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Analysis of Environmental Risk Perceptions and Scores of Preservice Science Teachers in Terms of Some Variables

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Abstract

This research aims to determine the environmental risk perceptions of preservice science teachers (PSTs) and compare their risk scores in relation to different variables. The research participant group consisted of PSTs (N = 205) from the Faculty of Education in the Department of Science Education at Bolu Abant İzzet Baysal University in Turkey. The environmental risk perception scale (ERPS) was used as a data collection tool and the environmental risk perception interview form (ERPIF) was used during the interviews. A survey model was used in the research. An enriched design in which quantitative and qualitative analyses were used together was included. Quantitative results from the research show "radiation," "factory waste," and "hazardous (chemical) waste," as environmental problems that PSTs consider the riskiest. The least risky environmental problems were "overgrazing of animals in meadows and pastures," "commercial fishing," and "open mining." According to the qualitative interview results, "air pollution" and "factory waste" were seen as the riskiest environmental problems, while "environmental waste" was considered the least risky environmental problem. In addition, while the females had a higher environmental risk perception than the males, there was a significant difference between the 3rd and 4th levels with 4th level PSTs favoring a higher environmental risk perception. There was no significant difference between the environmental risk perception scores of the PSTs depending on whether they took an environmental course or not; neither was there any significant difference issuing from the educational status of PSTs' parents.

Keywords: environmental risk perception, environmental education, preservice science teachers

1. Introduction

Considering the technological and industrial developments in the last two centuries, it is evident that environmental problems continue to pose a fundamental problem for humanity, so much so that environmental problems directly affecting the lives of people and other living species are already causing irreparable damage. For example, it is estimated that 40% of the world's population will suffer from water shortages in 2050 unless precautions are taken (Öktem & Aksoy, 2014). Some of these problems are the result of nuclear accidents, urban waste, stratospheric ozone decomposition, increased UV radiation, genetic resources and biodiversity losses, acidification, climate change, forest destruction, waste disposal, pollution transport to seas through rivers, drinking water supply and difficulties, and hygienic and quality safety in foods (Baykal & Baykal, 2008). Nations need to prioritize sustainable development and life in the face of environmental problems while placing great importance on developing individuals' and society's environmental awareness. Individuals should be aware of events that occur in their environment and should be responsible for preventing environmental problems that may occur. Responsible behavior toward the environment is seen as one of the main objectives of studies in the field of environmental education and risk communication (Hungerford & Volk, 1990).

1.1 Environmental Risk Perception

"Risk perception" is defined as sensory perceptions or information about risks and dangers adopted by the individual, processed in the mind, and evaluated (Renn, 2002). Many fields in academic literature have studies in risk perception, including the fields of various accidents (Andersson, 2011; DeJoy, 1992; Rundmo, 1996), tourism (Türker, 2013; Yanık, 2014), economy (Kahyaoğlu, 2011; Tuncay, 2008), psychology and sociology (Geçer, 2014; Gökulu, 2011; Koçak, 2010), and nanotechnology (Güzeloğlu, 2015; O'Brien & Cummins, 2011; Savath &

Brainard, 2013; Siegrist & Keller, 2011). These risk perception studies can be related to environmental risks and environmental risk perception.

Risks of environmental problems are hidden in a chain of events controlled by human beings. Human needs have brought about the development of various technologies and products. Because of this, events and situations create a unique environment. As the first and last link in the chain, humans face many dangers resulting from their activities that cause deterioration and changes in the environment (Altunoğlu, 2010). Karger and Wiederman (1994) examined environmental risks under the three following headings:

1) The danger of anthropogenic sources of risk to the environment and nature: The activities carried out by human beings cause possible dangers for the environment and nature, and harm living things. The negative effects of tanker accidents on marine life can be given as an example.

2) The danger of global environmental changes for the environment and nature: The results of human intervention in nature can disrupt the balance of nature by bringing about changes in the environment. For example, the contribution of industrialized countries to the greenhouse effect threatens the natural structure in both their regions and developing countries.

3) The danger of global environmental changes for humans: Some human-induced environmental changes carry health risks for humans. Skin cancer, which more frequently occurs in humans due to damage to the ozone layer, is one example.

