Is Nuclear Power Acceptance Related To Environmental Literacy In Turkey?

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Abstract

Nuclear energy seems to be a promising alternative to meet Turkey's growing energy needs, and governments have been working on it for years. However, public acceptance of nuclear power is an important factor for governments to consider. This study aims to explore public acceptance of nuclear power in Turkey and its relationship with environmental literacy. There were 524 participants of this study, and data was gathered through a descriptive questionnaire, an environmental literacy scale for adults, and a questionnaire about acceptance of nuclear power. Findings were evaluated both qualitatively and quantitatively. It was found that the majority of the participants oppose the development of nuclear power as a major fuel source, particularly with reference to the harmful effects of nuclear power on the environment and general concerns over safety.Moreover, there is a slight negative correlation between acceptance of nuclear power and environmental literacy (i.e. participants with higher environmental literacy scores tended to oppose nuclear power). Also, a slight positive correlation was found between acceptance of nuclear power and gender(i.e. male support nuclear power more than female, those with children are more likely to oppose nuclear power).

*Keywords:*Nuclear power, public acceptance, environmental literacy, gender, having children

Introduction

Population growth, urbanization, and development in science and technology bring more energy consumption and demand. Therefore needs for energy or energy usages are seen as one of the parameters in the level of development of countries. The higher level of energy consumption leads to higher economic growth.(Melikoglu, 2016)

According to the World Energy Outlook report of 2015, the Global Demand for Energy Per Capita is assumed to grow at an average annual rate of 3.4% over 2016-2040, meaning it will expand by more than two-and-a-half times. This will force countries to use more efficient energy sources and new technologies of energy generation (Nowotny et al., 2016). Nowadays, projects investing in nuclear power, as well as other renewable fuel sources, have increased hugely in number(Ministry of Energy and Natural Resources ,2014). Currently, there are 446 nuclear power plants (NPP) in operation in 31 countries, with 59 further NPP under construction in 16 countries (as of August 2017). By the year 2035, it is expected that the electric production from nuclear power will increase to 3908 TWh, and that the world's installed nuclear power capacity will increase to 524 GW (Ministry of Energy and Natural Resources, 2014).
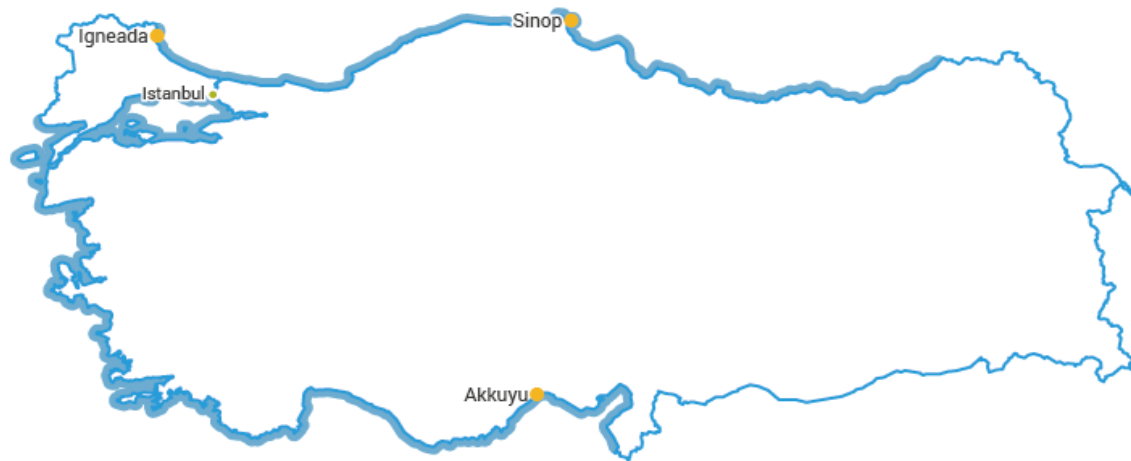
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Figure 1. Planned Nuclear Power Plants in Turkey (Source: World Nuclear Association)

According to the International Energy Association (IEA, 2017), the United States is the number one nuclear power producer in the world with 822 TWh (about 55.2% of the world's output) and 99 GW net-installed capacities. France, similarly, meets 74.7% of its domestic energy needs with nuclear power. Turkey, however, imports much of its energy, including 56% of its natural gas and 11% of its oil in 2015.

Improving energy efficiency and energy security are, therefore, high priorities (World Nuclear Association, 2017). In 2015 Turkey's electricity production was 262 TWh gross (Electricity Generation Company, 2015). In addition, 99 TWh (38%) came from gas (two-thirds of this from Russia, most of the rest from Iran), 76 TWh (29%) from coal, 67 TWh (26%) from hydraulic and 12 TWh (4.6%) from solar and wind. Consumption in 2015 came to 217 TWh, or about 2700 kWh, per capita on average. It is expected to be 450 billion kWh in 2023, which will demand implying new investment of $100 billion.

