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EVALUATION OF HIGH SCHOOL STUDENTS' ATTITUDES TOWARDS RENEWABLE ENERGY WITHIN THE SCOPE OF SUSTAINABLE ENERGY

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Abstract: The aim of this study is to determine the attitudes of high school students in a northern province of Türkiye toward renewable energy sources. To achieve this goal, a 37-item Renewable Energy Attitude Scale, developed by Çelikler and Aksan (2016), was administered to 721 high school students in grades 9, 10, 11, and 12. The collected data were analyzed using the SPSS statistical software package. The results revealed that the students scored above-average points on both the overall scale and its sub-factors. Additionally, the highest mean scores were observed in the "Energy sources and their area of use" factor, while the lowest scores were in the "Economy" factor. Furthermore, while there was no significant difference in the students' total attitude scores based on gender, a significant difference was found in favor of 12th-grade students when considering grade level.

Key words: Renewable energy source, sustainable energy, high school student, attitude, environmental education

1. Introduction

In the modern world, it is observed that the increase in societies' welfare levels is directly proportional to energy consumption. Considering that energy consumption serves as an indicator of social and economic development in nations, and that being a powerful country is contingent upon economic and social progress, the decisive role and potential significance of energy in the future of the world and humanity becomes more evident (Bozkurt, 2008).

Nowadays, approximately 65% of the world's energy production is derived from fossil fuels due to their accessibility and usability (Veziroğlu & Şahin, 2008). However, the unsustainability of fossil fuel resources, their tendency to create foreign dependency for nations, and their contribution to environmental problems have increased interest in and demand for renewable energy sources (Güler, 2006). Renewable energy sources—classified as solar, wind, geothermal, hydraulic, hydrogen, wave, and biomass energy—are resources that can be reused within nature's own cycle, do not cause pollution, and are healthy and reliable (Biçici, 2008; Güneş, 1999; Oktit, 2000; Yıldız, Sipahioğlu & Yılmaz, 2000).

The most effective solution to the environmental problems threatening the world for sustainable development is the use of renewable energy sources. Renewable energy sources are crucial in meeting countries' growing energy demands, as they are unlimited, clean, practical, cost-effective (Zeray, 2010) and environmentally friendly (Yıldız, Sipahioğlu & Yılmaz, 2000; Zeray, 2010).

Sustainable energy is a paradigm aimed at reducing dependence on fossil fuels while ensuring environmental sustainability and energy security. Within the framework of the United Nations Sustainable Development Goals (SDGs), particularly SDG-7 (Affordable and Clean Energy) and SDG-13 (Climate Action), sustainable energy plays a pivotal role in global development and climate change mitigation. A symbiotic relationship exists between sustainable energy and renewable energy: renewable energy sources form the core components of sustainable energy, reducing reliance

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on fossil fuels while minimizing environmental degradation (IPCC, 2022). As emphasized in the 2030 Sustainable Development Agenda, universalizing energy access and improving energy efficiency are directly linked to poverty reduction (SDG-1) and economic growth (SDG-8) (UN, 2015). Analyses by IRENA (2023) highlight renewable energy investments' potential to generate employment while enhancing energy security by reducing dependence on energy imports. However, the success of the sustainable energy transition hinges on policymakers' incentive mechanisms (e.g., carbon pricing), technological innovations (e.g., battery storage systems), and international financing collaborations (e.g., the Green Climate Fund) (IEA, 2021). Thus, the shift to renewable energy represents a holistic strategy that supports not only environmental sustainability but also socioeconomic development. At the societal level, this transformation contributes to reducing energy poverty through energy democratization (Bouzarovski & Petrova, 2015), expanding local employment opportunities (IRENA, 2023), and strengthening energy independence. Moreover, the success of the sustainable energy transition depends on social acceptance (Wüstenhagen, Wolsink & Bürer, 2007), policy support (IEA, 2021), and innovative financing mechanisms (GCF, 2022). This comprehensive transition is not merely a technological shift but a multidimensional process involving the transformation of socioeconomic structures and consumption patterns.