Studies on environmental risk perception are few. Environmental problems listed in the studies that seem to be the most harmful include ozone depletion, car exhaust pollution, cigarette pollution, factory waste, radioactive waste, chemical waste, pesticides, nuclear waste, mobile phones, charcoal stoves, stress, motor vehicle accidents, radiation, sewage, greenhouse effect, deforestation, and air problems such as pollution. Included among the environmental problems seen as lowest risk are: commercial fishing, open mining, bottled water, noise, water reduction, fluorescent lamps, natural disasters, and overgrazing of animals in meadows and pastures (Altunoğlu & Atav, 2009; Beyhun et al., 2007; Sam, Gürsakal, & Sam, 2010; Walsh-Daneshmandi & MacLachlan, 2000). In terms of gender, some studies showed that women have higher risk scores than men (O'Connor, Bord, & Fisher, 1999; Riechard & Peterson, 1998; Safi, Smith, & Liu, 2012; Sam et al., 2010; Semenza et al., 2008), whereas others showed no significant difference between environmental risk scores in relation to gender (Bayoğlu & Özgen, 2010; Slimak & Dietz, 2006). In addition to studies showing that environmental risk perception scores correlate age (Safi et al., 2012) or environmental anxiety, the studies show that risk perception scores increase in direct proportion with age (Botwinick, 1984) and that a negative relationship exists between age and environmental anxiety (Van Liere & Dunlap, 1980). There are also studies stating that environmental anxiety is not related to year level (Sam et al., 2010). While education level is positively associated with environmental risk perception in some studies (Van Liere & Dunlap, 1980), it is negatively correlated in other studies. In addition, the maternal education level (such as whether an individual's mother took environmental courses, and the type of high school she graduated from) does not cause a significant difference between environmental risk perception scores (Sam et al., 2010). However, Leiserowitz (2006) determined that Americans have a moderate risk perception about global climate change.

1.2 Research Problem

In general, to reduce or eliminate dangers of environmental problems, it is necessary to raise future generations who can perceive and correctly gauge environmental problems and consequently behave in environmentally sensitive and responsible ways. Nations today are dealing with environmental risks and dangers rather than environmental enemies. Although people encounter many environmental risks in daily life, they often do not recognize these risks (Sönmez & Kılınç, 2012). If people's reactions to environmental problems threatening them are in line with their perceptions of said risk and if this risk perception is false, then their subsequent efforts to protect society and the environment will be out of proportion, misguided, or lacking in relation to the actual problem. A person's activities may result in adding to environmental deterioration and change, and this person must then face these dangers (Altunoğlu & Atav, 2009). The first step in preventing false environmental risk perceptions should be to correct them. In this context, which environmental problems do people perceive as high risk, and which are perceived as low risk? What do people reveal about their mindset by causing environmental problems to be perceived in this way? Answers to these questions may also reveal how individuals who make up society look at environmental problems, and how they might how they may experience a shift in attitude and emotion as they better discern environmental problems. Incorrect environmental risk perceptions can lead to more negative environmental effects, as individuals, societies, and the planet move in the wrong direction to construct the future. Accordingly, a correct risk perception orientation has a vital and sustainable importance for the dynamic

world that is developing, changing, and transforming every day through science and technology. The literature has found that many environmental problems are associated with low interest, a negative mindset, a lack of knowledge, and an incomplete perception of the environment regarding environmental issues, as well as false risk perceptions regarding the environment (Riechard, 1993). In this context, environmental risk perceptions must also be correctly determined to find solutions to environmental problems.

Although this process of determination is important for all individuals in society, determining the environmental risk perceptions of preservice teachers can be seen as an important priority step for the prevention of environmental problems. Preservice teachers will shape future generations by educating students in schools. They will be role models for many students in their professional lives and will have an opportunity to reflect their environmental perceptions to their students during their lessons. Consequently, correctly determining the environmental risk perceptions of preservice teachers and correcting any wrong perceptions and tendencies may enable large groups of people to currently assess environmental risks. While environmental issues are discussed in a variety of disciplines, the fields of science education include subjects that are directly related to the environment. Accordingly, this study has chosen to narrow in on determining the environmental risk perceptions of preservice science teachers (PSTs), who will give environmental education to primary and secondary school students. PSTs have a professional interest in environmental issues; as a target population for this study, they will have a particular perspective on what they perceive to be environmental problems, environmental risks, and causes for said risk.

1.3 Research Goals

This research aims to determine the environmental risk perceptions of PSTs and to compare their risk scores in relation to different variables. For this purpose, answers to the following two basic research questions and their sub-questions were sought:

1) What are the environmental problems that PSTs perceive as the most and least risky, and what are their views on these problems?

2) Are there any significant differences between the environmental risk perception scores of PSTs in relation to different variables?

