



Research article

Anti-littering Attitude among University Graduates in Khulna City

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ABSTRACT

This study aims to evaluate the anti-littering scale for students and reveals the factors of anti-littering attitude among university graduates in Khulna city. This is mainly a cross-sectional study where 209 samples are collected by employing multistage sampling technique. Descriptive statistics, cross-tabulation and logistic regression analysis have been used to address the research objective. This study finds that the average anti-littering score is 3.60 on a scale of 5.0 which implies that students have medium level of anti-littering attitude. We find that parental education and the father's income are positively associated with an anti-littering attitude. In addition, pure science and engineering students have the highest level of positive anti-littering attitude. Regression analysis reports that family type, father's income, attending environmental program, environmental attitude and sensitivity to the environment are positively related to the anti-littering attitude. These findings help to understand students' anti-littering attitude which helps to solve the problem of littering.

Introduction

Environmental pollution, a well-known and significant global issue, is the term used to describe the degradation of environmental quality caused by the improper and careless disposal of solid waste, chemicals, and untidy trash into the environment (Zolotova et al., 2022; Balestra and Bellopede, 2022; Allamuratov and Tlepbergenova, 2023; Chaudhary et al., 2021). One of the important aspects of pollution in the world is considered to be littering (Wetzel et al., 2004; Ojedokun, 2011; Tesfaldet et al., 2022; Vanapalli et al., 2023). It is the exact opposite of anti-littering behavior (Kaur and Singh, 2023). Littering is the improper disposal of waste in small amounts in public spaces like streets, parks, institutions (such as schools, colleges, universities, and so on), and water bodies. It affects environmental quality and is a concerning issue from the viewpoints of the economy, society, and the environment. (Keenan et al., 1996; Raffoul et al., 2006; Khawaja and Shah, 2013; Schultz et al., 2013). In addition, littering has a wide range of negative effects, including harming the environment, aesthetics, and wildlife around the world (Singh and Kaur, 2021; Chaudhary et al., 2023). Both active and passive littering fall into this broad category (Sibley and Liu, 2003; Sibley, 2003; Salgado-Hernanz, 2021). Active littering refers to deliberate behavior, such as holding litter in hand while occupying an area and then placing it in the area when leaving. Passive

littering, on the contrary, is an unintentional behavior that is defined as placing litter in an area that is occupied when leaving the area. The crucial problem is that both behaviors add to the world's littering issue (Liu and Sibley, 2004).

When it comes to the effects of littering, they include harm to the drainage system, obstruction of water flow, and street flooding in urban areas (Nepal and Bharadwaj, 2022), as well as direct and indirect pollution of the air, water, and soil, which has a negative impact on the atmosphere (Zhou et al., 2013). More than 10 million tons of plastic trash were dumped into the oceans worldwide in 2015, which is a worrying development (Landon-Lane, 2018). Lavers et al. (2019) also noted that 238 tons of garbage had a negative impact on Australia's Cocos Island and had an impact on over 200 million people worldwide (Chaudhary et al., 2021).

Given the factors that influence littering behavior, engaging children in beneficial endeavors like recycling or neighborhood clean-up projects can help to further reinforce sustainable littering behavior (Herdiansyah et al., 2021). Street litter generation in the Middle East was significantly influenced by socioeconomic factors, such as education level, age, and type of residence (Arafat et al., 2007). While using attractive bins, clear signage, and other visual cues to encourage responsible waste disposal can significantly reduce the amount of littering that occurs (Johannes et al., 2021). In addition, there is a relationship

