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Environmental Literacy of Generations X, Y, and Z in a Provincial Center in Türkiye: A Descriptive-Comparative Study

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Abstract:
Objective: This research was conducted to determine the environmental literacy and behaviors of Generations X, Y, and Z.
Method: This descriptive-comparative study involved a total of 1,148 participants, comprising 376 from Generation X, 399 from Generation Y, and 373 from Generation Z. Data were collected using the Demographic Characteristics Form and the Environmental Literacy Scale for Adults.
Results: A study revealed that 67.8% of participants had not received any education on environmental issues. Additionally, 81.8% disposed of used cooking oil either in the trash or down the sink, while 43.6% discarded waste batteries in the trash. Furthermore, 62.1% of the participants were unfamiliar with the concept of an ecological footprint. The environmental literacy of Generation Z was significantly lower than that of Generations X and Y. The following factors were identified as influencing environmental literacy among all participants: the nuclear family structure, the perception of high income, lack of social security, willingness to receive environmental education, proper disposal of waste cooking oil, appropriate disposal of waste batteries in designated units, and the use of recycling bins.
Conclusion: The results revealed insufficient environmental behaviors in the sample and lower environmental literacy in Generation Z compared to Generations X and Y. It is recommended to conduct informative and educational programs and prepare public service announcements in order to enhance community environmental awareness and promote appropriate environmental health behaviors.

Keywords: Environment, literacy, generations, community-based participatory research, public health.

Türkiye'de Bir İl Merkezinde X, Y ve Z Kuşaklarının Çevre Okuryazarlığı: Bir Tanımlayıcı-Karşılaştırmalı Çalışma

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Öz:
Amaç: Bu araştırma X, Y ve Z kuşaklarının çevre okuryazarlığı ve çevre davranışlarını belirlemek amacıyla gerçekleştirilmiştir.
Yöntem: Tanımlayıcı-karşılaştırmalı araştırma olarak yürütülen bu çalışma, X kuşağından 376 kişi, Y kuşağından 399 kişi ve Z kuşağından 373 kişi olmak üzere toplam 1148 katılımcı ile tamamlanmıştır. Veri toplama aracı olarak tanıtıcı özellikler soru formu ve Yetişkinler için Çevre Okuryazarlığı Ölçeği kullanılmıştır.
Bulgular: Yapılan araştırma, katılımcıların çevre konusunda herhangi bir eğitim almadığını ortaya koydu. Ayrıca, %81,8'i kullanılmış yemeklik yağlarını çöpe veya lavaboya atarken, %43,6'sı atık pilleri çöpe atıyordu. Ayrıca, katılımcıların %62,1'i ekolojik ayak izi kavramına aşina değildi. Z kuşağının çevre okuryazarlığın X ve Y kuşaklarına göre anlamlı olarak düşük olduğu tespit edilmiştir. Tüm katılımcılar arasında çevre okuryazarlığını etkileyen faktörler olarak aşağıdaki faktörler belirlendi: çekirdek aile yapısı, yüksek gelir algısı, sosyal güvence eksikliği, çevre eğitimi alma isteği, atık yemeklik yağların uygun şekilde bertaraf edilmesi, atık pillerin belirlenmiş birimlerde uygun şekilde bertaraf edilmesi ve geri dönüşüm kutularının kullanılmasıdır.
Sonuç: Değerlendirmeler sonucu toplumun çevre davranışlarının yetersiz olduğu ve Z kuşağının çevre okuryazarlığının X ve Y kuşağına göre düşük olduğu sonucuna varılmıştır. Toplumun çevre farkındalığının artırmak ve uygun çevre sağlığı davranışlarına teşvik etmek amacıyla bilgilendirme ve eğitimlerin yapılması, kamu spotlarının hazırlanması önerilmektedir.

Anahtar kelimeler: Çevre, okuryazarlık, nesiller, toplum tabanlı katılımcı araştırması, halk sağlığı.

INTRODUCTION

Environment, in its broadest definition, refers to the interactions between living and non-living entities. Living organisms engage in biological, physiological, social, and cultural activities that sustain and perpetuate their lives in specific areas (Suryawati et al., 2020). The rapid advancement of technology, population growth, and uninformed environmental interventions have brought about numerous global environmental problems, including climate change, deforestation, the extinction of plant and animal species, and pollution of air, water, and soil (Çelik et al., 2018). Environmental issues, initially perceived as local problems in the early 1900s, gained global dimensions by the 1950s due to changing and evolving world conditions. In 1972, the United Nations (UN) established the UN Environment Programme (UNEP) to address environmental issues globally. The 2012 World Summit underscored the increasing environmental challenges, emphasizing the heightened importance of a clean and safe environment (McBride et al., 2013; Purvis et al., 2019; Kayabek, 2021). The escalation of environmental problems has prompted the initiation of local, regional, national, and international efforts aiming to ensure sustainable living standards (Rowe, 2002; Akıllı & Genç, 2015).