Research Sub-Questions

- What are the environmental problems that PSTs perceive as the most and least risky?
- What are the views of PSTs on environmental problems that they see as the most and least risky?
- What are the views of PSTs regarding their reasons for seeing certain environmental problems as most and least risky?
- What are the sources of information about environmental problems that PSTs consults and which form their risk perceptions?
- Are there any significant differences between the environmental risk perception scores of PSTs in relation to gender?
- Are there any significant differences between the environmental risk perception scores of PSTs in relation to year level?
- Are there any significant differences between the environmental risk perception scores of PSTs in relation to previous experience with environmental courses?
- Are there any significant differences between the environmental risk perception scores of PSTs in relation to educational status of PSTs' mothers?
- Are there any significant differences between the environmental risk perception scores of PSTs in relation to educational status of PSTs' fathers?

2. Method

2.1 Research Design

A survey model was used in the research to track the opinions of the participants on a subject or event, as well as their interests, skills, abilities, and attitudes. Surveys are studies in which the characteristics of the research are determined (Büyüköztürk, Çakmak, Akgün, Karadeniz, & Demirel, 2009). In this study, the environmental risk perceptions of PSTs were examined in relation to different variables. The study also involved an enriched design (triangulation design), in which qualitative and quantitative research were used together. With this research design, researchers collected quantitative and qualitative data simultaneously, and used their findings to compare if the two

sets of data support each other (Büyüköztürk et al., 2009).

2.2 Participant Characteristics

The participants of the research are PSTs studying in their 1st, 2nd, 3rd, and 4th year at the Bolu Abant İzzet Baysal University in Turkey, under the Faculty of Education in the Department of Science Education. A total of 205 PSTs were reached within the scope of the study. During the scale application process, information on gender, current year level, whether or not they took environmental courses, and mother and father educational statuses were collected from the PSTs in the participant group. The data regarding the distribution of participants in sub-categories of demographic variables are shown in Table 1. Code names were given to a total of 12 PSTs from the participant group (with three from each year level) who were randomly selected and interviewed. The generated codes are as follows:

Table 1. Descriptive characteristics of the participants

Variable	Category	N	Percentage	Interviewer code
Gender	Female	172	83.9	F1a, F1b, F2a, F2b, F3a, F3b, F4a, F4b
	Male	33	16.1	M1, M2, M3, M4
	Total	205	100	
Year Level	1st	42	20.5	F1a, F1b, M1
	2nd	54	26.3	F2a, F2b, M2
	3rd	55	26.9	F3a, F3b, M3
	4th	54	26.3	F4a, F4b, M4
	Total	205	100	
Previous Environmental Course	Yes	113	55.1	F3a, F3b, M3, F4a, F4b, M4
	No	92	44.9	F1a, F1b, M1, F2a, F2b, M2
	Total	205	100	
Mother's Educational Status	Primary School	119	58.0	F1b, M1, F2b, M3, F4a, F4b, M4
	Middle School	44	21.5	M2
	High School	37	18.0	F1a, F2a, F3a, F3b
	University	5	2.5	
	Total	205	100	
Father's Educational Status	Primary School	67	32.7	F1b, M3, M4
	Middle School	44	21.5	M1, F3b, F4a, F4b
	High School	62	30.2	F1a, M2, F2b, F3a,
	University	32	15.6	F2a
	Total	205	100	

Note. 1st year male: M1/1st year 1st female: F1a/1st year 2nd female: F1b/2nd year male: M2/2nd year 1st female: F2a/2nd year 2nd female: F2b/3rd year male: M3/3rd year 1st female: F3a/3rd year 2nd female: F3b/4th year male: M4/4th year 1st female: F4a/4th year 2nd female: F4b.

Table 1 shows that 172 female (83.9%) and 33 male (16.1%) PSTs were in the participant group. While 113 PSTs took an environmental course, 92 PSTs did not take any environmental course. When the educational status of the mothers and fathers of the PSTs are examined, it is found that most mothers graduated from primary school (58%) and most fathers graduated from primary school (32.7%).

