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Original Article

Determinants of Environmental Pollution Awareness Among University Students: A Case Study of Atatürk University

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ABSTRACT

Environmental pollution has adverse effects on living organisms and contributes to a wide range of health issues in individuals. Given this reality, enhancing public awareness and knowledge regarding environmental issues is of utmost importance. Accordingly, this study aims to identify the factors influencing environmental pollution awareness levels among university students. The primary objective is to determine which components of air, radiation, and noise pollution students are most aware of and concerned about. Achieving this objective required conducting a survey through face-to-face interviews with 400 students enrolled in various departments at Atatürk University in Erzurum, Turkey. The survey was designed to collect data for an academic study and to examine the extent to which students' understanding of environmental pollution is influenced by various sociodemographic and behavioral factors, including gender, household education level, mother's employment status, regular breakfast and exercise habits, interest in social sciences, and daily television consumption. The findings indicate that these factors significantly shape students' awareness of environmental pollution. Results from logistic regression analysis reveal that each of these variables exerts a statistically significant impact when considered simultaneously. Based on the study's conclusions, it is recommended that family members serve as the primary initiators of environmental education. Furthermore, local governments should implement systematic and consistent educational programs addressing environmental pollution. Additionally, the media holds significant potential for disseminating awareness and information effectively, thereby playing a crucial role in fostering students' environmental consciousness..

Key words: Environment, awareness, logit, university students, Turkey.

Üniversite Öğrencilerinde Çevre Kirliliği Farkındalığını Etkileyen Faktörler: Atatürk Üniversitesi Örneği

ÖZ

Çevre kirliliği canlılar üzerinde olumsuz etkilere sahiptir ve bireyler üzerinde çok çeşitli rahatsızlıklara neden olabilmektedir. Bu durum göz önüne alındığında insanların çevre sorunları konusunda farkındalığını ve bilgi düzeyini artırmak son derece önemlidir. Bu nedenle bu çalışma üniversite öğrencileri arasında çevre kirliliği farkındalık düzeyini etkileyen unsurları belirlemek için yapılmıştır. Öğrencilerin hava, radyasyon ve gürültü kirliliğinin hangi bileşenlerinin en çok farkında olduklarını ve endişe duyduklarını belirlemek çalışmanın temel amacını oluşturmuştur. Bu amacı gerçekleştirmek için Erzurum ilinde bulunan Atatürk Üniversitesi'nin çeşitli bölümlerine kayıtlı dört yüz öğrenciyle fakültelerde yüz-yüze görüşülerek anket soruları cevaplandırılmıştır. Bu anketin amacı, akademik çalışma için bilgi toplamak olup öğrencilerin çevre kirliliği anlayışının; cinsiyet, hane halkının eğitim düzeyi, annenin çalışma durumu, düzenli kahvaltı ve spor yapma alışkanlığı, sosyal bilimlere ilgisi

ve günlük televizyon izleme süresi gibi çeşitli faktörlerden ne derece etkilendiğini araştırmaktır. Araştırma sonucunda, bu faktörlerin tamamının öğrencilerin çevre kirliliği konusundaki farkındalığını önemli ölçüde etkilediği belirlenmiştir. Lojistik regresyon analizi sonuçları, bu unsurların her birinin aynı anda önemli bir etki uyguladığını göstermiştir. Çalışmanın sonuçlarına göre çevre eğitiminin öncelikli başlatıcısının aile bireyleri olması gerektiği, yerel yönetimlerin çevre kirliliği konusunda tutarlı ve metodik eğitim programları düzenlemesi gerektiği, medyanın da farkındalık ve bilgilendirmeyi başarılı bir şekilde yaygınlaştırma potansiyeli ile öğrencilerin çevre bilinci konusunda eğitilebileceği sonucuna varılmıştır.

Anahtar kelimeler: Çevre, farkındalık, logit, üniversite öğrencileri, Türkiye.