The solution to environmental problems is multifaceted, yet the first step in preventing these issues is to enhance people's knowledge about the environment and develop their responsibilities (Maurer & Bogner, 2020). Among the methods developed for solving environmental problems, environmental education is considered the most effective. The goal of environmental education is to cultivate individuals' environmental literacy, creating environmentally literate individuals who are conscious of environmental issues (Kışoğlu et al., 2010; McBride et al., 2013). The concept of Environmental Literacy (EL) was initially defined by Charles E. Roth in 1968, expressing an individual's level of environmental knowledge and awareness (Roth, 1992). An environmentally literate individual is expected to possess knowledge related to the environment and environmental health, be able to perceive environmental problems, and utilize appropriate behavioral skills to prevent these problems. Furthermore, environmentally literate individuals are anticipated to contribute to raising awareness about environmental issues in society by discussing environmental topics (McBride et al., 2013; Febriasari & Supriatna, 2017; Fettahlıoğlu, 2018). Therefore, increasing awareness of the globally escalating environmental issues, preventing and resolving these problems, leaving a sustainable life for future generations, and instigating appropriate behavioral changes at the individual level regarding environmental responsibility are crucial, making EL highly important (Bahar & Kiras, 2017; Ardoin et al., 2023).

When examining the demographic composition of society by age cohorts, often referred to as generations, three distinct groups emerge: Generations X, Y, and Z (Gıcır et al., 2020). X generation individuals, born between 1965 and 1979, are characterized as being sensitive to social events but having a reserved demeanor. Y generation individuals, born between 1980 and 1999, experienced political silence due to political pressures until adolescence, encountered technological changes, addictions, radical changes in the workplace, and a consumption culture outside the norm. They are described as individuals inclined towards independence and freedoms. Z generation individuals, born in 2000 and after, have faster access to information due to the technology age they live in, have a higher standard of living compared to previous generations, are aware of global agendas due to technological capabilities, and play an influential role in the spread of global developments. They are characterized as individuals who desire an easier and more effortless life being more impatient (Lin & Chen, 2022). Due to these characteristics, it is thought that X generation has high environmental literacy but less appropriate environmental behaviors. Y generation, due to being in a period immersed in a consumption culture, is considered less sensitive to environmental events and has lower environmental literacy compared to the X generation. As for the Z generation, it is expected to exhibit more environmentally sensitive behaviors than other generations, given that they live in a period where environmental issues are increasing and receiving more attention. However, their environmental literacy is anticipated to be lower than that of X and Y generation (Gıcır et al., 2020).

Environmental issues are a significant global problem, and environmental literacy is crucial for preventing and resolving them. It is also recognized that different generations may approach and behave toward societal events differently. Research on Environmental Literacy (EL) primarily focuses on university students, teacher candidates, and middle school students (Karatekin & Aksoy, 2012; Kıyıcı et al., 2014; Akıllı & Genç, 2015; Şenyuva & Bodur, 2016; Bahar & Kiras, 2017; Gürbüz & Kışoğlu, 2017; Demirtaş et al., 2018; Koç et al., 2018; Ulu Kalın, 2018; Veise et al., 2019; Nurwidodo et al., 2020). Studies aiming to determine environmental literacy in society are found to be very limited (Kayabek, 2021). Moreover, an analysis of environmental studies specific to Generations X, Y, and Z reveals a predominant emphasis on researching the environmental behaviors exhibited by these generations (Gıcır et al., 2020). The evaluation of environmental literacy across generations in society as a whole is found to be

lacking in the literature, highlighting a significant gap in research (Gıcır et al., 2020; Volkova et al., 2020).

In light of this context, the present study was designed to evaluate the environmental literacy and behaviors of Generations X, Y, and Z within a provincial center in Turkey, with the aim of making a meaningful contribution to the existing literature. The anticipated outcomes of this research are expected to provide valuable insights for formulating effective solutions to environmental challenges.

MATERIAL AND METHOD

Purpose and Type of Research: This study was conducted as a descriptive comparative study to determine the environmental literacy and environmental behaviors of Generations X, Y, and Z in a provincial center in Turkey. The descriptive comparative research design aims to compare differences in variables between two or more groups. Data are collected from each group, and statistical tests are employed to compare differences between the groups (Erdoğan et al., 2021). The preference for a descriptive comparative research design in this study is rooted in the belief that the perspectives of Generations X, Y, and Z on societal events may differ, and consequently, their environmental literacy and behaviors may also vary (Notaro & Paletto, 2022; Volkova et al., 2020). This research design was chosen to examine these differences and contribute to the existing literature.

Research Setting, Population, and Sample: The research was conducted in the province of Artvin, located in the Eastern Black Sea Region of Turkey. The reason for selecting Artvin as the research center stems from the fact that previous assessments of environmental literacy were limited to middle school students only in this region (Ulu Kalın, 2018). Furthermore, there was a lack of community-based research evaluating environmental literacy and behaviors among adults in the area. Consequently, the research focused on individuals residing in Artvin province.

To calculate the sample size for the study, a table commonly used to estimate population proportions with specific accuracy (Lemeshow et al., 2000) and relevant a research (Fettahlıoğlu, 2018) were utilized. This table is used to calculate the necessary sample size with 95% confidence for predicting within a certain absolute percentage point of p (expected population proportion) with a deviation of d (deviation in the frequency of the event) (Lemeshow et al., 2000). The sample size was determined as 369 individuals with a 95% confidence level, 5% relative risk, and an expected population proportion (p) of 0.40 (p=0.40=0.60). To enhance the generalizability of the study, the goal was to reach a total of 1,107 participants, with 369 participants from each generation. The research was completed with a total of 1,148 participants, including 376 from Generation X, 399 from Generation Y, and 373 from Generation Z.