The global energy bottleneck compels societies to establish energy policies aimed at utilizing energy sources that best meet their energy needs while causing minimal or no harm to the environment. A society's education and energy policies shape its technological, industrial, social, and cultural foundations. Moreover, a society's competence in energy and education serves as an indicator of its advancement in technology, industry, and socio-cultural development (Karagöz, 2007). Halting global degradation is only possible through changes in individuals' technological and social behaviors (McLaughlin, 2008).

Societal-level transformation can only succeed when supported by energy literacy and technical training programs. As emphasized by UNESCO (2021), equipping individuals with green skills—essential for sustainable development—requires updating educational curricula to focus on renewable energy and climate change. Indeed, projections by IRENA (2023) estimate that the renewable energy sector could create up to 30 million new jobs globally by 2030, underscoring the critical role of vocational training programs. Thus, the sustainable energy transition is not merely a technological shift but a multidimensional process that must be reinforced through public engagement, educational reforms, and just transition mechanisms.

Sustainable environmental education, an interdisciplinary approach aimed at developing the knowledge and skills necessary for a sustainable future, enhances quality of life by transforming individuals' perspectives, thereby making the world safer and healthier (Keleş, 2007). In addressing today's escalating environmental challenges, enduring solutions that shape the fate of both the planet and humanity can only be achieved through societies that embrace sustainability as a life philosophy—a mindset cultivated by sustainable environmental education (Aksan, 2016).

According to Agenda 21, individuals are equipped for sustainable development through education that fosters environmental and ethical awareness, values, attitudes, skills, and behaviors (UNCED, 1992). The World Conservation Union (IUCN) has emphasized that individuals' attitudes toward sustainable living must be transformed through educational programs (IUCN, 1991). The United Nations states that education is a prerequisite for achieving sustainable development and an essential tool for promoting good governance, informed decision-making, and democracy (UN, 2005). Education for sustainable development enables the cultivation of values, attitudes, and skills that influence decision-making (Summers et al. 2000).

A review of attitude studies on renewable energy sources in the literature reveals that research conducted with teachers (Liarakou, Gavrilakis, & Flouri, 2009; Lay et al., 2013; Zyadin et al., 2014), pre-service teachers (Bilen, Özel, & Sürücü, 2013; Cebesoy & Karışan, 2017; Yenice & Tunç, 2018; Balbağ & Balbağ, 2019; Yüzbaşıoğlu & Kabuklu, 2019; Yılmaz & Aydoğdu, 2020), and university students (Eren et al., 2017; Ludwig & Parkins, 2019) appears to be predominant. However, it has been found that there are only a limited number of studies involving high school students (Zyadin et al., 2012; Çelikler, Aksan, & Yılmaz, 2016; Keramitsoglou, 2016).

In order to leave a livable world for future generations, it is vital to raise conscious, aware, and sensitive individuals who recognize the importance of renewable energy sources. In this context, this study aims to determine the attitudes of high school students in a northern province of Türkiye toward renewable energy sources. This research, which examines high school students' attitudes toward renewable energy, is considered significant as it will contribute depth to the literature, given the limited number of studies conducted with high school students.

2. Methodology

2. 1. Research Model and Design

In the research, the survey model—preferred when there is a need to determine individuals' attitudes, actions, opinions, and beliefs (Christensen, Johnson & Turner, 2015) —and the cross-sectional research design, in which data are collected at a single and relatively short time period (Christensen, Johnson & Turner, 2015), were employed.

2.2. Participants

The study was conducted with 721 high school students (N_{Female}: 423, N_{Male}: 298) in a northern province of Türkiye, including 9th grade (N=170), 10th grade (N=184), 11th grade (N=179), and 12th grade (N=188) students.

2.3. Data Collection Tools

In the study, data were collected using the 37-item Renewable Energy Attitude Scale developed by Çelikler and Aksan (2016). The applied scale consists of seven dimensions: "Impact on the Environment (8 Items)," "Impact on Living Beings (3 Items)," "Energy Sources and Fields of Use (9 Items)," "Education (6 Items)," "Economy (5 Items)," "Safety (4 Items)," and "Media (2 Items)." The minimum possible score from the scale is 37, while the maximum is 185. The scale's overall Cronbach's alpha reliability coefficient was calculated as .753 in the original study (Çelikler & Aksan, 2016). In the current study, the overall Cronbach's alpha reliability coefficient was found to be .732.