In 1955, Turkey signed an agreement with the US on the peaceful use of atomic power; these initial ideas finally came to fruition on May 2010, when Turkey began to cooperate with Russia on the building of a nuclear power plant in Akkuyu, a small town in the south-west of Turkey (Ministry of Energy and Natural Resources, 2014). In order to meet the increasing demand for electricity and to decrease the risks arising from import dependency, current plans are to bring two nuclear power plants into operation and another one into construction by the year 2023. The planned nuclear power plants' locations on the map can be seen in Figure 1. The nuclear power plant been planning to build in Sinop, in the northeast of Turkey, and agreements relating to this investment were signed in 2013 (Ministry of Energy and Natural Resources, 2014, World Nuclear Association, 2017). By taking into account these two power plants (Akkuyu and Sinop),we can predict that soon Turkey will be producing 80 billion kWh of electricity per year. This amount of electricity would be produced from a natural gas power plant, with an annual export of 16 billion cubic meters of natural gas with a cost of 7.2 billion US dollars. Over three years, this profit could be used to construct four further nuclear power plants (Ministry of Energy and Natural Resources, 2014, Akkuyu Nuclear, 2017). By 2025, it is predicted that the percentage of energy produced by nuclear power plants will rise to 5% (Ministry of Energy and Natural Resources, 2014).

Although nuclear power is an efficient way to produce energy, public acceptance of nuclear power is a crucial factor for the governmental establishment of a nuclear energy program. Therefore, it is important to understand the determinants of public acceptance of nuclear power (Kim, Kim, & Kim, 2014).

There are already some studies in the literature that investigate the acceptance of nuclear power. Ertor-Akyazi, Adaman, Ozkaynak, & Zenginobuz (2012) explored citizens' preferences on nuclear and renewable energy sources by face-to-face surveying, gathering data from 2422 residents in urban Turkey. According to their findings, opposition to nuclear power was strong, and only a small number of respondents listed it in their top two choices for energy sources. They also found that citizens who listed nuclear or renewable energy in their top two energy choices were mostly males, were knowledgeable about climate changes but not concerned about environmental problems. On the other hand citizens who did not list nuclear or renewable energy sources in their top two choices were concerns about the environment and pessimistic about the future. In another study by Benzer et al. (2014), knowledge and opinions of middle school students about nuclear power were investigated; students learn about nuclear energy in school, but still were mostly opposed to the establishment of nuclear power plants in Turkey, citing nuclear disasters such as the one in Fukushima.

In fact, the Fukushima nuclear disaster of 2011 has had worldwide repercussions on public acceptance of nuclear energy, as examined by Kim, Kim and Kim (2013). Their study showed that, in 42 countries,opinions on nuclear power became considerably negative after the energy accident, suggesting fundamental changes in public acceptance regardless of the level of acceptance before the disaster. Kim et al., in 2014, examined the effects of knowledge, trust, risk, and benefit related factors on public acceptance of nuclear power across 19 countries. According to their findings, knowledge of nuclear inspection is more effective than trust in inspection authorities in creating stronger public acceptance among people in countries with a high level of 'reluctant acceptance' and a low level of 'strong acceptance'. In countries with a low level of 'reluctant acceptance' and a high level of 'strong acceptance', trust in inspection authorities is more important than knowledge of nuclear inspection. In a recent study, Guo and Ren (2017) explored factors that affect the local acceptance of planned nuclear power plants, and concluded that public acceptance is influenced byparticipants' proximity to the proposed sites. According to their findings, closeness to the plant sites and willingness to nuclear power are negatively correlated; that is, peoplewho live further away from a nuclear power plant (actual or potential) are more willing to show positive emotions towards nuclear power.One of the factors that affect nuclear power usage is public acceptance, that might potentially berelated to environmental literacy.

Environmental literacy, which was originally described by Roth as "the level of environmental awareness and environmental knowledge" (Wright, 2006), was explained by Orr (1990) as "the widespread understanding of humans' and societies' relations with the natural environment". Individuals with enhanced environmental literacy have awareness of, knowledge of, and sensitivity to how natural systems work, and the effects of human activities on these systems (Teksoz, Sahin, & Ertepinar 2010). According to Roth (1992) an environmentally literate individual should be aware of the effects of technological developments on environment. Although there are many different views on the precise components of environmental literacy, one definition includes the categories of'environmental knowledge', 'environmental attitude', 'environmental skills' and 'environmental behavior' (Roth, 1992). There are many studies exploring the environmental literacy of university students (Teksoz, Sahin, & Ertepinar 2010; Tuncer et al., 2009), teachers (Owens, 2000), primary and secondary school students (Ulucinar-Sagir, Aslan& Cansaran, 2008; Alp, Ertepinar, Tekkaya, & Yilmaz, 2006), and adults (Atabek-Yigit, Köklükaya, Yavuz, & Demirhan, 2014).