Data Collection Tools: The research data were collected using the Demographic Characteristics Form and the Environmental Literacy Scale for Adults (ELSA).

The Demographic Characteristics Form: The form was developed based on a literature review (Demirtaş et al., 2018; Veise et al., 2019; Gıcır et al., 2020; Nurwidodo et al., 2020) and consists of two sections: Socio-demographic Characteristics and Environmental Knowledge and Experiences. The *Socio-demographic Characteristics* section includes 8 items assessing personal characteristics, including age, education level, marital status, family type, presence of social security, and presence of children. The *Environmental Knowledge and Experiences* section includes 13 items evaluating aspects such as receiving environmental education, willingness to receive environmental education, awareness of the location of recycling bins in the region, disposal of waste batteries, disposal of waste cooking oil, knowledge of the definition of ecological footprint, and understanding of the definition of carbon footprint.

Environmental Literacy Scale for Adults (ELSA): The scale was developed by Atabek-Yiğit et al. (2014) to assess the environmental literacy of adults. It consists of 20 items, answered on a five-point Likert scale (1: Strongly Disagree, 2: Disagree, 3: Neutral, 4: Agree, 5: Strongly Agree). Items 3 and 16 are reverse-scored. The total scale score is obtained by summing the responses to each item. The minimum score is 20, and the maximum score is 100, with a higher score indicating higher environmental literacy. The Cronbach's Alpha reliability coefficient for the scale is 0.88 (Atabek-Yiğit et al., 2018). In this study, Cronbach's Alpha was calculated as 0.85 (Generation X: 0.76, Generation Y: 0.85, Generation Z: 0.85).

Data Collection Procedure: The research data were collected between December 1, 2022, and July 1, 2023, using the voluntary-based random sampling method. Information about the research topic and its content was disseminated to individuals in high-traffic public spaces, including markets, apartment complexes, parks, etc. They were invited to participate in the study, and those willing to participate voluntarily were provided with the data collection tools. The response time for completing the data collection forms was 5-6 minutes. The participants who completed the forms thoroughly were given an environmental handbook prepared by the researchers. This handbook provided information on environmental health, reliable sources of information about the environment, disposal of waste batteries and cooking oil, the location of recycling bins in the area, definitions of carbon footprint and ecological footprint, and individual practices that can be undertaken to reduce ecological and carbon footprints. Additionally, the participants received a seed pen as a token of appreciation.

Research Inclusion and Exclusion Criteria: Participants in the study were individuals aged 18 and older who lived in the central district of Artvin and voluntarily agreed to participate in the research. Residents from other districts within the province were excluded from the study because those living outside the city center are often unfamiliar with the locations of recycling bins in the area, which could lead to inaccurate findings.

Dependent and Independent Variables, Research Hypotheses and Questions: The independent variables of the research are the participants' sociodemographic characteristics, and the dependent variable is the environmental literacy of generations X, Y, and Z. The research hypothesis was formulated as "H_0: There is no difference in the environmental literacy of generations X, Y, and Z". Within the scope of the research, the following questions have been addressed:

- What environmental behaviors do generations X, Y, and Z exhibit?
- What is the level of environmental literacy of generations X, Y, and Z?
- Is there a difference in the environmental literacy levels of generations X, Y, and Z?
- What are the determinants of environmental literacy for generations X, Y, and Z?

Data Analysis: The research data were analyzed using the Statistical Package for Social Sciences (SPSS) 24.0 software. Descriptive statistics such as frequency, percentage, mean, and standard deviation were employed for the evaluation of descriptive data. The ability of the ELSA scale to meet the assumptions of normal distribution was assessed using skewness and kurtosis values. According to the literature, a range of +/-2 for these values is considered critical for establishing normal distribution assumptions (Blanca et al., 2013). Based on these evaluations, it was determined that the total score of the scale adheres to the assumptions of normal distribution (Skewness: -1.240, Kurtosis: 1.993), allowing for the use of parametric tests. Determinants of the ELSA for generations X, Y, Z, and all the participants were evaluated using multiple regression analysis (enter model). The independent variables included in the model were coded as dummy variables (0: zero), and factors predicting the level of environmental literacy and protective factors for environmental literacy were examined. There were no missing or incomplete data in the study, and no imputation method was used for missing data. All analysis results were interpreted considering a 95% confidence interval and a 5% error margin.

Ethical Considerations: This research was supported within the scope of the TÜBİTAK–2209-A University Students Research Projects Support Program, and it adhered to the research ethics rules defined by TÜBİTAK. Prior to the research, ethical committee approval (Number: E-18457941-050.99-52669, Date: 20.06.2022) and department chair approval (Date: 16.06.2022) were obtained. During the data collection process, the participants were informed about the research topic and content, and their written consent was obtained. This research was conducted in accordance with the principles of the Helsinki Declaration.