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between education level and littering behavior, with people with higher levels of education showing less of a tendency to litter. The best ways to encourage anti-littering behavior are through educational campaigns, encouraging responsible behavior, and enhancing waste management infrastructure (Eastman et al., 2013). The Sustainable Development Goals (SDGs) established by the United Nations in 2015 must be ensured and achieved in order to ensure and achieve city and community development goals (Hondo et al., 2020; Batista et al., 2021; Neumann and Brudermann, 2023). Deposit-refund systems support environmentally friendly waste management practices and provide financial incentives for waste reduction (Schuyler et al., 2018). In addition, economic instruments like taxes, levies, and deposit-refund systems are used to effectively reduce marine litter and promote ethical waste management practices among industries, consumers, and other stakeholders (Oosterhuis et al., 2014). The study highlights the need for comprehensive interventions that address the societal norms and economic factors that contribute to marine plastic litter in order to lessen its adverse effects (Abalansa et al., 2020). For instance, according to The Ocean Cleanup, the Great Pacific Garbage Patch (GPGP) has accumulated more than 1.8 trillion pieces of trash that weight about 80,000 tons in 2018. A significant portion of a municipality's budget is spent on cleaning up trash from roads and storm water drainage systems. Municipalities in the UK and Belgium spend 18 million euros and 10.4 million euros per year, respectively, cleaning up trash from beaches (Madhani et al., 2009; Ong and Sovacool, 2012). In contrast, according to Wagner and Broaddus (2016), the cost of cleaning up litter and lost recycling revenue in the USA ranges from \$3,920 to \$19,250 per 1,000 households annually. Additionally, a study's results demonstrated the effectiveness of Singapore and Japan's waste management systems and anti-littering campaigns (Ong and Sovacool, 2012). Other literature showed that there is still a lot of littering going on because of things like societal norms, a lack of awareness, and inadequate waste management infrastructure.9+- To reduce littering in Nairobi City, effective interventions concentrate on increasing awareness, enhancing waste management practices, and encouraging responsible behavior (Wanjohi, 2016). It is more challenging to properly reduce litter from the world rather it can be minimized. Despite numerous programs designed to reduce littering, it remains a significant problem in many places worldwide.

Littering and anti-littering are important to keep the environmental quality taken by collative strategies for both developed and developing countries (Alpizar et al., 2020; Moqbel and Haddad, 2020; Zambezi et al., 2021). The positive relationship between economic growth and environmental pollution in developing countries of Asia contributes nearly 5% yearly (Ray, 2008). Like other developing countries, among them, Bangladesh is also facing these challenges severely for a long time. Littering is a common phenomenon and most people do not perform anti-littering behavior and they do not know and do not think deeply about how the intensity of this bad habit can affect the environment in the country, especially in the ocean area of Bangladesh (Sahabuddin et al., 2021). The research paper revealed that the urban center of

Bangladesh provides almost 23,688 tons of Municipal Solid Waste (MSW) daily (Alam and Qiao, 2020; Ahmed and Hussain, 2013). A more important issue is that anti-littering is primarily important for making a sound environment but people, and concerned authorities often ignore one significant environmental problem and concerned issues because there has no strong rules and regulations against littering (Ong and Sovacool, 2012) and also affected by several economic, social, psychological, behavioral, and environmental factors (Singh and Kaur, 2022). In addition, numerous factors contribute to littering, including a lack of adequate infrastructure for waste management, bad habits, laziness, dirty streets, lack of laws and enforcement of existing anti-littering laws, overflowing trash cans, and ignorance (Al-Khatib et al., 2009; Hansmann and Steimer, 2017). Generally, it does not depend upon rules and regulations rather it totally relies on the conscious awareness and behavior of people (Ellen et al., 1991; Porges, 2003; Farrow et al., 2017). Developing anti-littering behavior and strong waste management system can make a litter-free and sound environment (Singh and Kaur, 2021; Alam et al., 2020). It also uses proper disposal methods, raising public awareness, and tightening laws governing can reduce environmental pollution (Novotny, 2009).