The current study, different from the literature, aims to determine the public acceptance of nuclear energy and its relationship with environmental literacy, as well as considering some other variables which may influence this acceptance.

In this study, environmental literacy of adultswas obtained through a scale, while their opinions on nuclear energy were gathered with a question form. Findings from this study would provide useful inputs to policy-makers and nuclear power developers, providing ideas to enhance the level of social acceptance of nuclear energy.

Methodology

Participants

The participants of this study consisted of 524 adults (69.08% female and 30.92% male) who live in different cities of Turkey. The ages ranged from 18 to 56+, with a mean age of 20.42 (±1.90). Participants'type of living place wasrecorded, with 61.07% urban, 28.43% rural and 10.50% village. The descriptive features of the participants were presented in Table 1.All participants completed the instruments anonymously and voluntarily.

Data Collection Instruments

Three instruments were administered to the participants(with paper and pencil): a descriptive questionnaire, an environmental literacy scale for adults, and aquestionnaire about acceptance of nuclear power.

Descriptive Questionnaire.A demographic questionnaire was used to obtain data ofthe participants' age, gender, type of living place, education level, monthly income, number of children, and so on.

Environmental Literacy Scale for Adults (ELSA). TheEnvironmental Literacy Scale for Adults was developed by Atabek-Yigit et al. (2014) and is used for identifying the participants' levels of environmental literacy. This instrument was composed of 20 items with a 5-point Likert-type scale, and three subscales of "environmental consciousness", "environmental anxiety" and "environmental awareness". The internal consistency coefficient of the scale was 0.881, and the sub-scales' coefficientswere 0.807, 0.765 and 0.715 respectively. In the presentstudy, the scale's total Cronbach-Alpha coefficient was 0.80.

Questionnaire about Acceptance of Nuclear Power.Thisquestionnaire was developed by the researchers to gather data on participants'acceptanceof nuclear power. It contained two items, allowing participants to write in their own comments or to choose from provided options that fit best with their ideas.

Data Analysis

In this research, the data was analyzed both quantitatively and qualitatively. In the quantitative part of the study, the distribution of scores from ELSA and its subscales were examined for normality via skewness and kurtosis (>±1). The variables were not normally distributed and non-parametric statistics were conducted.Descriptive statistics [mean (x), standard deviation (s), percentage (%), frequency (f)] andthe Spearman Rank Difference Correlation werecalculated.Also, the Spearman Rank Difference Correlation Analysis was used to determine the relationship between participants' environmental literacy (as in their total and sub-scores from ELSA)and different demographic factors.The level of significance was set to .05 and the software package PASW Statistics 18.0 was used for statistical analyses in the quantitative part of the study.

In the qualitative part of the study, content analysis was performed on participants'acceptance of nuclear power, assigning each response to one of

threecategories: 1) definitely opposed to the establishment of a nuclear powerplant,2) definitely in favour of the establishment of a nuclear power plant, and3) possibly in favour of the establishment of a nuclear power plant, depending on location of plant.

Findings

Descriptive statistics of the participants by demographic characteristics

Table 1 demonstrates participants' acceptance of nuclear power plant (NPP) along with descriptive statistics on their environmental literacy scores in relation to some demographic characteristics.

Table 1.

Participants' Acceptance of NPP and Descriptive Statistics on Their Environmental Literacy Scores in Relation with Some Demographic Characteristics.