RESULTS

The mean age of Generation X is 49.8±4.5, Generation Y is 32.6±5.9, and Generation Z is 19.2±1.3, with an overall participant mean age of 33.9±13.1. In Generations X and Z, the majority of participants are high school graduates, while in Generation Y, the majority have a bachelor's degree or higher. In Generations X and Y, the participants are mostly married, while in Generation Z, the participants are mostly single. Across the entire study group, 46.4% of the participants are high school graduates, 74.5% had a nuclear family structure, 52.9% are married, and 56.2% have income equal to expenses (Table 1).

Table 1. The socio-demographic characteristics of Generations X, Y, Z, and all participants.

Characteristics	Gen X n (%)	Gen Y n (%)	Gen Z n (%)	Total n (%)
Age (M±Std)	49.8±4.5	32.6±5.9	19.2±1.3	33.9±13.1
Min – max	(44-62 age)	(23-43 age)	(18-22 age)	(18-62 age)
Education Level				
Primary school	86 (22.9)	23 (5.8)	2 (0.5)	111 (9.7)
Middle school	85 (22.6)	46 (11.5)	12 (3.2)	143 (12.5)
High school	115 (30.6)	113 (28.3)	305 (81.8)	533 (46.4)
Graduate and post-graduate	90 (23.9)	217 (54.4)	54 (14.5)	361 (31.4)
Family Type				
Nuclear family	223 (59.3)	318 (79.7)	314 (84.2)	855 (74.5)
Extended family	118 (31.4)	72 (18.0)	40 (10.7)	230 (20.0)
Single-parent family	35 (9.3)	9 (2.3)	19 (5.1)	63 (5.5)
Marital status				
Single	44 (11.7)	134 (33.6)	363 (97.3)	541 (47.1)
Married	332 (88.3)	265 (66.4)	10 (2.7)	607 (52.9)
Employment status				
Yes	271 (72.1)	304 (76.2)	29 (7.8)	604 (52.6)
No	105 (27.9)	95 (23.8)	344 (92.8)	544 (47.4)
Perceived Income				
Income less than expenses	108 (28.7)	73 (18.3)	86 (23.1)	267 (23.3)
Income equal to expenses	199 (52.9)	242 (60.7)	204 (54.7)	645 (56.2)
Income more than expenses	69 (18.4)	84 (21.1)	83 (22.3)	236 (20.6)
Social security				
Yes	360 (95.7)	358 (89.7)	192 (51.5)	910 (79.3)
No	16 (4.3)	41 (10.3)	181 (48.5)	238 (20.7)
Presence of Children				
Yes	347 (92.3)	238 (59.6)	9 (2.4)	594 (51.7)
No	29 (7.7)	161 (40.4)	364 (97.6)	554 (48.3)
Total	376 (100)	399 (100)	373 (100)	1148 (100)

M: Mean, Std: Standard deviation, n: number, %: percentage.

When examining the environmental education status of Generations X, Y, and Z, it is observed that Generations Y and Z have a higher frequency of receiving environmental education compared to Generation X. Regarding the willingness to receive environmental education, it was found that the desire for environmental education is higher in Generations X and Y compared to Generation Z. Evaluating the disposal of waste cooking oil and batteries, it is noted that individuals from Generation Y dispose of waste cooking oil and batteries in the respective

units more frequently than those from Generation X. Regarding awareness of the definitions of carbon footprint and ecological footprint, it is observed that in Generation X, a higher proportion is not aware of these terms compared to Generations Y and Z. When examining the perception of environmental responsibility among Generations X, Y, and Z, it is observed that in Generation Z, the belief that environmental responsibility should be shared by everyone is less prevalent compared to Generations X and Y (Table 2).

In the entire sample, it was determined that 67.8% of participants did not receive any environmental education, 84.8% did not join any environmental non-governmental organization, 50.3% did not read environmental reports related to their regions, 36.8% did not know the location of recycling bins in their regions, 59.1% were unfamiliar with the definition of carbon footprint, and 62.1% were unfamiliar with the definition of ecological footprint. When examining participants' environmental behaviors, it was found that 34.4% did not use recycling bins, 81.1% poured used cooking oil down the drain or into the trash, and 43.6% disposed of used batteries in the trash. Additionally, when participants' views on environmental health responsibility were examined, it was determined that 77.5% believed that environmental responsibility should be shared by everyone (Table 2).

Table 2. Environmental education and some environmental behaviors of X, Y, Z generations and the participants.