2.3 Data Collection Tools

2.3.1 Environmental Risk Perception Scale

The environmental risk perception scale (ERPS) was introduced by Slimak and Dietz (2006). The scale consists of 24 items in a 5-point Likert-type scale. The scale, which has four sub-dimensions ("ecological," "chemical," "global," and "biological") was adapted to Turkish culture by Altunoğlu and Atav (2009) after some corrections. After the scale adaptations, it was used as a seven-point Likert scale instead of a 5-point Likert-type scale. In addition, question 21 in the original scale was removed. In Altunoğlu and Atav (2009), the scale's Cronbach's alpha reliability coefficient was determined to be 0.89. The scale's alpha coefficient for the sub-dimensions is 0.82 for the dimension of the ecological risk, 0.79 for the chemical waste risk dimension, 0.81 for the resource depletion risk dimension, and 0.69 for the global environmental risks dimension. A high mean score from the scale indicates a high environmental risk perception, and a low one indicates a low environmental risk perception. The highest and

lowest mean scores that can be obtained from the scale range from 1.0 to 7.0. In this research, the scale used was adapted from that of Altunoğlu and Atav (2009).

2.3.2 Environmental Risk Perception Interview Form

The environmental risk perception interview form (ERPIF) researchers were prepared by the researchers in the structured interview format. Interviewing is defined as a mutual and interactive communication process based on questioning and answering, conducted for a predetermined and serious purpose (Stewart & Cash, 1985). Interviews are conducted to uncover what goes on in a person's mind and to bring together people's stories (Patton, 2014). The interview form method, however, is prepared to receive the same type of information from different people on similar topics (Patton, 1987).

ERPIF consists of five open-ended questions. The final version of the form was prepared by taking the opinions of two different experts. In the form, the participants are asked questions about what environmental problems they see as the most and least risky, why they see the environmental problems in such a way, and from which sources they get their information about environmental problems.

2.4 Data Analysis

The collected data were analyzed using the descriptive statistical method. Descriptive statistics describe statistical operations that allow for collecting, describing, and presenting numerical values for a variable. This includes techniques such as frequency, percentage, measures of central tendency, measures of variability, and a correlation coefficient used to describe the characteristics of a group (Büyüköztürk, 2014).

Frequency and percentage analysis were used in presenting demographic information about the participant group, and an arithmetic mean was used to make comparisons in subcategories of different variables related to the scale. Before the mean scores of the subgroups were analyzed, the skewness coefficients were checked, and suitability of the parametric tests was checked. In cases where the assumptions were met, data analysis was performed using unrelated samples t-test and ANOVA test, according to the number of categories of the investigated variable. The t-test was used for variables with two categories (i.e. gender, previous environmental course), while the ANOVA test was used for variables with three or more categories (i.e. year level, mother's educational status, father's educational status).

Interview recordings were first converted into written format. Then the data were coded, and content was analyzed and presented in a table with percentage and frequency distributions. In this way, environmental problems that PSTs consider the most and least risky were identified. In addition, information sources related to environmental problems were determined. In the analysis, themes and codes were created under the interview questions. Encodings were carried out by two independent coders. The percentage of agreement between independent encoders was calculated. Thus, data analysis reliability was ensured. The following formula was used for data analysis reliability:

Percentage of Reliability = Number of Subject/Terms on which Consensus was reached ÷ (Number of Subject/Terms on which Consensus was reached + Number of Subject/Terms on which Dissensus was reached) x 100 (Miles & Huberman, 1994; Miles, Huberman & Saldaña, 2014; Patton, 2002).

Accordingly, the percentage of reliability obtained during the analysis of qualitative interview records in this study was calculated to be 94%. This is a sufficient rate, since for a data analysis to be reliable, the rate should be 85% or more (Miles et al., 2014; Patton, 2002).

3. Results

In this section, the findings related to the data analysis are included, and answers to research questions are sought.

3.1 Environmental Problems PSTs Perceive as Most and Least Risky According to ERPS

To determine the environmental problems that participating PSTs perceived as most and least risky according to the ERPS, the arithmetic average of the scores given to each item was taken to determine the highest and lowest scores.

Table 2. Items with highest and lowest environmental risk scores obtained from PSTs' ERPS

Item number	Environmental problems with the highest risk scores	$\bar{X}$
6	Radiation	6.55
7	Factory waste	6.54
5	Hazardous (chemical) waste	6.51
	Environmental problems with the lowest risk scores	
20	Overgrazing of animals in meadows and pastures	4.56
22	Commercial fishing	4.61
19	Open mining	5.13

According to the data in Table 2, the environmental problems that PSTs consider the most risky are "radiation" ($\bar{X}$ = 6.55), "factory waste" ($\bar{X}$ = 6.54), and "hazardous (chemical) waste" ($\bar{X}$ = 6.51), while the environmental problems that PSTs consider the least risky are "overgrazing of animals in meadows and pastures" ($\bar{X}$ = 4.56), "commercial fishing" ($\bar{X}$ = 4.61), and "open mining" ($\bar{X}$ = 5.13).