Variables		Supporters				Non-supporters				Total			
		N	%	X	S	N	%	X	S	N	%	X	S
Gender	Female	100	54.64	78.615	7.62	262	76.83	79.158	7.53	362	69.08	79.008	7.55
	Male	83	45.35	78.649	8.49	79	23.17	81.251	9.42	162	30.92	79.918	9.03
	Total	183	100	78.631	8.00	341	100	79.643	8.04	524	100	79.289	8.04
Age	18-25	83	45.36	76.606	6.92	171	50.15	78.704	7.47	254	48.47	78.018	7.37
	26-35	48	26.23	80.325	8.21	76	22.29	79.206	8.10	124	23.66	79.639	8.13
	36-45	26	14.21	81.470	7.61	37	10.85	80.439	8.73	63	12.02	80.864	8.24
	46-55	17	9.29	79.588	11.67	38	11.14	81.897	8.16	55	10.50	81.184	9.33
	56+	9	4.92	78.266	4.81	19	5.57	83.789	9.59	28	5.34	82.010	8.67
	Total	183	100	78.631	8.01	341	100	79.643	8.04	524	100	79.290	8.04
Place of residence	Urban	110	60.11	80.170	7.51	210	61.58	80.672	8.07	320	61.07	80.500	7.87
	Rural	50	27.32	77.060	8.61	99	29.03	78.790	7.68	149	28.43	78.209	8.01
	Village	23	12.57	74.682	7.22	32	9.38	75.530	7.55	55	10.50	75.175	7.36
	Total	183	100	78.631	8.01	341	100	79.643	8.04	524	100	79.290	8.04
Educational status	Primary school	24	13.11	76.120	8.29	37	10.85	77.167	7.77	61	11.64	76.752	7.93
	Secondary school	17	14.75	79.692	9.29	20	5.86	79.920	9.79	37	7.06	79.815	9.43
	High school	24	13.11	79.167	8.17	54	15.83	81.937	9.35	78	14.88	81.078	9.04
	University	105	57.38	78.641	7.92	200	58.65	79.378	7.52	305	58.21	79.125	7.65
	Graduate	13	7.10	80.803	5.86	30	8.80	80.168	7.40	43	8.21	80.360	6.91
	Total	183	100	78.631	8.01	341	100	79.643	8.04	524	100	79.290	8.04
Having children	Yes	69	37.70	79.532	9.11	118	34.60	80.299	8.57	187	35.69	80.016	8.75
	No	114	62.29	78.085	7.25	223	65.39	79.296	7.75	337	64.31	78.887	7.59
	Total	183	100	78.631	8.01	341	100	79.643	8.04	524	100	79.290	8.04
Number of children	1	13	18.84	77.087	8.02	35	29.66	79.344	7.54	48	25.67	78.732	7.65
	2	27	39.13	81.472	8.40	49	71.01	81.987	8.86	76	40.64	81.804	8.65
	3	16	23.19	83.751	9.33	20	28.98	78.162	8.66	36	19.25	80.646	9.27
	4	5	7.25	74.000	8.00	9	13.04	78.072	9.95	14	7.49	76.618	9.20
	5	4	5.80	74.964	6.95	5	7.25	83.000	9.03	9	4.81	79.429	8.76
	6+	4	5.80	69.000	7.87					4	2.14	69.000	7.87
	Total	69	100	79.533	9.11	118	100	80.299	8.57	187	100	80.016	8.75
Employment status	Employed	81	44.26	80.130	8.55	151	44.28	81.534	8.06	232	44.27	81.044	8.24
	Unemployed	102	55.74	77.440	7.38	190	55.72	78.141	7.72	292	55.72	77.895	7.60
	Total	183	100	78.631	8.01	341	100	79.643	8.04	524	100	79.290	8.04
Monthly income(TL')	Below 1.000	40	30.30	77.562	7.43	66	27.97	78.664	6.95	106	28.80	78.248	7.12
	1.000-1.999	33	25.00	79.320	8.09	68	28.81	80.692	9.23	101	27.44	80.243	8.86
	2000-3.999	40	30.30	81.578	8.90	84	35.59	82.152	7.77	124	33.69	81.970	8.12
	4.000-4.999	7	5.30	77.571	7.25	9	3.81	81.111	8.45	16	4.35	79.562	7.90
	5.000 and above	12	9.09	79.790	9.73	9	3.81	83.043	6.57	21	5.71	81.184	8.49
	Total	132	100	79.424	8.31	236	100	80.750	8.06	368	100	80.275	8.17

*TL is Currency in Turkey, 1TL is roughly 0.25 $.

In Table 1 it can be seen that the average scores of environmental literacy of female and male supporterswere very close to each other, whereas the average scores of

male opponents to nuclear power werehigher than female opponents. When the average scores of environmental literacy of supporters and opponents were examined, it was determined that the average score of both male and female opponentswas higher than supporters.In addition, it shows that the environmental literacy averages of supporters of the nuclear power plant are highest in the age range of 36-45 years, while the averages of opponents are the highest in the 56+ age range. The average environmental literacy scores of urban-residing individuals are higher than those of rural-residing individuals, whether these groups support or oppose the establishment of nuclear power plants. When the averageenvironmental literacy scores of individuals were examined, a correlation between larger settlement size and higher scores on the scale was found. When the average environmental literacy scores of supporters and non-supporters were examined, it was revealed that the averages of individuals who do not support the nuclear power plant installation, whether they live in urban spaces or rurally, are higher than the individuals who support it.

Most of the participants were educated to university level; educational status was also linked to environmental literacy scores and support of nuclear power. Table 1 shows that individuals who support nuclear power and whose educational status is at the graduate level had a higher environmental literacy score than other individuals. When the averageenvironmental literacy scores of individuals who do not support the nuclear power plant were examined, it was determined that the averages of high school graduate participants were higher than the other participants. When the averageenvironmental literacy scores of supporting individuals were examined, it was seen that as the level of education increased, scores from the scale also increased.The majority of participants did not have children. The averageenvironmental literacy scores of individuals who do not support the nuclear power plant installation and have children are higher than the averages of the individuals who do not support the nuclear power plant installation and who do not have children. Similarly, the scores obtained from individuals who support plant installation and have children were determined to be higher.