Characteristics	Gen X n (%)	Gen Y n (%)	Gen Z n (%)	Total n (%)
Having received environmental education				
Yes	66 (17.6)	153 (38.3)	151 (40.5)	370 (32.2)
No	310 (82.4)	246 (61.7)	222 (59.5)	778 (67.8)
Willingness to receive environmental education				
Yes	264 (70.2)	273 (68.4)	174 (46.6)	711 (61.9)
No	112 (29.8)	126 (31.6)	199 (53.4)	437 (38.1)
Being a member of an NGO				
Var	43 (11.4)	82 (20.6)	50 (13.4)	175 (15.2)
Yok	333 (88.6)	317 (79.4)	323 (86.6)	973 (84.8)
Participating in environmental activities				
Yes	92 (24.5)	161 (40.4)	153 (41.0)	406 (35.4)
No	284 (75.5)	238 (59.6)	220 (59.0)	742 (64.6)
Reading environmental reports				
Yes	211 (56.1)	226 (56.6)	134 (35.9)	571 (49.7)
No	165 (43.9)	173 (43.4)	239 (64.1)	577 (50.3)
Knowing the location of recycling bins				
Yes	268 (71.3)	272 (68.2)	185 (49.6)	725 (63.2)
No	108 (28.7)	127 (31.8)	188 (50.4)	423 (36.8)
Using the recycling bins				
Yes	259 (68.9)	291 (72.9)	215 (57.6)	765 (66.6)
No	117 (31.1)	108 (27.1)	158 (42.4)	383 (33.4)
Disposal of used cooking oil				
Pouring into the sink/trash	117 (31.1)	96 (24.1)	87 (23.3)	300 (26.1)
Collecting separately and throwing in the trash	194 (51.6)	221 (55.4)	213 (57.1)	628 (54.7)
Depositing in the waste oil container	65 (17.3)	82 (20.6)	73 (19.6)	220 (19.2)
Disposal of waste batteries				
Throwing in the trash	172 (45.7)	154 (38.6)	175 (46.9)	501 (43.6)
Waste battery collection unit	204 (54.3)	245 (61.4)	198 (53.1)	647 (56.4)
Knowing the definition of carbon footprint				
Yes	66 (17.6)	167 (41.9)	236 (63.3)	469 (40.9)
No	310 (82.4)	232 (58.1)	137 (36.7)	679 (59.1)
Knowing the definition of ecological footprint				
Yes	55 (14.6)	163 (40.9)	217 (58.2)	435 (37.9)
No	321 (85.4)	236 (59.1)	310 (41.8)	713 (62.1)

The mean ELSA score for generation X is 91.2±6.9. When determinants for generation X (enter model) were examined, it was found that perceived income level (β=-0.152) and the disposal of used batteries in designated recycling units (β=-0.139) were significant determinants of environmental literacy. These two variables account for approximately 9% of environmental literacy for generation X (Table 3).

The mean ELSA score for Generation Y is 89.3±9.1. When determinants (enter model) for Generation Y were examined, it was observed that willingness to receive environmental education (β=-0.181), reading environmental reports (β=-0.110), disposing of used cooking oil separately in the trash and depositing it in the waste oil container (β=-0.168), and disposing of used batteries in the waste battery collection units (β=-0.119) are the determinants of environmental literacy. These variables account for approximately 14% of environmental literacy for Generation Y (Table 4).

The mean ELSA score for Generation Z is 82.1±11.5. When determinants (enter model) for Generation Z were examined, it was seen that nuclear family type (β=-0.131), perception of income equal to or greater than expenses (β=-0.110), lack of social security (β=-0.169), willingness to receive environmental education (β=-0.168), and the use of recycling bins (β=-0.212) are determinants of environmental literacy. Specifically, having a nuclear family structure increases the scale score by 6.3 points, and using a recycling bin increases it by 4.9 points. These variables account for approximately 22.4% of environmental literacy for Generation Z (Table 5).

The mean ELSA score for all participants is 87.6±10.1. When determinants (enter model) of environmental literacy were examined for participants, it was found that being from Generation X and Y (β=-0.267), having a bachelor's degree or higher education level (β=-0.060), perceiving income equal to or greater than expenses (β=-0.100), lack of social security (β=-0.077), willingness to receive environmental education (β=-0.128), reading environmental reports (β=-0.089), using recycling bins (β=-0.129), disposing of used cooking oil in a separate container and depositing it in the waste oil container (β=-0.066), and disposing of waste batteries in the waste battery collection units (β=-0.060) are determinants of environmental literacy. Specifically, being from Generation X and Y increases the scale score by 5.7 points, recycling bin usage increases it by 2.7 points, and the willingness to receive environmental education increases it by 2.6 points. These variables explain approximately 23.1% of environmental literacy for participants (Table 6).

Table 3. Determinants of Environmental Literacy for Generation X.

Independent Variables	Unstandardized Coefficients					
	B	SE	*B*	t	p	95.0% CI
Level of Education (0: Graduate and post-graduate)	-1.125	0.935	-0.069	-1.203	0.230	-2.964 - 0.714
Family type (0: nuclear and single-parent family)	-1.451	0.826	-0.097	-1.756	0.080	-3.075 – 0.174
Employment status (0: Yes)	-0.745	0.812	-.048	-0.918	0.359	-.2341 – 0.851
Perceived income level (0: income equal to expenses)	-2.105	0.702	-0.152	-2.997	0.003	-3.487 - -0.724
Reading environmental reports (0: Yes)	-.1314	0.724	-0.094	-1.815	0.070	-2.279 – 0.110
Disposal of used cooking oil (0: Disposing separately)	-0.431	0.863	-0.029	-0.499	0.618	-2.127 – 1.266
Disposal of waste batteries (0: Throwing in the waste battery collection units)	-1.930	0.857	-0.139	-2.252	0.025	-3.616 - -0.245

Abbreviations: CI, confidence interval; SE, standard error; β, standardized regression coefficient.
Durbin–Watson = 1.586
F = 6.245, p < 0.001
R = 0.326 R^2 = 0.106 Adjusted R^2 = 8.9%
* The significance level was accepted as p < 0.05.