3.2 Environmental Risk Perceptions of PSTs in Relation to Different Variables

3.2.1 Environmental Risk Perceptions of PSTs in Relation to Gender

An independent group t-test was conducted to determine whether the environmental risk perception scores of PSTs differ according to gender.

Table 3. "Independent Group T-Test" results of environmental risk perception score in relation to gender

Gender	N	$\bar{X}$	SD	t	df	p
Female	172	135.360	16.118	-3,898	203	.000
Male	33	123.240	17.577			

The independent group t-test results in Table 3 show that there is a significant difference between environmental risk perception scores according to gender, at a level of .05 in favor of females [t(203) = -3.898, p = .000].

3.2.2 Environmental Risk Perception of PSTs in Relation to Year Level

One-way analysis of variance (ANOVA) was conducted to determine whether the environmental risk perception scores of PSTs differ depending on their year levels.

Table 4. ANOVA results of environmental risk perception scores in relation to year level

Variable	Source of Variation	Sum of Squares	df	Mean of Squares	F	p
Year Level	Between Groups	2705.382	3	901.794	3.256	.023
	Within Groups	55670.199	201	276.966		
	Total	58375.580	204			

When Table 4 is examined, it is seen that there is a significant difference at the .05 level between the environmental risk perception scores of PSTs in relation to year level: $F(3,204) = 3.256$ $p < .05$. Tukey's multiple comparison test was used for comparisons between subgroups. A significant difference of 8.81 points in favor of the 4th year level at the level of .05 between the 3rd year ($\bar{X}$ = 129.93) and 4th year ($\bar{X}$ = 138.74) subgroups. There is no significant difference between other year levels.

3.2.3 Environmental Risk Perceptions of PSTs in Relation to Previous Environmental Course

An independent group t-test was conducted to determine whether the environmental risk perception scores of PSTs differ according to whether they have taken an environmental course or not.

Table 5. "Independent Group T-Test" results of environmental risk perception scores in relation to previous environmental course

Took an Environmental Course	N	$\bar{X}$	SD	t	df	p
Yes	113	134.584	17.479	1.102	203	.272
No	92	131.967	16.176			

The independent group t-test results in Table 5 show that there is no significant difference at the .05 level between the environmental risk perception scores and whether or not PSTs took an environmental course: [$t(203) = 1.102$, $p = .272$].

3.2.4 Environmental Risk Perceptions of PSTs in Relation to Mother's Educational Status

One-way analysis of variance (ANOVA) was conducted to determine whether the environmental risk perception scores of PSTs differ depending on their mother's educational status.

Table 6. ANOVA results of environmental risk perception scores in relation to mother's educational status

Variable	Source of Variation	Sum of Squares	df	Mean of Squares	F	p
Mother's Educational Status	Between Groups	35.281	3	11.760	0.041	.989
	Within Groups	58340.299	201	290.250		
	Total	58375.580	204			

Table 6 shows that there is no significant difference between the environmental risk perception scores of PSTs in relation to their mother's educational status: $F(3, 204) = 0.041$ $p > .05$.

3.2.5 Environmental Risk Perceptions of PSTs in Relation to Father's Educational Status

One-way analysis of variance (ANOVA) was conducted to determine whether the environmental risk perception scores of PSTs differ depending on the father's educational status.

Table 7. ANOVA results of environmental risk perception scores in relation to father's educational status

Variable	Source of Variation	Sum of Squares	df	Mean of Squares	F	p
Father's Educational Status	Between Groups	862.411	3	287.470	1.005	.392
	Within Groups	57513.170	201	286.135		
	Total	58375.580	204			

Table 7 shows there is no significant difference between the environmental risk perception scores of PSTs in relation to the father's educational status: $F(3, 204) = 1.005$ $p > .05$.

3.3 Environmental Problems Viewed as Risks in Interviews with ERPIF

Findings from the interview data obtained through the ERPIF regarding qualitative data analysis are shown in Table 8. In this section, themes and codes were created under the interview questions.