INTRODUCTION

Global environmental pollution poses a major challenge to the planet's long-term habitability. The environment is essential for sustaining life on Earth; however, increasing global pollution has become a major concern in recent years (Awewomom et al., 2024). Harmful substances and pollutants released into the air, soil, and water cause significant damage to the environment and human health, leading to environmental contamination and pollution (Li et al., 2019). Environmental contamination has received significant scrutiny as a critical issue over the past century, posing a serious threat to all forms of life unless appropriate measures are taken. Globally, nations strive to enhance their citizens' quality of life through development; however, this often leads to environmental challenges such as pollution and degradation. Rapid economic growth frequently results in environmental destruction, particularly in developing countries. The transformative effects of economic activities and expansion put pressure on the environment, leading to the redefinition of green spaces, the depletion of natural resources, and the pollution of land, water bodies, and air (Long et al. 2023). Environmental pollution can occur in different forms, such as air, water, soil, radioactive, noise, and light pollution (Michalski and Ficek, 2016).

Urbanization and industrialization have resulted in an increase in air pollution, which has detrimental effects on human health, plant life, and agricultural practices. Wildfires, livestock emission, and volcanoes are the natural sources of air pollution. Anthropogenic sources include agriculture, deforestation, denitrification, transportation, urbanization, and industry. These processes lead to the formation of contaminants and suspended particles in the atmosphere, which have adverse effects on human health, plant growth, and agricultural activities (Rafie-Rad et al., 2024). In 2019, the global mortality toll from environmental air pollution reached 7 million, with 4.1 million fatalities attributed to ambient pollution and 2.3 million to indoor pollution. Air pollution causes 9–12 million fatalities per year, primarily affecting impoverished populations with low and middle incomes. According to the World Health Organization, more than 80% of individuals residing in cities with air quality monitoring systems inhale polluted air that surpasses the levels recommended by the WHO (2024) (Henning, 2024).

Health concerns frequently arise due to repeated violations of the World Health Organization's recommended standards. Urban areas contribute to water pollution, public health issues, and river contamination. Climate change and urbanization are major contributors to environmental pollution (Noor et al., 2023). Nations use extensive pesticides and chemicals in agriculture to boost per capita income, ensure economic growth, and meet nutritional demands, resulting in soil and water contamination. Additionally, the escalating population pressure makes it challenging to obtain less than 1% of high-quality freshwater (Zahoor and Mushtaq, 2023). Industrialization and disorganized urbanization cause soil pollution, which poses a serious threat to the earth's soil ecosystem and the health of trillions of living organisms. Plants can absorb contaminants in soil, which then move up the food chain and impact human health. The concentration of pollutants in soils varies according to anthropogenic emissions, production, urbanization, and the competitive environment. Growing pollutants in agricultural soils are considered minimal contaminants, but they have a significant negative effect on individuals and the environment (Gautam et al., 2023).

The impact of urban expansion on biological variety is a significant problem, as it disrupts the natural environment through the introduction of artificial sound and light, which affects the life forms of living animals (Morelli et al., 2023). Pollution is currently the primary environmental factor responsible for disease and premature mortality on a global scale. Air transportation noise, often associated with air pollution in metropolitan areas, is an increasingly recognized environmental issue. Europe has an estimated 12,000 early deaths and 48,000 new cases of ischemic heart disease each year as a result of prolonged exposure to environmental noise (Münzel et al., 2021). Human activities have caused a significant increase in light pollution, which has had a major impact on the Earth's ecosystems. This increase in light intensity and illuminated surfaces is primarily due to socioeconomic factors and large-scale cultural activities. Furthermore, we expect this trend to

continue and even accelerate owing to lower production and usage costs and advancements in technology (Ramírez et al., 2023).

According to Cankurt et al. (2016), the most efficient approach to addressing this issue is to enhance individuals' consciousness regarding the preservation of the natural environment and amplify their understanding of environmental challenges. In this context, the study aimed to determine the elements that university students find most important in terms of environmental pollution and the factors that have an effect on the environmental pollution elements which the students identify as significant. Therefore, this study aims to serve as a resource for research focused on raising awareness and consciousness about environmental pollution, which has increasingly become a global threat to human health in recent years.