Also, it is seen that the majority of the participants are unemployed. Among the participants who support or do not support the nuclear power plant, it was determined that the averageenvironmental literacy scores of those who are employed are higher than those who are not employed. According to the employment status, it was determined that the scores of individuals who do not support the installation of the plant are higher than those who support nuclear power.

Finally, it can be said that the income level of the majority of the individuals supporting the nuclear power plant is below 1000 and between 2000 and 3999 TLwhile the income level of the majority of opponents is between 2000 and 3999 TL. According to Table 1, the scores obtained from individuals who support the nuclear power plant and have income level of 2000-3999 TL, and the scores of individuals who do not support the nuclear power plant and have income level of 5000 TL or above, are higher than those at other income levels. When the average environmental literacy scores of supporters and opponentswere examined, it was determined that the averages of the opponents and who have an income level of 5000 TL and above are higher than supporters.

Findings Related to the Relationship between whether NPP are Supported and Various Variables

This study aimed to explore public acceptance of nuclear power in Turkey and its relation with environmental literacy. For this reason, the relations among research variables were investigated. The results of Correlation Analysis, which were made to determine the relationship between NPP and ELSA, are listed in Table 2.

Table 2.

Correlations Between Acceptance of NPP and ELSA

	(I)	(II)	(III)	(IV)	(V)
(I) Acceptance of NPP	1	-.107*	-.090*	-.099*	-.066
(II) ELSA total		1	.807**	.835**	.730**
(III)Environmental anxiety			1	.521**	.508**
(IV)Environmental consciousness				1	.359**
(V)Environmental awareness					1

When Table 2was examined, there is a negative, statistically insignificantrelationshipbetween supportive opinions of nuclear power plant and the environmental literacy (r=-.107; p<0.05), environmental anxiety (r=-.090; p<0.05) and environmental consciousness (r=-0.99; p<0.05) sub-dimensions. It can be argued that individuals with high environmental literacy do not support the installation of nuclear power plants. There was no significant relationship between acceptance of NPP and the sub-dimension of environmental literacy awareness (r =-.066; p> 0.05).

A secondary aim of the study was to determine whether there is a significant relationship between NPP and demographic characteristics. Results of the calculations of the Spearman Rank Difference Correlation have been indicated in Table 3.

Table 3.

Correlations Between NPP and Demographic Characteristics

	(I)	(II)	(III)	(IV)	(V)	(VI)	(VII)	(VIII)	(IX)
(I) Acceptance of NPP	1	.229**	.027	.024	-.046	.031	.160*	.000	.023
(II)Gender		1	.221**	-.050	-.066	.105*	.182*	-.355**	.233**
(III)Age			1	.023	-.481**	.720**	.431**	-.334**	.302**
(IV)Place of residence				1	-.244**	.094*	.198*	.158**	-.164*
(V)Educational status					1	-.545**	-.341**	-.045	.223**
(VI)Having children						1	.971**	-.226	.148
(VII)Number of children							1	.179*	-.110
(VIII)Employment status								1	-.506**
(IX) Monthly income									1

Table 3demonstrates a positive andstatistically significant relationship between support of nuclear power plants,and gender (r=0.229; p<0.05), and number of children (r=0.160; p<0.05). There is no significant relationship between acceptance of NPP and the age of the participant (r=0.027; p>0.05), type of living place (r=0.024; p>0.05), educational status (r=-0.046; p>0.05), having children (r=0.031; p>0.05), employment status (r=.000; p>0.05) and monthly income (r=0.023; p>0.05).

Opinions of participants for the nuclear plants construction in their living area

The data on the frequencies and percentages of opinions regarding the installation of a NPP in the region where participants live depending on the acceptance of NPPwas presented inTable 4.

Table 4.

The Frequencies and Percentages of Opinions Regarding the Installation of a NPP in the Region Where Participants Live Depending on the Acceptance of NPP

Answers according to the installation of NPPs in the region where they live	NPPs			
	Supporters		Opponents	
	N	%	N	%
I would give the same answer	143	78.14	310	90.91
I would give a different answer	36	19.67	25*	7.33
Unanswered	4	2.18	6	1.76
Total	183	100	341	100

* Some participants had already answered that their support of a NPP would be conditional on it being built far from them, so their answers were not included in this section

When Table 4 was examined, it is seen that the vast majority of individuals continue to either support or oppose the establishment of nuclear power plants when asked if their answer would change if a NPP was proposed near where they live.

Within the scope of the research, participants' responses to the questions "Do you support the installation of nuclear power plants to meet the increasing energy demand in our country?" and "If you had known that the nuclear power plant would be installed in the region where you live, would you still give the same answer to the previous question and why?" were analyzed and presented in Table 5, Table 6 and Table 7.

Table 5.