The majority of previous literature (Gusmerotti et al., 2016; Singh and Kaur, 2021; Singh and Kaur, 2022; Webler et al., 2022) focuses on attitudes, self-efficacy, perceived control, perceived threat, perceived barriers, perceived benefits, social norms, and motivations to develop people's anti-littering behavior. On the other hand, environmental factors that influence anti-littering behavior are identified as environmental concern, a positive attitude, and knowledge (Liu and Sibley, 2004; Ibrahim et al., 2021; Singh and Kaur, 2022). Age, financial status, parental education and awareness, and anti-littering practices in families and communities are some of the economic and social factors and also subjective norms are the determinants of anti-littering behavior (Singh and Kaur, 2021). By examining 9,757 people in the USA, Schultz et al. (2013) discovered the personal and environmental factors that contribute to littering and discovered that the availability of trash cans has a negative impact on people's tendency to litter while the presence of existing litter has a positive impact. Similar to this, environmental awareness has a positive impact on attitudes, which in turn affects students' intentions to engage in anti-littering behavior (Ibrahim et al., 2021). They found that anti-littering behavior is affected both directly and indirectly by environmental concern. When Singh and Kaur (2022) applied the health belief model to anti-littering behavior, they found that perceived threat had no impact on it. The littering attitude scale (LAS), in addition, is a reliable instrument for assessing people's attitudes toward littering (Ojedokun, 2015).

Overall, littering is a global and social problem (Singh and Kaur, 2022) that ultimately has an impact on the environment (Vanapalli et al., 2023). It poses a risk to human health, the bodies of animals, the air, and the water, as well as a serious threat to the environment's aesthetic beauty, which is impacted by human activity (Campbell, 2016; Ong and Sovacool, 2012; Chaudhary et al., 2021; Schultz et al., 2013; Novotny, 2009). More specifically,

Ryan et al. (2020) found that the lockdown during COVID-19 significantly reduced street litter due to reduced human activity and movement restrictions. After all, it has grown to be a serious concern for many developing nations worldwide at the moment.

The prior literature places a strong emphasis on working together to find solutions to the littering issue. This includes buyers, suppliers, governments, and other stakeholders. The majority of littering literature, however, focuses on overall people. However, the authors of this study want to examine specifically how university graduates in Bangladesh's Khulna City behave when it comes to littering. Understanding the factors that influence students' environmental responsibility is crucial for finding solutions to this problem. It entails figuring out the best motivation for students given their circumstances. Thus, it is crucial to comprehend anti-littering behavior and develop efficient strategies to reduce littering in order to create sustainable, sound, and liveable societies, cities, and countries referring to the 11th goal of SDGs. This is what drives researchers to examine the anti-littering behavior of students. Therefore, this study's objective is to determine a scale measuring anti-littering attitudes among students and how anti-littering attitude score among Khulna City's university graduates is influenced by various factors. To address the objective, the researchers formulate two research questions enlisted as follows:

- a) How much university graduates environmentally literate regarding anti-littering attitudes?
- (b) How does socio-demographic factor affect anti-littering behavior?

To answer research questions, the authors use logistic regression, cross-tabulation, and descriptive statistics. The results of the study provide insightful information to improve anti-littering behavior of students and inspire them to develop pro-environmental literacy.

Materials and Methods

Sampling and Study Area

The primary objective of this study is to investigate the anti-littering behavior of university graduates in Khulna city. To accomplish this, the researchers deliberately selected Khulna City as the study area. The city boasts 13 higher education institutions, including eight public and private universities, as well as five colleges affiliated with the national university. We pick four institutions (Table 5) purposively as a study area for this research and select 209 samples from four institutions. It is mainly a cross sectional study where we collect data from the students from 15 March 2023 to 6 April 2023.

Basically, we use multistage sampling method. First, we purposively choose four institutions and then we randomly select three departments/disciplines from each institution. Finally, we employed systematic random sampling to distribute questionnaires to students, with a total of 320 questionnaires administered. However, the number of respondents we received was only 209 students. Therefore, the response rate for the survey amounts to approximately 65%. The formula for finding interval $K = N / n$ where, K denotes the sampling interval, N denotes the total population and n denotes the sample size. This formula has been used for every departments/disciplines for finding interval. Our total population for this study is

49705. By using Cochran's formula for sample size calculation, we determine the standard sample size for such studies. A sample size of 209 provides a 95% confidence level with a margin of error of $\pm 7\%$, ensuring a reliable representation of the target population (Lev et al., 2023; Sikdar et al., 2023).