MATERIALS AND METHODS

Materials

Face-to-face interviews with students at the central campus of Atatürk University in Erzurum provided data for this study on environmental pollution. The sample size was determined using a proportional sampling method with a 95% confidence interval and 5% margin of error. The formula used to calculate the sample size was as follows, as stated by Uzundumlu and Sezgin (2017) and Akan et al. (2021):

$$n = \frac{N \cdot p \cdot (1-p)}{(N-1) \cdot (Q_{px})^2 + p \cdot (1-p)} \quad (\text{Eq.1})$$

where n: size of the sampling,

N: the number of active students in graduate programs in the central county of Atatürk University (29,600),

P: the proportion of environmentally conscious students (50%),

Q_{px}: variance (0.000650771).

r: mean deviation (5%),

Z_{α/2}: z or t table value=1.96,

variance = (r/t table value)²=0.000650771

The data for this study on environmental pollution was obtained through face-to-face interviews conducted with students at the central campus of Atatürk University in Erzurum. The sample size was determined using a proportionate sampling procedure with a 95% confidence level and a 5% margin of error. The formula utilized for determining the sample size was as follows:

$$n_i = \frac{N_i}{N} * n \quad (\text{Eq.2})$$

n_i= Number of students sampled in faculty of i,

N_i= Number of students in faculty of i,

n= Total number of samples for the population

The formula (2) was used to determine the number of students to be involved in the study from different departments and classes.

In addition, a pre-survey was carried out within the scope of the study with 100 students from different departments. The students were given air, radiation, water, soil, noise, and light pollution choices as environmental pollution elements, and the three most disturbing elements were determined (Table 1). These elements were identified as air, noise, and radiation respectively. The items in the questionnaire were designed based on these three elements.

Table 1. The distribution of pollution elements rated by the extent of students' disturbance

Pollution elements	Percentage
Air	28
Noise	25
Radiation	19
Water	12
Soil	9
Light	7
Total	100.00

Methods

The logistic regression method was employed in the analysis of data obtained from the questionnaires. In econometric studies, the categorical models whose dependent or explained variables are responded as yes-no or successful-unsuccessful and coded as 0 and 1 are called bipolar limited dependent variable models. This type of model is estimated using three different methods. These are Linear Probability Model, Logit Model, and Probit Model. Probit model is used as an alternative to the Logit model (Kalayci, 2018; Miran, 2018). However, Logit model is generally used instead of Probit model. The three environmental pollution (air, noise, and radiation) elements that the students were disturbed by were presented to the students as a dependent variable, and the factors causing disturbance were identified. The following is the functional form of the regression model used to estimate the effect of the factors having an influence on the issue.

$Y = f(X_1, X_2, X_3, X_4, X_5, \dots, X_{12})$ where

Y1= the state of disturbance or getting influenced by air pollution (yes=1, no=0)

Y2= the state of disturbance or getting influenced by the radiation in the environment (yes=1, no=0)

Y3= the state of disturbance or getting influenced by noise pollution (yes=1, no=0)

X1: age of the student (year),

X2: gender of the student (male:1, and female:0),

X3: education level of the householder (year),

X4: employment status of the mother

X5: residence in the city center

X6: the student's education period so far (year),

X7: studying science

X8: daily regular sport participation (hour/day)

X9: sleeping time of student (hour/day),

X10: regular daily breakfast consumption (hour/day)

X11: television viewing time of the student (hour/day)

X12: total time spent surfing the Internet (hour/day)

RESULTS AND DISCUSSION

The study conducted a survey of 400 students from various departments. The average age of the students participating in the study was 20.7 years, and 38% of them were male (Table 2). Uzundumlu et al. (2019) found that the average student age was 21.5 years, with 40% of the participants being male. However, in this study, the majority of participants were male. The average length of education of the head of the household was approximately nine years, while Uzundumlu et al. (2019) reported an average of 9.30 years. Furthermore, the data indicated that 20% of the students had employed mothers, and 71% lived in rural areas. The study participants had an average educational attainment of 14 years, with approximately 64% pursuing science-related subjects. Uzundumlu et al. (2019) reported an average educational attainment of 14.98 years among students. Students engaged in sports for less than 30 minutes on average. Pavlovic et al. (2023) found that 44.6% of university students did not participate in any sports activities. The mean duration of sleep was 7.4 hours per day, and 58% of the students consistently had breakfast. Özdişli & Yildiz (2021) found that university students slept an average of 7.1 hours per day, while Yamamoto et al. (2021) reported that 81.0% of students did not skip breakfast. On average, students spent 1.14 hours watching television and 4.68 hours using the internet in this study. Similarly, Benaich et al. (2021) observed that students spent an average of 1.11 hours watching television, while Chowdhury et al. (2020) found that more than half of the students spent 2 to 4 hours on the internet daily, with an average internet usage of 3.7 hours.