Table 4. Determinants of Environmental Literacy for Generation Y

Independent variables	Unstandardized Coefficients					
	B	SE	*β*	t	p	95.0% CI
Perceived income (0: Equal and more)	-1.846	1.119	-0.079	-1.649	0.100	-4.046 – 0.354
Willingness to receive education (0: Yes)	-3.521	0.963	-0.181	-3.657	0.000	-5.414 - -1.628
Reading environmental reports (0: Yes)	-2.008	0.905	-0.110	-2.219	0.027	-3.787 - -0.229
Using recycling bins (0: Yes)	1.422	0.989	0.073	1.438	0.151	-0.522 – 3.365
Disposal of used cooking oil (0: Disposing separately)	-3.570	1.107	-0.168	-3.225	0.001	-5.747 - -1.394
Disposal of used batteries (0: Using battery recycling unit)	-2.216	1.006	-0.119	-2.203	0.028	-4.193 - -0.239
Knowing the definition of carbon footprint (0: Yes)	-1.251	0.902	-0.68	-1.386	0.166	-3.024 – 0.523

Abbreviations: CI, confidence interval; SE, standard error; β, standardized regression coefficient.
Durbin–Watson = 1.704
F = 10.123, p < 0.001
R = 0.392 R^2 = 0.153 Adjusted R^2 = 13.8%
* The significance level was accepted as p < 0.05.

Table 5. Determinants of Environmental Literacy for Generation Z

Independent variables	Unstandardized Coefficients					
	B	SE	*β*	t	p	95.0% CI
Level of Education (0: Graduate and post-graduate)	-0.690	1.596	-0.021	-0.432	0.666	-3.828 – 2.448
Family type (0: Nuclear and single-parent)	-6.330	1.269	-0.132	-2.828	0.005	--6.085 - -1.093
Perceived income (0: income equal to or more than expenses)	-3.589	0.905	-0.110	-2.219	0.027	-3.787 - -0.229
Social security (0: No)	-3.890	1.085	-0.169	-3.584	0.000	-6.024 - -1.756
Willingness to receive education (0: Yes)	-3.878	1.134	-0.168	-3.419	0.001	-6.109 - -1.647
Reading environmental reports (0: Yes)	-2.204	1.1164	-0.092	-1.893	0.059	-4.493 – 0.086
Knowing recycling bins (0: Yes)	-1.103	1.186	-0.048	-0.929	0.353	-3.436 – 1.231
Using recycling bins (0: Yes)	-4.929	1.153	-0.212	-4.273	0.000	-7.197 - -2.661
Disposal of used cooking oil (0: Disposing separately)	-1.069	1.309	-0.039	-0.817	0.415	-3.643 – 1.505
Disposal of waste batteries (0: Using battery recycling unit)	-0.954	1.170	-0.041	-0.815	0.416	-3.255 - 1.347
Knowing the definition of carbon footprint (0: Yes)	-1.964	1.110	-0.082	-1.770	0.078	-4.147 - 0.218

Abbreviations: CI, confidence interval; SE, standard error; β, standardized regression coefficient.
Durbin–Watson = 1.641
F = 10.785, p < 0.001
R = 0.497 R^2 = 0.247 Adjusted R^2 = 22.4%
* The significance level was accepted as p < 0.05.

Table 6. Determinants of participants' environmental literacy

Independent variables	Unstandardized Coefficients					
	B	SE	*β*	t	p	95.0% CI
Generation (0: X and Y)	-5.760	1.005	-0.267	-5.570	0.000	-7.732 - -3.787
Level of Education (0: Graduate and post-graduate)	-1.315	0.657	-0.060	-2.000	0.046	-2.605 - -0.025
Perceived income (0: income equal to or more than expenses)	-2.399	0.631	-0.100	-3.799	0.000	-3.638 - -1.160
Employment status (0: Yes)	-0.098	0.706	-0.005	-0.139	0.890	-1.483 – 1.287
Presence of children (0: Yes)	-0.803	0.936	-0.40	-0.858	0.391	-2.640 – 1.034
Marital status (0: Married)	-0.660	0.932	-0.033	-0.707	0.479	-2.489 – 1.170
Social security (0: No)	-1.930	0.765	-0.077	-2.522	0.012	-3.431 - -0.428
Willingness to receive environmental education (0: Yes)	-2.667	0.578	-0.128	-4.614	0.000	-3.801 - -1.533
Reading environmental reports (0: Yes)	-1.794	0.575	-0.089	-3.120	0.002	-2.922 – -0.666
Knowing about recycling bins (0: Yes)	-0.295	0.624	-0.014	-0.472	0.637	-1.519 – 0.930
Using recycling bins (0: Yes)	-2.762	0.615	-0.129	-4.489	0.000	-3.969 - -1.555
Disposal of used cooking oil (0: Disposing separately)	-1.527	0.663	-0.066	-2.305	0.021	-2.827 – -0.227
Disposal of used batteries (0: Using battery recycling unit)	-1.219	0.613	-0.060	-1.987	0.047	-2.422 - -0.015
Knowing the definition of ecological footprint (0: Yes)	0.969	0.618	0.047	1.568	0.117	-0.244 – 2.183

Abbreviations: CI, confidence interval; SE, standard error; β, standardized regression coefficient.
Durbin–Watson = 1.617, F = 25.640, p < 0.001, R = 0.491, R^2 = 0.241, Adjusted R^2 = 23.1%
* The significance level was accepted as p < 0.05.