2.4. Data Analysis

The data obtained in the study were analyzed descriptively using percentages (%) and frequencies (f). The scores of high school students on the Renewable Energy Sources Attitude Scale and its sub-dimensions were determined, and the arithmetic mean and standard deviation distributions of the scores were examined. Additionally, the skewness and kurtosis values of the data were analyzed, and it was confirmed that the data met the necessary assumptions. Since the assumptions were satisfied, parametric tests were applied. Whether students' attitude scores toward renewable energy sources differed significantly by gender was tested using an *independent samples t-test*, while differences by grade level were examined using a one-way analysis of variance (ANOVA).

3. Results

The percentage and frequency distributions of high school students' responses to items in the "Effects on the environment" factor of the Renewable Energy Sources Attitudes Scale are presented in Table 1.

Table 1. *Percentage and frequency distributions of high school students' responses to the items under the "Effects on the environment" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
Renewable energy sources are environmentally friendly.	28	3,9	43	6,0	103	14,3	247	**34,3**	300	**41,6**

The use of renewable energy sources will reduce global warming.	52	7,2	106	14,7	166	23,0	248	**34,4**	149	**20,7**
The use of renewable energy sources will not reduce environmental pollution.	193	**26,8**	266	**36,9**	99	13,7	118	16,4	45	6,2
The use of renewable energy sources will not reduce the greenhouse effect.	232	**32,2**	264	**36,6**	106	14,7	70	9,7	49	6,8
Power plants that use renewable energy sources have harmful effects on the environment.	127	**17,6**	249	**34,5**	183	25,4	91	12,6	71	9,8
The use of renewable energy sources will not reduce air pollution.	217	**30,1**	243	**33,7**	116	16,1	81	11,2	64	8,9
The use of renewable energy sources will reduce the depletion of the ozone layer.	36	5,0	87	12,1	199	27,6	251	**34,8**	148	**20,5**
The use of renewable energy sources will not reduce the occurrence of acid rains.	182	**25,2**	200	**27,7**	169	23,4	81	11,2	89	12,3

When Table 1 is examined, it is observed that a majority of high school students hold the view that renewable energy sources are environmentally friendly and that their use would reduce global warming, environmental pollution, the greenhouse effect, acid rain, and air pollution. Additionally, most students expressed that they believe the use of renewable energy sources would decrease ozone layer depletion and do not think that power plants utilizing renewable energy cause significant harm to the environment.

The percentage and frequency distributions of students' responses to the items in the 'Effects on the living creatures" factor of the Renewable Energy Sources Attitudes Scale are presented in Table 2.

Table 2. *Percentage and frequency distributions of high school students' responses to the items under the "Effects on the living creatures" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
I am concerned about the negative effects the use of renewable energy sources might have on the living creatures.	148	**20,5**	179	**24,8**	156	21,6	129	17,9	109	15,1
I am not knowledge about the harmful effects that renewable energy sources might have on living creatures.	75	**10,4**	225	**31,2**	128	17,8	156	**21,6**	137	**19,0**
Power plants that use renewable energy sources do not have harmful effects on living creatures.	98	13,6	88	12,2	138	19,1	180	**25,0**	217	**30,1**

When Table 2 is examined, it was determined that nearly half of high school students expressed being concerned about renewable energy sources having negative effects on living organisms, while more than half of the students did not believe that power plants using renewable energy sources could harm living organisms. Additionally, the proportion of students who stated they did not know what kind of harm renewable energy sources might cause to living organisms was found to be similar to the proportion holding the opposite view.

The percentage and frequency distributions of high school students' responses to the items under the 'Energy sources and their area of use' factor of the Renewable Energy Sources Attitudes Scale are presented in Table 3.