Opinions of Participants Who Support the NPP but Do Not Approve of Its Installation in Their Own Region (N=36)

Theme	Code	Frequency (f)	Percentage (%)	Total Percentage (%)
Humans	NPP should not be installed in settlements	12	22.22	
	NPP harm humans	11	20.37	46.29
	NPP should not be installed in areas where there is a risk of earthquakes	2	3.70	
Environment	NPP harm environment.	12	22.22	
	NPP cause environmental pollution	3	5.55	
	Radiation	3	5.55	42.57
	Waste	3	5.55	
	Air pollution	1	1.85	
	Risk of explosions	1	1.85	
Positive aspects of nuclear energy	Benefit for the country	2	3.70	
	Employment	1	1.85	5.55
Other	Concern	2	3.70	5.55
	No ideas	1	1.85	
Total		54	100	100

When Table 5 was examined, it is seen that participants mostly emphasized the negative effects of NPP on human health. Also, a large proportion of the participants stated that these plants harm both people and the environment, and should not be installed in or near settlements. A sample of responses from the participants are given below:

> K59: It would certainly not be appropriate to install a plant where I live. The region where I live is an earthquake-prone zone; it must be installed where there is less risk of an earthquake.

K82: Iwould rather we didn't have to rely on outside financial resources, and that we could produce more energy with our own raw materials.

K98: The waste it will produce may cause harm. It must be installed far away from humans

K400: I think that Nuclear Power Plants should be installed far away from the settlements, not close to them.

Table 6.

Opinions of Individuals Who Support the NPP and Approve of Its Installation in Their Region (N=143)

Theme	Code	Frequency (f)	Percentage (%)	Total Percentage (%)
Country	Increase in welfare	13	13.98	
	Indicator of development	13	13.98	
	Usefulness	12	12.90	
	Provides efficient energy production	11	11.83	
	Reducing dependence on foreign resources	11	11.83	79.56
	Lowering energy cost	8	8.60	
	Keeping up with the age	3	3.22	
	Meeting energy needs	3	3.22	
Environment	The wide range of adverse effects	8	8.60	
	Environmentally friendlier than alternatives	4	4.30	16.12
	The environment is already dirty	2	2.15	
	Does not harm natural life	1	1.07	
Other	No ideas	4	4.30	4.30
Total		93	100	100

In Table 6 itwas seen that the vast majority of participants emphasize the various positive effects that nuclear power has. Most participants commented on how nuclear power plants increase the level of development and prosperity of the country, are beneficial and provide efficient energy production. A sample of responses is included below:

K175: Nuclear power provides high-efficiency energy production.

K274: In order for our country to be a developed country, there must most certainly be a nuclear power plant; but, as I have already mentioned in the previous question, I don't have sufficient knowledge on the topic. If I had sufficient knowledge, why wouldn't I support it?

K474: I believe that it must be installed in order for our country to have a say among the developed countries.

K457: Our country is dependent on foreign resources in terms of energy. Nuclear power plants should be established to reduce or even eliminate this dependency - to be a country that does not pay for energy but gains from it.

Table 7.

Opinions of Participants Who Do Not Support NPP or the Installation of NPP in Their Region. (N=310)

Theme	Code	Frequency (f)	Percentage (%)	Total Percentage (%)
Harmful aspects	Harmful to the environment	67	25.09	
	Harmful to human health	59	22.10	
	Harmful (general)	30	11.23	63.66
	Harmful to natural resources	14	5.24	
	Radiation	5	1.87	
Security risks	Risk of explosion	21	7.86	
	Concerns about ensuring occupational safety	20	7.49	
	Storage of waste	8	3.00	20.97
	Lack of information	4	1.50	
	Dangerous	3	1.12	
Concerns	Future generations	13	4.87	
	Large impact	4	1.50	
	Irreversible damage	3	1.12	8.61
	Negative views of developed countries on nuclear power plants	3	1.12	
Alternative resources	Renewable energy	9	3.37	4.87
	Natural energy	4	1.50	
Total		267	100	100

When Table 7was examined,an overwhelming majority of NPP-opposing participants indicated that such plants cause various damages, especially to the environment and human health. In addition, some of the participants stated that these plants should not be installed due to security risks, such as occupational safety and possibility of explosion. Accordingly, sample responses from the participants are given below:

> K6: I am against a plant that threatens our health and harms the environment.

> K66: Regardless of where they are installed, I am against them. No matter where they are, I think they generate energy that damages nature. In case of an explosion, outcomes will be general, not regional. I am of the opinion that it does not affect only the region where it is installed.

> K91: I think it will damage our natural resources. I do not want it to be installed in the region I live because I think it is an energy that harms human health.

> K494: I do not believe that this will be done properly in our country. I think the storage of waste is too risky.