DISCUSSION

Due to the distinct eras that shape Generations X, Y, and Z within society, responsible environmental behaviors such as environmental knowledge, environmental awareness, the use of recycling units, and the use of waste batteries and oil units may vary. Despite

numerous studies in the literature evaluating environmental literacy in different groups, it has been observed that the environmental literacy and behaviors of society have not been examined specifically for generations X, Y, and Z. Based on this gap in the literature, this study was conducted to evaluate the environmental literacy and behaviors of generations X, Y, and Z. Variations in sociodemographic characteristics, including education level, marital status, employment status, and the presence of children among Generations X, Y, and Z, are interpreted as anticipated differences resulting from the transformations individuals undergo across age periods and life courses

The study found that high education levels and perceived income equal to or higher than expenses are the determinants of environmental literacy. The existing literature on the subject reports varying research results, such as students with parents having higher education levels having better environmental knowledge, attitudes, and behaviors (Akıllı & Genç, 2015), no difference in environmental literacy and behavior between children based on parental education levels (Koç et al., 2018), and no impact of income status on environmental literacy (Karatekin & Aksoy, 2012). Knowledge is acquired through various ways and processes, including the educational process, experiences, and interaction with peer groups. Individuals with higher education levels are thought to have higher environmental literacy due to their experiences of acquiring knowledge about environmental issues during their educational lives or participating in activities to increase environmental knowledge. Individuals with a higher income perception are believed to have higher environmental literacy due to factors such as using products that can be recycled within their economic means and having greater access to health-related information due to their higher technological capabilities. Additionally, education levels and economic status, which are social determinants of health, are expected to positively influence environmental literacy, as observed in various literacies (Atabek-Yiğit et al., 2013; Brevaman & Gottlieb, 2014).

While the study revealed that marital status and the presence of children are not determinants of environmental literacy, it is reported in contrast that the parents of Generation Z play a crucial role in enhancing environmental literacy and exhibiting responsible environmental behavior (Aktan & Kethüda, 2024). Due to various reasons such as the educational process, social media, and the increasing focus on environmental issues.

The study found that willingness to receive environmental education is a determinant of environmental literacy. In the literature, it is reported that individuals who consider themselves environmentally sensitive and have an interest in environmental issues tend to have higher environmental literacy (Çelik, 2016). Additionally, those who are curious about the environment and experience an increase in environmental curiosity also tend to have higher environmental literacy (Karatekin & Aksoy, 2012). Individuals with high knowledge, awareness, and literacy in a particular subject may feel responsible and inclined to take initiatives to acquire new information and adopt appropriate behaviors (Liu et al., 2022). Therefore, it can be interpreted that individuals with high environmental literacy are more likely to express a willingness to receive environmental education. Within this context, considering the shared responsibility for environmental and environmental health issues, it is recommended to enhance awareness and promote responsible environmental health and behavior for all individuals.

The study found that reading environmental reports is a determinant of environmental literacy. Considering that literacy is associated with skills such as information search, retrieval, reading, understanding, and analysis, individuals who read environmental reports are likely to have higher environmental literacy (McBride et al., 2013). Acknowledging that reading environmental reports supports environmental literacy and can contribute to the acquisition of responsible behavioral changes, it is recommended to provide information on how to access regional, national, and international environmental reports. Additionally, sharing reports through social media could be a significant initiative to increase the reading of reports (Aktan & Kethüda, 2024).

The study found that the use of recycling bins, disposing of waste batteries in battery units, and proper disposal of waste cooking oil in oil units or separately in the trash are determinants of environmental literacy. Disposing of waste batteries in the trash and pouring waste cooking oil down the drain or in the trash can lead to significant water and soil pollution, making the cleaning process difficult and expensive (Ministry of Environment and Urbanization, 2015). Proper disposal of waste batteries and cooking oil helps prevent soil and water pollution, reducing economic losses (Ministry of Environment and Urbanization, 2014). The recycling system contributes to preventing raw material and cost losses by enabling the recovery of waste materials such as paper, glass, plastic, and metal (Ministry of Environment and Urbanization, 2021). Individuals with high environmental knowledge and literacy are expected to exhibit responsible environmental behaviors, such as using recycling bins and properly disposing of waste batteries and cooking oil. Considering the potential positive impact of responsible environmental behaviors on preventing water and soil pollution and reducing raw material and financial losses, it is recommended to provide information for the acquisition

and maintenance of responsible environmental behaviors. Additionally, to support responsible environmental behaviors, widespread use of recycling bins, community-based education on responsible environmental behaviors at the local and national levels, organizing campaigns that encourage responsible environmental behaviors (such as coffee vouchers, financial incentives), and creating awareness through communication tools such as television and radio with informational messages and public service announcements are suggested (McBride, 2013).