Table 3. *Percentage and frequency distributions of high school students' responses to items under the "Energy sources and their area of use" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
Energy should not be produced from waste.	267	**37,0**	216	**30,0**	118	16,4	63	8,7	57	7,9
The use of renewable energy sources is increasing across the world.	48	6,7	68	9,4	158	**21,9**	254	**35,2**	193	**26,8**
The use of renewable energy sources will help solve the world's energy demand.	34	4,7	40	5,5	106	14,7	213	**29,5**	328	**45,5**
The use of renewable energy sources should be promoted.	9	1,2	10	1,4	53	7,4	210	**29,1**	439	**60,9**
Energy cannot be produced from energy resources such as the sun and water.	344	**47,7**	330	**45,8**	35	4,9	7	1,0	5	0,7
Renewable energy sources are not being sufficiently utilized across the world.	27	3,7	43	6,0	128	17,8	238	**33,0**	285	**39,5**
The energy produced by nuclear power plants is not a form of renewable energy.	46	6,4	49	6,8	165	**22,9**	202	**28,0**	259	**35,9**
It is necessary to build power plants which use renewable energy sources.	5	0,7	7	1,0	69	9,6	349	**48,4**	291	**40,4**
I support the use of hydrogen as a fuel in vehicles.	61	8,5	88	12,2	247	**34,3**	166	**23,0**	159	**22,1**

When Table 3 is examined, it is found that the vast majority of high school students believe that energy can be produced from the sun, water, and waste. Additionally, while the majority of students support the use of hydrogen fuel as a vehicle fuel, a portion of them expressed indecision. The majority of students hold the belief that: the use of renewable energy sources has increased worldwide, renewable energy sources are not utilized sufficiently, renewable energy could solve the world's energy needs, power plants using renewable energy should be established, and the use of renewable resources should be encouraged. Furthermore, while the vast majority of students do not consider energy obtained from nuclear power plants as renewable energy, some remain undecided on this issue.

The percentage and frequency distributions of high school students' responses to the items under the "Education" factor of the Renewable Energy Sources Attitudes Scale are presented in Table 4.

Table 4. *Percentage and frequency distributions of high school students' responses to items under the "Education" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
It is important to provide education in schools regarding renewable energy sources.	5	0,7	7	1,0	36	5,0	342	**47,4**	331	**45,9**
I am not sufficiently knowledgeable about renewable energy sources.	102	**14,1**	235	**32,6**	177	**24,5**	156	21,6	51	7,1
Society's level of awareness regarding renewable energy sources should be increased.	6	0,8	15	2,1	49	6,8	335	**46,5**	316	**43,8**
In general, people are not sufficiently knowledgeable about renewable energy sources.	30	4,2	57	7,9	121	16,8	270	**37,4**	243	**33,7**

In classes, more emphasis must be placed on the subject of renewable energy sources.	38	5,3	53	7,4	87	12,1	258	**35,8**	285	**39,5**
I believe it is necessary to organize various educational programs in schools regarding the importance of renewable energy sources.	32	4,4	35	4,9	105	14,6	241	**33,4**	308	**42,7**

When Table 4 is examined, it is determined that high school students believe providing education about renewable energy sources in schools is important, think various educational projects should be conducted in schools, and consider that renewable energy topics should be given more place in lessons. Additionally, it is found that students believe people lack sufficient knowledge about renewable energy sources and that public awareness should be raised about renewable energy. Moreover, while the majority of students state they believe they have adequate knowledge about renewable energy sources, some are found to be undecided.

The percentage and frequency distributions of high school students' responses to the items under the "Economy" factor of the Renewable Energy Sources Attitudes Scale are presented in Table 5.

Table 5. *Percentage and frequency distributions of high school students' responses to items under the "Economy" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
The use of renewable energy sources will contribute to the country's economy.	34	4,7	66	9,2	138	19,1	261	**36,2**	222	**30,8**
Energy produced from renewable energy sources is not cheap.	114	**15,8**	196	**27,2**	173	**24,0**	134	18,6	104	14,4
It is important for energy produced from renewable energy sources to be cheap.	4	0,6	6	0,8	33	4,6	301	**41,7**	377	**52,3**
The construction of power plants using renewable energy sources is not less costly than the construction of other types of power plants.	93	12,9	114	15,8	224	**31,1**	186	**25,8**	104	**14,4**
The investments currently being made for promoting the use of renewable energy sources are not sufficient.	32	4,4	63	8,7	108	15,0	287	**39,8**	231	**32,0**

When Table 5 is examined, it is observed that a majority of high school students believe the use of renewable energy sources contributes to the national economy and consider the cost-effectiveness of renewable energy important. However, they perceive insufficient investment in renewable energy adoption. Additionally, while a portion of students disagree with the notion that renewable energy is inexpensive, others remain undecided. Furthermore, most students are convinced that constructing renewable energy plants involves lower costs compared to conventional power plants, though a minority express uncertainty about this matter.