Table 8. Environmental problems perceived as risky by PSTs

Question Number	Themes	Codes	Frequency (*f*)	Percentage (%)
Q1 Which environmental problems do you think are the riskiest?	Environmental problems perceived as riskiest	Air pollution	6	50
		Factory waste	6	50
		Nuclear power plants	4	33.3
		Global warming	3	25
		Pesticides	3	25
		Natural disasters	2	16.6
		Fossil fuels	1	8.3
		Soil pollution	1	8.3
		Open mining	1	8.3
		Chemical waste	1	8,3
		Deforestation	1	8.3
		GMO	1	8.3
		Environmental waste	1	8.3
Q2 What are your reasons for perceiving these environmental problems as the riskiest?	Reasons why it is perceived as the riskiest environmental problem	Human life is adversely affected	8	66.6
		Food sources being affected and damaged	6	50
		The necessity of clean water for life	6	50
		The necessity of clean air for life	4	33.3
		Causing diseases	4	33.3
		Negative effects on the lives of other living things other than humans	3	25
		The necessity of clean soil for life	1	8.3
		Decreased water supply for future generations	1	8.3
		Insufficient inspection of factories	1	8.3
		The fact that public transport is not preferred among transportation options	1	8.3
		Damaging the ozone layer	1	8.3
		Leaving a bad quality of life for future generations	1	8.3
Q3 Which environmental problems do you think are the least risky?	Environmental problems perceived as least risky	Environmental waste	6	50
		Noise pollution	3	25
		Nuclear power plants	2	16.6
		GMOs	2	16.6
		Air pollution	1	8.3
		Light pollution	1	8.3
		Wind roses	1	8.3
Q4 What are your reasons for perceiving these environmental problems as the least risky?	Reasons why it is perceived as the least risky environmental problem	Ease of disposal and collection	3	25
		Elimination of problems when precautions are taken and mistakes are not made	2	16.6
		Absorption and disappearance in nature	2	16.6
		The conference I attended affected my thoughts	1	8.3
		It will not cause a problem if it is not over-exposure	1	8.3
		Becoming commonplace for all	1	8.3

		The problem remains in a certain area and does not spread to large areas	1	8.3
		Beneficial in the storage of nutrients	1	8.3
		Tolerability of the problem	1	8.3
Q5 From which sources did you learn the information you have on this subject?	Information resources on environmental problems	Internet	8	66.6
		Course	5	41.6
		Teacher	4	33.3
		Conference	4	33.3
		Book	3	25
		Life experience	2	16.6
		News	1	8.3
		Signboards	1	8.3

Note. The frequencies (*f*) in Table 8 show the number of people. N = 12.

Considering the data in Table 8, it is found that the riskiest environmental problems with high frequency are air pollution (*f* = 6, 50%), factory waste (*f* = 6, 50%), nuclear power plants (*f* = 4, 33.3%), global warming (*f* = 3, 25%), and pesticides (*f* = 3, 25%). Environmental waste (*f* = 6, 50%) seems to be the least-risky environmental problem. Another high-frequency and least-risky environmental problem is noise pollution (*f* = 3, 25%). PSTs' information on this subject comes mostly from the internet (*f* = 8, 66.6%), courses (*f* = 5, 41.6%), teachers (*f* = 4, 33.3%), and conferences (*f* = 4, 33.3% and books (*f* = 3, 25%). PSTs tend to emphasize that "Human life is adversely affected" (*f* = 8, 66.6%) as the reason for perceiving certain environmental problems as the riskiest, and "Ease of disposal and collection" (*f* = 3, 25%) as the reason for seeing certain environmental problems as least risky.

3.3.1 Views on Environmental Problems Perceived Riskiest

Some of the PSTs see air pollution (*f* = 6, 50%), factory waste (*f* = 6, 50%), and nuclear power plants (*f* = 4, 33.3%) as the highest risks. For example, the views of F2a, F2b, F1b, and M1 regarding the environmental problems they perceive as the riskiest are as follows:

"[Regarding air pollution], my thoughts are the exhaust fumes from cars, coals, and natural gas." (F2a)

"Nuclear wastes, natural disasters. Landslides and avalanches." (F2b)

"The riskiest ones are the waste from factories being dumped into seas or lakes." (F1b)

"Nuclear power plants and . . . it could be nuclear power plants. Let's say greenhouse gases." (M1)

3.3.2 Reasons for Environmental Problems to be Perceived as Riskiest

Here are some of the answers given by certain PSTs (F2a, F4a, and M4) who said that air pollution, factory waste, and nuclear power plants are among the riskiest environmental problems when asked why they are high risk:

"Because, for example, the exhaust fumes coming out of that car mix into the air and return to us like rain in the air. I think it may harm us." (F2a)

"The air we breathe. We get oxygen and it has to be clean. There must be an order in the world that can be passed on to future generations. And that is . . . no air pollution." (F4a)