Before the research, it was anticipated that generation X would have high environmental literacy but fewer appropriate environmental behaviors, generation Y would be less sensitive to environmental events and have lower environmental literacy compared to generation X, and generation Z would have higher awareness of responsible environmental behaviors but lower environmental literacy compared to generations X and Y. According to the research results, it was determined that the environmental literacy of generations X and Y is higher than that of generation Z, but responsible environmental behaviors such as using recycling bins, waste battery units, and waste cooking oil units are higher in generation Z compared to generations X and Y. In light of the research results, the research hypothesis (H0: There is no difference in environmental literacy among generations X, Y, and Z) was rejected, and it was found that the environmental literacy of the generations that make up society could be different. Individuals in generation X having high environmental literacy may be related to their sensitivity to societal events, but their cautious attitudes towards environmental behaviors such as using recycling bins and properly disposing of waste cooking oil and used batteries due to their reserved nature imposed by the era, they live in. Additionally, the high environmental literacy of individuals in generation X may be related to their knowledge about the environment throughout their lives, gaining information about the environment through various sources and different situations. The environmental literacy of generation Y is lower than that of generation X and higher than that of generation Z. Similarly, in terms of knowing the definitions of carbon footprint and ecological footprint, generation Y is better than generation X but worse than generation Z. Moreover, the higher membership in civil society organizations and participation in environmental activities of generation Y compared to generations X and Z may also be an indicator of their inclination towards independence. As for generation Z, their environmental literacy is considered to be lower than that of generations X and Y. However, their awareness of responsible environmental behaviors is higher, which can be attributed to the frequent discussion of environmental issues during the period they live in and their high awareness of appropriate environmental behaviors for solving environmental problems. Despite being more advantageous in knowing and implementing responsible environmental behaviors, their lack of deep and rich knowledge on the subject may lead to lower environmental literacy compared to generations X and Y. A literature review on purchasing environmentally friendly clothing across different generations indicates that younger generations hold more positive attitudes toward such purchases (Notaro ve Paletto, 2022). Additionally, research shows that Generation Z demonstrates more responsible behavior regarding environmental issues (Volkova et al., 2020). The research findings align with existing literature.

When evaluated both within generational contexts and for the entire participant group, responsible environmental behaviors such as using recycling bins, disposing of waste batteries in designated units, and depositing used cooking oil in collection units were found to be insufficient in society. Considering this inadequacy, it is recommended to raise awareness about environmental health in the community, support responsible environmental behaviors through environmental education initiatives, and implement plans to enhance and encourage the use of recycling bins, with a focus on local collaborations and sustainability. Additionally, it is suggested to conduct planning for promoting recycling, including financial incentives, coffee vouchers, and similar approaches. Leveraging the environmental knowledge of Generation X and Generation Z disseminating appropriate environmental behaviors, such as waste battery disposal and recycling utilization, throughout the entire community, could be facilitated through intergenerational interaction in social responsibility projects like 'Inform Someone in Your Environment' and 'Both Inform and Learn,' especially by capitalizing on the knowledge of Generation X and promoting initiatives that encourage interaction between generations.

Limitations: This research, while conducted with a broad sample group, has high generalizability to the broader community and provides significant contributions to the literature; however, it also encompasses certain limitations. Firstly, the study was exclusively conducted in the provincial center, possibly excluding individuals residing in districts. Another limitation is that the research included individuals aged 18 and over, thereby excluding the evaluation of environmental literacy and behaviors of children in middle and high school residing in the provincial center. Additionally, as there are no existing studies assessing the environmental literacy and behaviors of generations X, Y, and Z, the results have been discussed within the scope of the current literature. Despite these limitations, the research results present new insights indicating the community's need for education on

environmental matters and the necessity for collaboration between relevant institutions and local authorities to support appropriate environmental behaviors.

CONCLUSION

This study was conducted in a provincial center in Turkey with the aim of determining the environmental literacy and behaviors of generations X, Y, and Z. It was found that 17.6% of generation X, 38.5% of generation Y, and 40.5% of generation Z received environmental education, while a significant portion of the society, 67.8%, did not receive environmental education. Regarding reading environmental reports, 56.1% of generation X, 56.6% of generation Y, and 35.9% of generation Z were reported to read them. In terms of environmental responsibility, 81.1% of generation X, 85.7% of generation Y, and 64.9% of generation Z believed that environmental responsibility should be shared by everyone.

The research results support existing literature and contribute to it. Considering that environmental education is a key component in supporting environmental literacy, it is recommended to develop educational plans to increase environmental knowledge for every member of society. Periodic environmental education should be conducted in places where individuals gather in large numbers, such as schools, universities, and public institutions. In addition to the crucial role of environmental education in preserving and sustaining environmental health and supporting appropriate environmental behavior, fostering local and national collaborations on the subject will be an important approach. Increasing collaboration with local governments, organizing education programs based on community participation, widespread deployment of recycling bins to promote recycling, and enhancing the sharing of regional and local environmental reports and outcomes with public institutions and society are recommended. Creating public service announcements to support responsible environmental behaviors and initiating efforts to enhance the interaction between generations X, Y, and Z will also be essential. Generation Z may have higher awareness of the environment and responsible environmental behavior. Generation Z could serve as a means to transfer knowledge and raise awareness about environmental literacy and responsible environmental behavior to Generations X and Y. To enhance environmental knowledge, cultivate habits of responsible environmental behavior, and ensure sustainable environmental conditions, it is recommended to organize projects and campaigns aimed at increasing interaction between Generation Z and different individuals for the transfer of environmental knowledge and responsible environmental behavior to Generations X and Y. Future studies are recommended to evaluate the impact of environmental education provided to the community on environmental literacy and responsible environmental behaviors.

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