Results and Discusiion

Nuclear energy is one of the socio-scientific issues that societies must recognize the importance of in order to develop sustainability and environmental understanding (Zengin-Kırbağ, Keçeci, Kırılmazkaya & Şener, 2011). It is proposed as an alternative to meet the increasing energy needs of our country (Udum, 2010), and the development of NPP is one of the main political objectives of our country (Ministry of Energy and Natural Resources, 2014). Although people throughout the world showed positive attitudes towards nuclear power plants until the 1970s (Wittner, 2003), it has been seen that the trust of the people was negatively affected due to accidents in Three Mile Island in the US in 1979, Chernobyl in Russia in 1986, and Fukushima Daiichi in Japan in 2011 (Venable, Pidgeon, Simkons, Henwood, & Parkhill, 2009; Palabıyık, Yavaş & Aydın, 2010;Greenberg & Truelove, 2011; Visschers & Siegrist, 2013; Siegrist & Visschers, 2013). In this study, the opinions of adults on the installation of nuclear power plants were investigated according to their level of

environmental literacy and various other variables. Furthermore, it was examined how the opinions of the participants were influenced by the probability that the region where nuclear power plants would be installed is the region where they live.

A remarkable finding in the current study reveals that individuals with high environmental literacy did not support the establishment of nuclear power plants. Similarly, Şenyuva and Bodur (2016) found that university students with a high level of environmental literacy had negative attitudes towards the installation of nuclear power plants and nuclear energy use in Turkey. Furthermore, according to Yilmaz, Çelik and Arslan (2010), individuals with low environmental sensitivity have positive attitudes towards nuclear energy, which supports the present study's findings. Along with that, according to various research results, the level of knowledge of individuals about the risks and benefits of nuclear energy affects their opinions of nuclear power plants (Stoutenborough, Sturgess, & Vedlitz, 2013; Kim et al., 2014; Özdemir, 2014; Eş et al., 2016). This may be one of the reasons why so many participants had negative opinions about NPP.

When the relationship between participants' support of nuclear power plants and their gender is examined, it was found that male participants are more supportive of the installation of nuclear power plants than female respondents. This aligns with the conclusions of several previous studies, which revealed that male participants approved more of nuclear energy than female participants (Özdemir & Çobanoğlu, 2008, 2013), and that female tend toconsider nuclear power plants as a more harmful and risky energy production method when compared to male (Gwartney-Gibbs & Lach, 1991; Davidson & Freudenburg, 1996; Atik, Ekici, Çimen, & Altunsoy,2010). Besides there are studies which indicate that the environmental literacy of individuals and their opinions on nuclear power plant installation - specifically on the use of nuclear energy in Turkey - do not differ according to gender (Özdemir & Çobanoğlu, 2008; Gürbüz, Kışoğlu, Alaş, & Sülün, 2011; Şenyuva & Bodur, 2016). Similarly, there are several studies indicating that gender has no effect on the attitudes towards nuclear power plants (Bilen, Özel, & Sürücü, 2013; Venable et al., 2009).

When the relationship between the number of children the participants have and their support for nuclear power plants is investigated, it was found that the more children respondents had, the less likely they were to support nuclear power plants. On the other hand, Özdemir and Çobanoğlu (2008) found no statistically significant difference between the number of children of the participants and their support of the installation and use of nuclear power in Turkey. Özbakır Umut, Topuz and NurtanışVelioğlu (2015) determined that individuals who have children are more concerned about the future and are more sensitive to environmental pollution than single individuals. Accordingly, it can be said that as the number of children participants have increased, their sensitivity towards the environment also increases and therefore they do not support the installation of nuclear power plants.

In the current study, it was found that most of the participants (N=341; 65.07% of total) did not support nuclear power plants. Similarly, in many studies, it has been found that Turkish people do not support the installation of nuclear power plants (Köksal & Civan, 2010; Palabıyık et al., 2010; Çakıcı & Yılmaz, 2012; Kahyaoğlu & Kaya, 2012). The vast majority of participants in the current study stated that their opinions on the installation of nuclear power plants would not change, even if it was to be installed in the region they live (N=453; 86.45% of total). Those who changed their opinions constitute a relatively smaller part of the participants (N=61; 11.64%). According to the literature, support for nuclear power plants usually changes according to the region where they are installed (Bisconti, 2010; Palabıyık et al., 2010). Guo and Ren (2017) found that those living in areas close to nuclear power plants are less willing to support nuclear energy than those living further away.

When the reason why individuals support nuclear power plants even if they were installed in their region (N=143; 27.29% of total) is investigated, it is seen that participants gave answers under a variety of titles ranging from "in terms of the country", "in terms of the environment" and "other". Within these themes, it was found that the codes of "increase in welfare", "indicator of development", "beneficial" and "reducing dependency on foreign resources"were the most common positive responses, while the code of "wide range of adverse effects" was the most common negative response. In other words, responses of participants who support nuclear power plants, and would still support them if installed in their own regions, included especially the ideas that nuclear energy would increase the welfare of our country, and that it is a more environmentally-friendly energy than other fuel energy sources. Supporting these findings, there are many studies that indicate that the use of nuclear energy is likely to reduce dependency on foreign resources and have a positive effect on reaching the level of developed countries (Palabıyık et al.,2010; Ergün & Polat, 2012; Ateş & Saraçoğlu, 2013; Sürmeli, Duru, & Duru, 2017).