Construction of LAS Score

Anti-littering behavior describes people's and organizations' actions and conducts to prevent or lessen littering and its adverse environmental effects. It includes reducing the amount of garbage production, correctly disposing of rubbish in authorized sites, recycling, and getting involved in cleanup initiatives. Anti-littering behavior is measured by using the littering attitude scale (LAS) provided by Ojedokun (2015) which is widely used in literature to measure a people's anti-littering behavior (Singh and Kaur, 2021; Singh and Kaur, 2022). By following Ojedokun (2015), we use 11 statements to measure a student's anti-littering attitude. Five-point Likert scale has been used for each statement. We add the 11 statements to create final values and then, the score is divided into two categories: positive and negative attitude of littering. The score (≥ 30) denotes as the positive anti-littering attitude and others are denoted as negative anti-littering attitude.

Covariates

This study employs several explanatory variables based on previous literature (Schultz et al. 2013; Mintz et al. 2019; Herdiansyah et al. 2021; Veisi et al. 2019; Al Masud et al., 2024; Mamun et al., 2024). Socio-demographic variables include age, gender, marital status, family type, number of family members, number of siblings, number of highly educated member, fathers' education and income. On the other hand, environmental variables include environmental attitude, environmental knowledge, environmental concern, and sensitivity to the environment (Veisi et al. 2019). These variables are measured using a five-point Likert scale (Strongly Disagree=1 to Strongly Agree=5). Environmental knowledge and attitude comprise nine statements, sensitivity to the environment includes eight statements, and environmental concern consists of six statements (Chowdhury et al., 2024).

Estimation Strategy

This study employs weighted mean index to measure the index value of anti-littering score. Further, descriptive statistics, cross-tabulation and figures are employed to find out the association of socio-demographic variables with anti-littering attitude (Chowdhury & Haider, 2023). Finally, we use logistic regression model to find out the factors of anti-littering attitude.

General form of the Logistic regression model is shown in equation (1).

$$L_i = \ln (p_i / 1 - p_i) = \beta_0 + \beta_1 X_i + \mu_i \dots \dots \dots (1)$$

Here, L = Logit, $i = 1, 2, \dots, n$, β = Coefficient of variables, X_i = Explanatory variables, μ_i = Stochastic error term.

Results

This study mainly focuses on the anti-littering behavior of the university graduates in Khulna city. First, we measure the littering score of the students. Then, we analyze the relationship of the littering with socio-demographic variables. Finally, we find out the factors that affect the littering attitude.

Students' Anti-Littering Score

The summary statistics in the table 1 represents the Index Value of LAS across various dimensions. We use data on 11 dimensions (LAS1 to LAS11), with corresponding scores for each dimension. The mean and standard deviation values are also provided for each dimension, along with the Total N (number of observations) and Index Value. Weighted mean index have been used to measure

the index value. Table 1 reports that mean value of LAS across all dimensions is 3.64, indicating that, on average, the students possess a moderate level of littering attitude. The Cronbach's Alpha Value, a measure of internal consistency, is reported as 0.90, which suggests a high level of reliability for the LAS Index. Looking at the individual dimensions, the mean values for each LAS dimension range from 3.38 to 3.86, with the corresponding standard deviation values ranging from 1.09 to 1.36. These values reflect the variability in the scores across the different dimensions, with some dimensions having higher mean scores (e.g., LAS4 with a mean of 3.86) and lower variability (e.g., LAS9 with a standard deviation of 1.15), while others have lower mean scores (e.g., LAS8 with a mean of 3.38) and higher variability (e.g., LAS6 with a standard deviation of 1.32).

Table 1: Littering Attitude Scale

Index Value of LAS													
Dimensions	1	2	3	4	5	Mean	Stdev.	Total	N	Index Value			
LAS1	23	20	43	45	78	3.65	1.36	762	209	3.65			
LAS2	15	14	42	68	70	3.79	1.19	791	209	3.78			
LAS3	13	18	45	57	76	3.79	1.20	792	209	3.79			
LAS4	12	22	35	55	85	3.86	1.22	806	209	3.86			
LAS5	27	8	39	68	67	3.67	1.31	767	209	3.67			
LAS6	26	23	47	59	54	3.44	1.32	719	209	3.44			
LAS7	20	17	44	58	70	3.67	1.28	768	209	3.67			
LAS8	23	26	53	62	45	3.38	1.26	707	209	3.38			
LAS9	12	24	33	85	55	3.70	1.15	774	209	3.70			
LAS10	13	22	60	69	45	3.53	1.13	738	209	3.53			
LAS11	8	26	53	74	48	3.61	1.09	755	209	3.61			
Mean value of Littering Attitude Scale									3.64				
Cronbach's Alpha Value									0.90				