The percentage and frequency distributions of high school students' responses to the items under the "Safety" factor of the Renewable Energy Sources Attitudes Scale are presented in Table 6.

Table 6. *Percentage and frequency distributions of high school students' responses to items under the "Safety" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
I would not like to see a power plant using renewable energy sources built in the location where I live.	46	6,4	163	22,6	112	15,5	96	**13,3**	304	**42,2**
Power plants using renewable energy sources are safer than other types of power plants.	43	6,0	47	6,5	105	14,6	227	**31,5**	299	**41,5**
Power plants using renewable energy sources are less dangerous than other types of power plants.	82	11,4	95	13,2	141	19,6	171	**23,7**	232	**32,2**
I believe that renewable energy power plants will not lead to problems that endanger the world.	35	4,9	72	10,0	150	20,8	192	**26,6**	272	**37,7**

When Table 6 is examined, it is observed that the majority of high school students state they do not want a power plant using renewable energy sources in their residential area. However, most students believe that renewable energy plants are safer than conventional plants, pose fewer risks, and will not contribute to global threats.

The percentage and frequency distributions of high school students' responses to the items under the "Media" factor of the Renewable Energy Sources Attitudes Scale are presented in Table 7.

Table 7. *Percentage and frequency distributions of high school students' responses to items under the "Media" factor in the Renewable Energy Sources Attitude Scale*

Items	Strongly Disagree		Disagree		Undecided		Agree		Strongly Agree	
	f	%	f	%	f	%	f	%	f	%
It is important for the media to broadcast news and programs regarding renewable energy sources.	31	4,3	31	4,3	43	6,0	264	**36,6**	352	**48,8**
There are not sufficient news and programs on the media regarding renewable energy sources.	39	5,4	95	13,2	125	17,3	285	**39,5**	177	**24,5**

When Table 7 is examined, it is determined that a majority of high school students believe media coverage of renewable energy sources (news, programs) is important, and think that current media coverage is insufficient.

In the study, the scores of high school students from both the overall attitude scale and all its factors were calculated, and the descriptive statistics results for their scores from the Renewable Energy Sources Attitude Scale are presented in Table 8.

Table 8. *Descriptive statistics of high school students' scores from the Renewable Energy Sources Attitude Scale*

Scale Factors		Number of Items	X	Mode	Median	Range	ss	Min	Max	Possible Min-Max Scores
Factor	**Effects on the environment**	8	25.35	25	25.00	22	3.230	13	35	8-40

	Effects on the living creatures	3	9.56	9	10.00	12	2.633	3	15	3-15
	Energy sources and their area of use	9	35.81	34	36.00	27	5.001	18	45	9-45
	Education	6	23.83	24	24.00	16	3.310	14	30	6-30
	Economy	5	18.34	19	19.00	15	2.684	9	24	5-30
	Safety	4	14.93	15	15.00	14	2.631	6	20	4-20
	Media	2	7.86	9	8.00	8	1.641	2	10	2-10
Renewable Energy Sources Attitude Scale		**37**	**135.67**	**140**	**136**	**69**	**12.861**	**95**	**164**	**37-185**

When Table 8 is examined, it is observed that high school students scored a maximum of 164 and a minimum of 95 on the attitude scale, with an arithmetic mean score of 135.67. The standard deviation of the obtained scores was determined to be 12.861. Regarding the scores from the sub-dimensions of the scale: in the 'Effects on the environment' sub-dimension, scores ranged from 13 (minimum) to 35 (maximum), with a mean of 25.35; in 'Effects on the living creatures', from 3 to 15 (mean=9.56); in 'Energy sources and their area of use', from 18 to 45 (mean=35.81); in 'Education', from 14 to 30 (mean=23.83); in 'Economy', from 9 to 24 (mean=18.34); in 'Safety', from 6 to 20 (mean=14.93); and in 'Media', from 2 to 10 (mean=7.86). Additionally, it was found that preservice teachers' mean scores on the factors of the Sustainable Development Awareness Scale were highest in the 'Energy sources and their area of use' factor and lowest in the 'Economy' factor.