"When we eat the food [chemicals] go directly to our bodies. . . . I see [chemicals] as riskier because they mix with the air and the air and water we breathe." (M4)

3.3.3 Views on Environmental Problems Perceived Least Risky

Some of the PSTs perceived environmental problems such as environmental waste (*f* = 6, 50%), and noise pollution (*f* = 3, 25%) to be the least risky. Here are the views of some of the PSTs, (F2a, F2b, F1b, and M1) regarding these two environmental problems, which are perceived to be the least risky but have the highest frequency, are as follows:

"The lowest risks are (types of environmental waste are listed) . . . littering, for example . . . cigarette butts thrown away, or the peel of a fruit we eat, they are thrown away. These seem to be the lowest risks at the moment." (F2a)

"The least risky is noise pollution. Then I think the exhaust fumes from cars. . . . The smoke coming out of

chimneys of houses, from the stoves." (F2b)

"[Environmental solid wastes means] the least risky is garbage thrown into the environment. Because they are more easy to collect, in a way. It is not as difficult as on seas or lakes." (F1b)

"The recyclable waste that people throw into the environment may be low risk. And noise pollution." (M1)

3.3.4 Reason for Environmental Problems to be perceived as Least Risky

In the interviews with the PSTs, the environmental problems with the highest frequency and the least risk were environmental waste (f = 6, 50%) and noise pollution (f = 3, 25%). PSTs F2a, F3a, and M1 explained their reasoning for why environmental wastes are low-risk, as follows:

"[Dumping of environmental waste on the ground is done] for now because these are considered very normal." (F2a)

"It may be the least (risky) garbage because there is also the recycling garbage. The plastics are separated, the glass bottles are separated, and the batteries are collected. So these may be less of a risk." (F3a)

"[Recyclable wastes and noise pollution] are lost in nature. . . . Because of that. So it doesn't harm the environment and habitats, because of that." (M1)

3.3.5 Information Resources on Environmental Problems

When learning about environmental problems, PSTs report to have benefited from the internet (f = 8, %66,6), courses (f = 5, %41,6), teachers (f = 4, %33,3), conferences (f = 4, %33,3), and books (f = 3, %25) as a source of information. At this point, the views of some of the PSTs (F2a, F2b, F4a, F3a, and M1) on these high-frequency information sources are as follows:

"From conferences, lectures I have taken. We see it in some parts of the course. Or, first of all, it is a situation that everyone should know. . . . we see it from the signs." (F2a)

"From my teachers, from the sourcebooks, I read, from the internet." (F2b)

"As a reference, from the environmental education course . . . I took conferences and attended a few of them this week. Our teachers are constantly in the surveys . . . and we talk about it in lectures." (F4a)

"I took an environmental science course from the university. I attended one of the conferences about environmental chemical waste. Then we can learn from magazines and books from anywhere." (F3a)

"We got some from the internet, some from the conferences we attended." (M1)

4. Discussion and Conclusion

The aim of this research has been to examine the environmental risk perceptions of PSTs in relation to different variables, such as the environmental problems they perceive as the most and least risky, and their views and information sources about their reasons for this opinion. According to the results of this research, the environmental problems that PSTs perceive to be the riskiest are "radiation" ($\overline{X}$ = 6.55), "factory waste" ($\overline{X}$ = 6.54), and "hazardous (chemical) waste" ($\overline{X}$ = 6.51), while the environmental problems they perceive to be the least risky are "overgrazing of animals in meadows and pastures" ($\overline{X}$ = 4.56), "commercial fishing" ($\overline{X}$ = 4.61), and "open mining" ($\overline{X}$ = 5.13). According to these results, environmental problems, which are perceived to be the riskiest by PSTs, may be seen by them as high risk because they directly affect human life. When these results are compared with studies in the literature, it seems that "radiation" (Altunoğlu & Atav, 2009; Beyhun et al., 2007; Lai et al., 2003; Sam et al., 2010; Slimak & Dietz, 2006; Walsh-Daneshmandi & MacLachlan, 2000), "hazardous (chemical) waste" (Altunoğlu & Atav, 2009; Beyhun et al., 2007; Lai et al., 2003; Sam et al., 2010; Slimak & Dietz, 2006) and "factory waste" (Walsh-Daneshmandi & MacLachlan, 2000) are among the five riskiest environmental problems. In parallel with the results of this research, Sam et al. (2010) similarly identified the lowest risk environmental problems as "overgrazing of animals in meadows and pastures," "commercial fishing," and "open mining."