Source: Author's Compilation

N.B.: Strongly Disagree =1, Disagree =2, Neutral = 3, Agree = 4, or Strongly Agree =5; Stdev. = Standard Deviation

Anti-Littering and Socio-Demographic Variables

Anti-littering Attitude and Father's Education

Figure 1 reports the relationship between anti-littering attitude and fathers' education. It shows that among fathers who are illiterate, only one reported engaging in negative anti-littering behavior, while five report engaging in positive anti-littering efforts. This suggests that despite

their lack of formal education, some fathers are still taking positive action against littering. Overall, the data suggests that there exists a positive association between fathers' education level and engagement in positive anti-littering behavior, with higher education levels being associated with higher frequencies of positive anti-littering efforts.

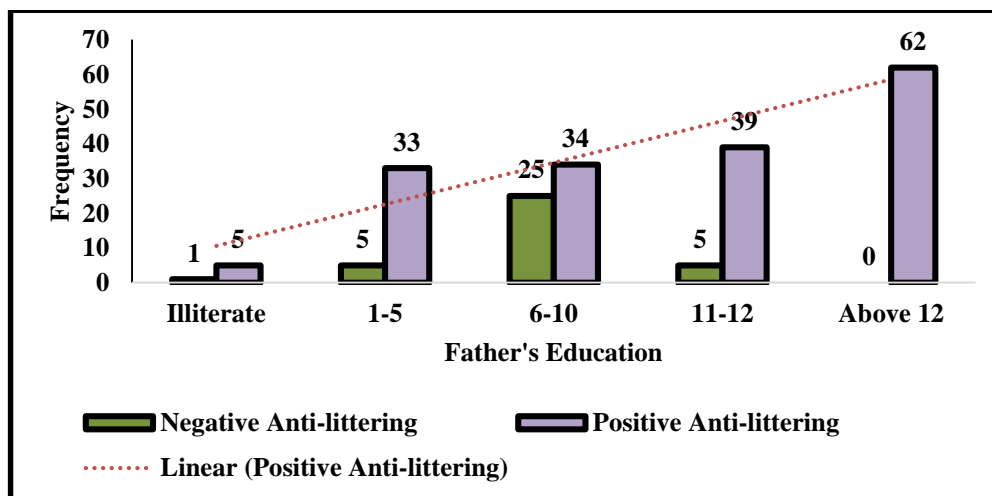


Figure 1. Relation between Anti-littering Behavior and Father's Education

Source: Author's Compilation

Anti-littering Attitude and Mother's Education

Table 2 shows the relationship between anti-littering attitude and mothers' education. Among mothers who are illiterate, 33.33 percentage reported engaging in negative anti-littering behavior, while 66.67 percentage reported engaging in positive anti-littering efforts. This suggests that despite their lack of formal education, a higher percentage of mothers are taking positive action against littering. It also reports that among mothers' education level above 12 years, none reported engaging in negative anti-littering behavior, while 100 percentage reported engaging in positive anti-littering efforts. This suggests that mothers with higher education levels are less likely to engage in negative anti-littering behavior and more likely to engage in positive anti-littering efforts. We notice that there is a positive association between mothers' education level and engagement in positive anti-littering behavior.