Independent samples t-test results conducted to determine whether high school students' attitudes toward renewable energy sources differed significantly by gender variable in terms of total scores and sub-dimensions are presented in Table 9.

Table 9. *t-test results of high school students' attitudes toward renewable energy sources by gender variable*

Factor	Gender	N	X	S	sd	t	p
Effects on the environment	Female	423	25,62	3,190	719	2,759	.006*
	Male	298	24,95	3,252			
Effects on the living creatures	Female	423	9,71	2,655	719	1,887	.060
	Male	298	9,34	2,590			
Energy sources and their area of use	Female	423	35,95	4,903	719	,925	.356
	Male	298	35,60	5,138			
Education	Female	423	23,81	3,247	719	-,215	.830
	Male	298	23,86	3,402			
Economy	Female	423	18,26	2,608	719	-,927	.354
	Male	298	18,45	2,789			
Safety	Female	423	14,94	2,671	719	,129	.897
	Male	298	14,91	2,578			
Media	Female	423	7,83	1,638	719	-,495	.621
	Male	298	7,90	1,647			
Renewable Energy Sources Attitude Scale	Female	423	136,13	12,736	719	1,150	.251
	Male	298	135,02	13,028			

When examining the t-test results in Table 9, it was found that there were no significant differences ($p > .05$) in the 'Renewable Energy Sources Attitude Scale' or its sub-dimensions of 'Effects on the Living Creatures', 'Energy Sources and Their Area of Use', 'Education', 'Economy', 'Safety', and 'Media'. However, a significant difference was observed in the 'Effects on the Environment' sub-dimension [$t_{(719)} = 2.759$; $p = .006 < .05$]. According to the analysis results, the significant difference favored female students.

The results of the ANOVA test examining high school students' attitudes toward renewable energy sources in terms of total scores and sub-dimensions by grade level variable are presented in Table 10.

Table 10. *ANOVA test results of high school students' attitudes toward renewable energy sources by grade level variable*

Factor	Grade	N	X	S	sd	F	p	Significant difference
Effects on the environment	9	170	25,32	3,206	3/717	5,414	,001*	12-11,10
	10	184	24,83	3,468				
	11	179	25,12	3,326				
	12	188	26,10	2,776				
Effects on the living creatures	9	170	9,41	2,729	3/717	1,160	,324	-
	10	184	9,37	2,721				
	11	179	9,63	2,517				
	12	188	9,82	2,560				
Energy sources and their area of use	9	170	35,07	5,434	3/717	4,569	,004*	12-9,10
	10	184	35,36	5,281				
	11	179	35,85	4,900				
	12	188	36,86	4,200				
Education	9	170	23,70	3,263	3/717	,240	,869	-
	10	184	23,83	3,418				
	11	179	23,99	3,383				
	12	188	23,80	3,191				
Economy	9	170	18,29	2,753	3/717	4,053	,007*	12-11
	10	184	18,21	2,668				
	11	179	17,96	2,897				
	12	188	18,89	2,339				
Safety	9	170	14,58	2,979	3/717	6,539	,000*	12-9,10
	10	184	14,54	2,493				
	11	179	14,94	2,508				
	12	188	15,60	2,420				
Media	9	170	7,72	1,723	3/717	11,603	,000*	12-9,10
	10	184	7,39	1,752				
	11	179	7,96	1,478				
	12	188	8,35	1,456				
Renewable Energy Sources Attitude Scale	9	170	134,09	13,961	3/717	8,117	,000*	12-9,10,11
	10	184	133,53	12,784				
	11	179	135,45	12,958				
	12	188	139,41	10,954				

When Table 10 is examined, it is seen that there is a significant difference in high school students' total attitude scores according to their grade level. Additionally, while no significant differences were observed in the 'Effects on the living creatures' and 'Education' sub-dimensions of the Renewable Energy Resources Attitude Scale ($p > .05$), significant differences were found in the 'Effects on the environment', 'Energy sources and their area of use', 'Economy', 'Safety', and 'Media' sub-dimensions ($p < .05$). In light of the obtained data, this significant difference was understood to be in favor of 12th grade students.