According to the results of the data obtained through interviews, PSTs identified "factory waste" (f = 6, 50%), "air pollution" (f = 6, 50%), and "nuclear power plants" (f = 4, 33.3%) as the riskiest environmental problems. "Factory waste" (f = 6, 50%) and "nuclear power plants" (f = 4, 33.3%) overlap with the quantitative scale findings. Moreover, problems originating from nuclear power plants, namely "radiation" ($\overline{X}$ = 6.55) and "factory waste" ($\overline{X}$ = 6.54), were among the highest-risk environmental problems on the risk perception scale. However, unlike the results from the quantitative scale, one of the highest risk environmental problems obtained from the interviews was "air pollution" (f = 6, 50%). The main reason why air pollution is perceived to be a high risk environmental problem may be based on the idea that polluted air has negative effects not only on humans but also

on all living species. In addition, the fact that there are many air pollutants, such as "house chimneys," "industrial chimneys," and "car exhaust," may have caused PSTs to perceive air pollution to be perceive as high risk in general. Yet "environmental waste" (f = 6, 50%) was seen as the least risky environmental problem, as reported in the interviews. In this sense, recyclable environmental waste is not considered high risk. The reason for this is that environmental waste can be collected. In other words, the existence of several studies and practices for recycling may have created an element that weakens the perception of high risk. However, the perception that they are widely ubiquitous may also be influential in characterizing environmental waste as low risk in general. While this misconception may be thought-provoking, there were opposing statements made in the interviews that environmental waste was taken for granted in the world and that people acted without paying much attention to the situation. However, there were also opinions that environmental waste is a regional and local problem, and therefore its global damage would be less. Similarly, this view was also valid for "noise pollution" (f = 3, 25%), which was perceived to be the other high frequency and least risky environmental problem.

Another interesting opinion that emerged from the interviews was the confusion around ideas about nuclear power plants. In fact, while the perceived environmental risk of nuclear power plants is perceived as high risk by some PSTs, this perceived risk is low for others. While the existence of nuclear power plants was perceived to be a threat to life by some PSTs, the opposite opinion prevailed for others. There were even those who expressed that their ideas had changed in favor of nuclear power plants in the training and conferences they attended on this subject. This situation can be seen as a strong indication of the importance of education in developing awareness, perception, and understanding of any environmental phenomenon or concept. Updates on what will be an environmental risk in the developing, changing, and transforming world may indeed be provided through education. The highest frequency of information sources about environmental problems in the interviews with PSTs were "internet" (f = 8, 66.6%), "courses" (f = 5, 41.6%), "teachers" (f = 4, 33.3%), "conferences" (f = 4, 33.3%), and "books" (f = 3, 25%). In other words, the resources included in PSTs' educational processes can be seen as improving the perceptions of environmental problems.

In this research, when examining the environmental risk perception scores obtained through quantitative data in relation to gender, it is determined that there is a significant difference between the environmental risk perception scores of PSTs in favor of females. In other words, females' environmental risk perceptions tend to be higher than males' environmental risk perceptions. These results may lead us to conclude that females are more sensitive to environmental problems than males. While some studies in the literature support this result (O'Connor et al., 1999; Riechard & Peterson, 1998; Safi et al., 2012; Sam et al., 2010; Semenza et al., 2008), other studies show that there is no significant difference between environmental risk perception scores in relation to gender (Bayoğlu & Özgen, 2010; Slimak & Dietz, 2006).

However, this research shows that, upon examining the environmental risk perception scores of PSTs in relation to year-level, past experience with an environmental course, and mother and father educational statuses, no significant difference between the scores was found. In other words, PSTs' year-level, past experience taking an environmental course, and parents' educational status do not affect their perception of environmental risk. Sam et al. (2010) found similar results in their study.

5. Suggestions

In this study, environmental risk perceptions of PSTs were determined by applying the environmental risk perception scale and examining interviews. While these research results reveal the environmental problems that PSTs perceive to be the most and least risky, they also point out how important education is in the development, change, and transformation of how these problems are perceived. In this sense, updated and well-planned educational environments and materials can strongly impact environmental risk perceptions or awareness of environmental problems. In future research, environmental risk perceptions can be examined in different age groups and different among different populations and fields of study. However, in-depth research must be conducted on environmental problems seen as high and low risk. In addition, the contribution of many elements, especially the internet, which is seen as a major source of information for individuals' development on environmental knowledge, can be further examined.

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