Table 2. Statistical summary and description of the variables

Variables	Description	Mean	St. Dev.
Age	Continuous variable	20.7	2.43
Gender	Male: 1, Female: 0	0.38	0.48
Education level of the householder	Continuous variable (year)	9.04	4.24
Employment status of the mother	Yes: 1, No: 0	0.20	0.40
Residence in the city center	Center: 1, Rural: 0	0.71	0.45
The student's education period	Years	14.43	1.65
Studying science	Yes: 1, No: 0	0.64	0.48
Sport participation (hour/day)	None:1, 0-0.5:2 0.5-1: 3, More than 1 hour: 4	1.76	1.10
Sleeping time (hour/day)	Continuous variable	7.44	1.35
Regular breakfast	Yes: 1, No: 0	0.58	0.49
Total time spent watching television (hour/day)	Continuous variable	1.14	1.61
Total time spent surfing the Internet (hour/day)	Continuous variable	4.68	2.84

According to the table, female students reported 10.4% more air pollution disturbances than male students (Table 3). Bozoglu et al. (2016) said that gender had very high impacts on the environmental awareness and behaviors of the students in question. Cankurt et al. (2016) also determined that women were more sensitive to air pollution. There are other studies coming up with similar findings, too (Chen & Chen 2021; Liao et al. 2021). On the contrary Carneiro et al (2021) found that boys were more sensitive to air pollution than girls. The likelihood of experiencing air pollution increases by 1% for each additional year of education of the household head. Yadama et al. (2012) found that the likelihood of a family having extra ventilation improves by 14% for every additional year of schooling that the head of the household receives. Those who regularly exercise for an hour more are 4.9% more sensitive to air pollution. Tainio et al. (2021) concluded that children who exercised in areas with high air pollution had significantly lower maximum oxygen available to them during exercise than children who exercised in areas with low air pollution.

Table 3. The results of the logistic regression analysis relating to the state of getting disturbed from air pollution

Variables	Coefficient	St. Dev.	P-value	Marginal effect
Constant	0.218	1.142	0.849	
Age	-0.015	0.056	0.789	-0.004
Gender	-0.449**	0.212	0.035	-0.104
Education level of the householder	0.047**	0.024	0.046	0.011
Residence in the city center	-0.057	0.216	0.791	-0.013
The student's education period	-0.020	0.082	0.804	-0.005
Studying science	0.119	0.206	0.564	0.027
Sport participation	0.218**	0.093	0.019	0.049
Regular sleep	0.018	0.071	0.797	0.005
Regular breakfast	0.076	0.196	0.697	0.017

* $\alpha=0.10$ ** $\alpha=0.05$ *** $\alpha=0.01$

The results indicate that male students were 8.2% more disturbed by noise pollution than female students. This could be attributed to the hypothesis that male students are exposed to louder surroundings, possess higher vocal frequencies, and experience greater levels of congestion in dorms, among other factors

(Table 4). But Okimiji et al. (2023) determined that women are more affected by noise pollution than men. Due to their heightened sensitivity, women may be more susceptible to noise, particularly in shared spaces. Also, Kocaman (2021) did not found significant difference observed between the independent variable of gender and the impression of noise pollution.

Table 4. The results of the logistic regression analysis relating to the state of getting disturbed from noise pollution

Variables	Coefficient	St. Dev.	P-value	Marginal effect
Constant	- 0.358	0.926	0.699	
Age	0.031	0.041	0.448	0.007
Gender	0.346*	0.230	0.099	0.082
Employment of the mother	0.624***	0.237	0.009	0.150
Education level of the householder	0.044*	0.023	0.055	0.011
Studying science	- 0.193	0.199	0.331	- 0.046
Daily time spent watching TV	- 0.126*	0.066	0.056	- 0.030
Daily time spent surfing the Internet	0.013	0.034	0.709	0.003
Sport participation	- 0.042	0.088	0.631	- 0.010
Regular breakfast	- 0.062	0.191	0.744	- 0.015

* $\alpha=0.10$ ** $\alpha=0.05$ *** $\alpha=0.01$

Our findings indicate that mothers' employment is associated with a 15% higher risk of noise pollution. Aryee and Ageziire's (2022) study found that children raised by employed mothers exhibit higher levels of environmental consciousness than children from households where the mother does not work. It is typical for mothers employed in professional sectors to have a significant level of education and hire private tutors to educate their children, thereby augmenting their knowledge.

