicated similar factorial structure with the results of original study (Walsh-Daneshmandi, & MacLachlan, 2000). In addition to factor analyses, the item analysis was performed and obtained high Cronbachs' α coefficients for each subscales displayed strong internal consistency. In the light of these findings, EAI-scale can be evaluated as reliable and valid measurement tools.

In the study, the environmental risk perception of secondary school students was analyzed with respect to level of class, school type and gender by MANOVA test. Results of the test indicated that there was a statistically significant effect of these independent variables in favor of girls, high school students and the 9th class students. Particularly gender was one of the most effective variable when the values of $\eta 2$ were interpreted (Table 6 &Table 7). Although the effect size of gender was quite low, it was detected that gender was a source of variance for each EAI-subscales while school type had statistically significant effect on industrial risks and everyday life risks subscales and level of class was an effective independent variable on industrial risks and natural disasters subscales. According to literature related with environmental concern, females consistently reported more pro-environmental views and greater levels of concern about specific environmental problems than man did (Xiao & McCright, 2015). According to gender socialization hypothesis, women were more concerned than men for environmental problems that pose significant health and safety risks for people, because women learn connecting with other people and expressing concern about their well-being through socialization into their society (Freudenburg & Davidson 2007. The another significant variable on environmental risk perception was type of school. Taskin (2009) and Tuncer, Ertepinar, Tekkaya, & Sungur (2005) found out that there was a significant difference in scope of environmental attitudes and concern between students from different school types. Especially Taskin (2009), in the same manner of the present study, pointed out that vocational high schools' students had less pro-environmental worldview and also less concern towards environmental issues and he explained these results with the blaming the same-sex education and the decrease of education quality in vocational high school. In addition to this explanation, Tuncer, Ertepinar, Tekkaya, & Sungur (2005) concluded that the significant difference of environmental concern and attitudes in favor of private school between students from different school types. Despite the Turkish educational research literature offered very rare empirical evidence regarding to biology or environmental education in vocational high schools, Kaya and Gürbüz (2002) found out that students in vocational high school stated that lesson hours for biology were insufficient, also they perceived the biology lesson was less important. In same direction, Cerrah and Ayas (2000) pointed out that biology teacher evaluated biology curriculum prepared for vocational high school as not appropriate for students'

knowledge level and interest. In accordance with these previous researches, the fewer environmental risk perception of students in vocational high school can be explained by the effects of curriculum and general educational aims of this schools in contrast to other types of high schools. It was aimed firstly that the students acquire the vocational formation in vocational high schools and of this reason, there is no sufficient time and resources (laboratories, physical construction of school etc.) in such schools for delivering knowledge in academic manner and provide pro-environmental affection, behavior etc.
In the study, it is found out that EAI subscales had positive moderate association with NEP subscale. The higher NEP subscale scores indicate endorsement of pro-environmental worldview which is represented by existence of ecological limits to growth, importance of maintaining the balance of nature, and rejection of the anthropocentric notion (Dunlap 2008). In contrast to this, DSP subscale showed very low associations with EAI subscales (Table8). In present study, high DSP scores indicate the endorsement of the rejection of anthropocentric evaluation of environmental issues. The results of some previous studies pointed out that the individuals from Turkey were confused or undecided regarding clearly rejection of anthropocentric worldview (Atav, Altunoğlu, Sönmez, 2015; Erdogan, 2009). Thus, EAI subscales can be used in future research to predict endorsement of a pro-environmental worldview. The NEP scale has been reported as predictive of support for pro-environment policies, perceived seriousness of air and water pollution, and self-reported pro-environmental behaviors (Dunlap, Van Liere, Mertig, & Jones, 2000). Although there is empirical evidence that an association exist between EAI subscales and NEP subscales, Walsh-Daneshmandi, & MacLachlan (2000) suspect that the EAI is predictive of at least some of these constructs and they suggested future investigation for predictive potential of EAI scale regarding supporting pro-environmental policies and pro-environmental behaviors.

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