3. Conclusion

The research results revealed that high school students generally hold positive attitudes toward renewable energy sources, believing them to be environmentally friendly and effective in reducing environmental problems such as pollution, acid rain, air pollution, global warming, and the greenhouse effect. However, they did not believe that using renewable energy would significantly reduce ozone layer depletion. Interestingly, the study found nearly equal proportions of students who were uncertain about potential harm to living organisms from renewable energy sources and those who held opposing views. This uncertainty appears to parallel the concerns expressed by students who fear negative impacts of renewable energy on living creatures. These findings suggest that students' knowledge gaps about renewable energy may be contributing to their anxiety and concerns.

The study determined that students were aware that energy derived from water, solar, and waste constitutes renewable energy. While the majority supported using hydrogen fuel in vehicles, some remained undecided, which is thought to stem from knowledge gaps about hydrogen and its relatively lesser use in renewable energy initiatives compared to other sources. Furthermore, most students believed that: (a) global use of renewable energy is increasing, (b) current utilization remains insufficient, (c) renewables could solve world energy demands, (d) more power plants using renewables should be constructed, and (e) renewable resource use should be incentivized. These results demonstrate students' positive attitudes toward renewable energy sources and plants. Although most recognized that nuclear power isn't renewable, some uncertainty persisted, likely due to knowledge deficiencies. Indeed, Keramitsoglou's (2015) study of Greek high schoolers found they often confused energy sources, primarily due to knowledge gaps. Similarly, Zyadin et al. (2012) investigated Jordanian students' renewable energy awareness, knowledge, and attitudes, reporting positive attitudes but confusion between renewable and non-renewable sources.

The research results reveal that high school students believe education about renewable energy sources in schools is crucial, suggesting that more class time should be devoted to this topic and various educational projects should be implemented. The study also determined that students think people lack sufficient knowledge about this issue and need to be better informed. Findings indicate students consider the affordability of energy from renewable sources important, yet believe insufficient investment is being made in renewable energy utilization. A noteworthy finding shows that while most students state renewable energy plants are safer, less hazardous, more cost-effective, and beneficial to the national economy compared to conventional plants, they paradoxically express unwillingness to have such plants in their own localities. Results demonstrate students emphasize the importance of media coverage about renewable energy, yet report inadequate news and programming on this subject, indicating their awareness of media's role in public awareness. These findings align with and are supported by Çelikler, Aksan, and Yılmaz's (2016) study that examined renewable energy attitudes among senior high school students across different school types.

The research results revealed that high school students scored above average on both the overall attitude scale and its subscales. Furthermore, it was determined that among the scale's subscales, the highest mean scores were in the 'Energy sources and their area of use' factor, while the lowest were in the 'Economy' factor.

The study determined that there was no significant gender difference in high school students' total attitude scores toward renewable energy sources. A significant difference was found only in the 'Effects on the environment' factor [$t_{(719)} = 2.759$, $p = .006 < .05$], with the significant difference favoring female students.

When examining high school students' attitudes toward renewable energy sources in terms of total scores and factors by grade level, no significant differences were observed only in the "Effects on living creatures" and "Education" factors. Significant differences were found in the "Effects on the environment", "Energy sources and their area of use", "Economy", "Safety", and "Media" factors as well as in total attitude scores. These differences particularly favored 12th grade students.

The cultivation of conscious and sensitive generations who understand energy problems and needs, strive to prevent future energy shortages, and recognize the importance of environmentally-friendly

renewable energy sources is vital for a sustainable world. Individuals raised with these qualities will serve as role models by both maintaining their lives in a habitable, clean environment and raising awareness about renewable energy for future generations. Developing such high-awareness generations depends on quality environmental education. In this context, essential knowledge, attitudes, behaviors, and awareness regarding alternative energy sources must be acquired from early childhood. Therefore, it is believed that increasing the inclusion of renewable energy topics from preschool through undergraduate programs is crucial, as is employing student-centered methods and techniques in relevant courses to ensure knowledge retention. Considering that education continues beyond school and the influence of internet and media on societies, the preparation of public service announcements, advertisements, and programs about renewable energy sources in the media is thought to contribute significantly to public awareness.

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