When the head of the household's education year increases by one year, the child's susceptibility to noise pollution rises by 1.1%. This finding can be attributed to high level of awareness in the family. Şenyurt et al. (2011) and Özden (2016) found similar findings in their studies. They also reported in their study that children who grew up in families with educated parents had a higher level of environmental awareness.

Students who watched television every day for an extra hour had a 3% lower sensitivity to noise pollution. According to Iqbal et al. (2023), 76% of Pakistani university students acknowledge noise pollution as a significant environmental hazard that negatively impacts both health and the environment. Additionally, 72% of the participants report experiencing traffic noise, indicating that mass media, particularly television, fails to adequately address this issue. This perception is prevalent among university students.

When the house leader's education level increases by one year, their susceptibility to radiation pollution rises by 1.6%. The rising degree of education of the person responsible for the household logically influences the environmentally sensitive and knowledgeable children in the household (Table 5). Ahmar et al. (2022) said that the education level of the household head is positively effective in the use of clean and modern energy sources.

Table 5. The results of the logistic regression analysis relating to the state of getting disturbed from radiation

Variables	Coefficient	St. Dev.	P-value	Marginal effect
Constant	- 0.548	1.064	0.632	
Age	0.084	0.057	0.145	0.019
Gender	- 0.210	0.214	0.326	-0.048
Education level of the householder	0.070***	0.023	0.003	0.016
Residence in the city center	- 0.162	0.214	0.451	-0.038
The student's education period	- 0.147*	0.082	0.072	-0.034
Studying science	- 0.572***	0.205	0.005	-0.134
Sport participation	0.109	0.089	0.221	0.025
Regular sleep	- 0.031	0.071	0.660	-0.007
Regular breakfast	0.390**	0.194	0.044	0.090

* $\alpha=0.10$ ** $\alpha=0.05$ *** $\alpha=0.01$

When a university student's educational level rises by one year, their susceptibility to radiation pollution falls by 3.4%. Research has revealed that students' concern for the environmental pollution resulting from radioactive emissions from technological vehicles is insufficient. Technological advancements, which have made their lives more efficient and pleasurable, have contributed to this lack of concern. Hanin et al. (2019) stated that the damage caused by radioactive substances is caused by dangerous ionizing radiations such as alpha, beta and gamma, and that cancer is the most common disease caused by radioactive pollution.

The sensitivity to radiation pollution increases by 9% in people who eat regular breakfast compared to those who do not eat breakfast. Islam and Hasan (2023) stated that students who live in a polluted environment and are exposed to inorganic compounds, heavy metals, or radionuclides need a good diet along with a good breakfast. In this sense, students who know of the effects of radiological contamination in their living spaces do not skip breakfast.

CONCLUSION

Environmental pollution poses a substantial risk to living organisms. Consequently, the global community has undertaken comprehensive investigations and dedicated significant resources to addressing and reducing environmental pollution. Nevertheless, the primary objective is to enhance knowledge and understanding of environmental pollution and foster a mindful and careful attitude towards the environment. It is critical to determine individuals' perceptions, sensitivities, and awareness of environmental contamination, as well as the elements that influence them. The findings of this study indicate that to raise awareness about environmental contamination, it is advisable to initially focus on reaching families. Local authorities should systematically and continuously organize educational efforts that specifically target environmental pollution. In order to promote awareness among the general population about healthy lifestyles, it is crucial to create educational programs that emphasize the influence of having a regular breakfast and engaging in physical activity on environmental consciousness. Furthermore, effective mass media utilization will help to raise public awareness about environmental pollution. Also, the importance of maintaining clean and efficient energy conversion is increasing. Consequently, it is imperative to establish a training program to educate individuals about various sources of pollution. Universities should incorporate interdisciplinary departments focused on climate change, technological advancements, and preventive measures against pollution into their educational offerings.

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Declaration of Interests

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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1st Ahmet Semih UZUNDUMLU: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; software; writing—original draft; writing—review and editing.

2st Büşra ÇAKMUR: Conceptualization; data curation; formal analysis; funding acquisition; investigation; methodology; project administration; software;

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