When the reasons that those who did not support nuclear energy (N=310; 59.16% of total) are examined, their responses can be gathered under four themes:"harmful aspects", "security risks", "concerns" and "alternative sources". Within these themes, it is seen that the codes of "harmful to the environment", "harmful to human health", "harmful", "risk of explosion" and "future generations" were stated more than the other codes. When the answers in this category are examined generally, it can be seen that those who do not support nuclear power plants, and would still not support them if they were installed in the regions other than where they live, explained the reason for this by emphasizing the harmful effects of nuclear power plants on the environment and human health.

Finally, when the opinions of participants who support nuclear power plants but do not approve of their installation in their own regions (N=36; 6.87% of total) are examined, these opinions can be collected under four themes: "harmful to human health", "harmful to the environment", "positive aspects of nuclear energy" and "other". When the codes within these broader themes were examined, it was found that the codes "they should not be installed in settlements", "harms the environment" and "harms humans"were frequently repeated. In other words, although participants in this category supported nuclear power plants, they stressed the negative effects of nuclear power plants on human health and the environment if they were to be installed in their own regions.

When the answers in the last two categories are examined, it is seen that they overlap with the results of many studies in the literature. For example, studies that indicate that accidents occurring in nuclear power plants have a negative effect on societies' opinions on nuclear energy support this finding (Venableet al., 2009; Whitfield, Rosa, &Dan ve Dietz, 2009; Greenberg &Truelove, 2011;Neumann & Hopf, 2012; Kim et al., 2013; Visschers & Siegrist, 2013). In addition, the IAEA (2017) revealed that technological problems (i.e. how to design, install and operate) of nuclear power plants are still important. Also, the fact that nuclear power plants have negative impacts on the environment and human health due to waste and safety risks, and that these effects influence a large area and the individuals living in this area, affects the opinions on nuclear power plants negatively (Palabıyık et al., 2010; Çakıcı & Yılmaz 2012; Kaya, 2012; Şenyuva & Bodur, 2016; Sürmeli, Duru, & Duru, 2017).

In summary, the study found that participants' acceptance of NPPs is negatively correlated with their environmental literacy. In addition, it was found out participants' opinions on nuclear power plants changed slightly according to gender and the number of children they had. When the findings related to the participants' opinions on the installation of nuclear power plants in the regions where they live are examined, it can

be concluded that the participants do not support the installation of nuclear power plants in their living place. Furthermore, it was found out that the participants who supported the installation of nuclear power plants but not in their regions explained this by stressing the negative effects of nuclear power plants, in a manner similar to those who do not support them under any circumstances.

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Türkiye'de Nükleer Enerji Taraftarlığı ve Çevre Okuryazarlığı İlişkili mi?

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Özet

Nükleer enerji, hükümetlerin üzerinde yıllarca çalıştığı ve Türkiye'nin büyüyen enerji ihtiyacını karşılamak için geleceği parlak bir alternatif olarak görülmektedir. Bununla birlikte toplumun nükleer santral taraftarlığını belirlemek hükümetin bu durumu değerlendirmesi için önemli bir faktördür. Bu çalışma ile Türkiye'de toplumun nükleer santral taraftarlığı ve bu durumun çevre okuryazarlığı ile ilişkinin araştırılması amaçlanmıştır. Bu çalışma dahilinde 524 katılımcı yer almaktadır ve veriler, demografik özellikleri belirleyen soru formu, yetişkinler için çevre okuryazarlığı ölçeği ve nükleer santral taraftarlığı ile ilgili bir soru formu/anket yardımıyla toplanmıştır. Bulgular, hem nitel hem de nicel olarak değerlendirilmiştir. Katılımcıların çoğunluğunun temel yakıt kaynağı olarak özellikle çevre üzerindeki zararlı etkilerine ve güvenlik ile ilgili genel kaygılarına bağlı olarak nükleer santral kurulumuna karşı oldukları sonucuna ulaşılmıştır. Ayrıca, çevre okuryazarlığı ile nükleer santral taraftarlığı arasında negatif bir ilişki olduğu tespit edilmiştir (çevre okuryazarlık puanı yüksek olan katılımcıların nükleer santral kurulumuna karşı olma eğilimi fazladır). Ayrıca, cinsiyet ile nükleer santral taraftarlığı arasında pozitif bir ilişki olduğu bulunmuştur (Erkek katılımcıların kadın katılımcılara göre nükleer santral kurulumunu daha çok desteklemesi,çocuğu olan bayan katılımcıların nükleer santral kurulumuna karşı olması).

Anahtar Kelimeler:Nükleer santral, toplum taraftarlığı, çevre okuryazarlığı, cinsiyet, çocuk sahibi olma

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