Table 2: Cross tabulation between Mother's Education and Anti-littering Attitude

Mother's Education	Anti-littering Attitude		
	Negative	Positive	Total
Illiterate	2 (33.33)	4 (66.67)	6 (100.00)
1-5	19 (42.22)	26 (57.78)	45 (100.00)
6-10	15 (17.05)	73 (82.95)	88 (100.00)
11-12	0 (0.00)	38 (100.00)	38 (100.00)
Above 12	0 (0.00)	31 (100.00)	31 (100.00)
Total	36 (17.31)	172 (82.69)	208 (100.00)

Source: Author's Compilation

Anti-littering Behavior and Father's Income

Table 3 shows the frequency of negative and positive littering behavior among different categories of father's income level. This table illustrates that among fathers with an income less than 10,000 BDT per month, 38.55 percentage reported engaging in negative littering behavior, while 61.45 percentage reported engaging in positive anti-littering efforts. This suggests that a higher percentage of fathers with lower income levels are taking positive action against littering. Alternatively, among fathers with an income above 40,001 BDT per month, none reported engaging in negative littering behavior, while 100 percentage reported engaging in positive anti-littering efforts. This suggests that fathers with higher income levels above 40,000 BDT per month are less likely to engage in negative anti-littering behavior and more likely to engage in positive anti-littering efforts. Overall, it reports that there is a positive association between fathers' income level and engagement in positive anti-littering behavior.

Faculty-wise Anti-littering Distribution

Table 4 shows the frequency of negative and positive littering behavior among different faculties, including Social Science, Business Studies, Pure Science, and Engineering. This table shows that the positive anti-littering attitude is higher among pure science (92.31) and the littering attitude scale into two categories based on literature. Here, 0 indicates Negative Anti-littering

engineering students (90.38). However, the students of business studies are the highest level of negative anti-littering attitude.

Table 3: Cross tabulation between Fathers Income and Anti-littering

Father's Income (BDT/Month)	Anti-littering Attitude		
	Negative	Positive	Total
Less than 10,000	32 (38.55)	51 (61.45)	83 (100.00)
10,001-20,000	4 (9.52)	38 (90.48)	42 (100.00)
20,001-30,000	0 (0.00)	28 (100.00)	28 (100.00)
30,001-40,000	0 (0.00)	15 (100.00)	15 (100.00)
Above 40,000	0 (0.00)	41 (100.00)	41 (100.00)
Total	36 (17.22)	173 (82.78)	209 (100.00)

Source: Author's Compilation

Table 4: Faculty-wise Anti-littering Distribution

Faculty	Anti-littering Attitude		
	Negative	Positive	Total
Social Science	14 (17.95)	64 (82.05)	78 (100.00)
Business Studies	14 (35.00)	26 (65.00)	40 (100.00)
Pure Science	3 (7.69)	36 (92.31)	39 (100.00)
Engineering	5 (9.62)	47 (90.38)	51 (100.00)
Total	36 (17.22)	173 (82.78)	209 (100.00)

Source: Author's Compilation

N.B.: The percentage of faculty-wise anti-littering distribution is shown in the parenthesis.

University-wise Anti-Littering Distribution

Table 5 shows the frequency of negative and positive littering behavior among students from different institutions, including Khulna University, Khulna University of Engineering and Technology, North Western University, and Brojo Lal College. This table shows that positive littering attitude is higher among KUET (96.15) and Khulna university (90.38) students.

Table 5: University-wise Anti-littering Distribution

Institution Name	Anti-littering Attitude		
	Negative	Positive	Total
Khulna University	5 (9.62)	47 (90.38)	52 (100.00)
Khulna University of Engineering and Technology	2 (3.85)	50 (96.15)	52 (100.00)
North Western University	15 (28.85)	37 (71.15)	52 (100.00)
Brojo Lal College	14 (26.42)	39 (73.58)	53 (100.00)
Total	36 (17.22)	173 (82.78)	209 (100.00)

Source: Author's Compilation

Factors Affecting Anti-Littering Attitude

This study performs logistic regression model to find out the factors that affect anti-littering attitude among university graduates in Khulna city. For this, we divide Behavior and 1 indicates Positive Anti-Littering Behavior. Table 6 represents the logistic regression model where

socio-economic variables (family type, father’s income), attending environmental program, environmental attitude and sensitivity to the environment are positively related to the anti-littering attitude. Specifically, students from nuclear family have higher probability of positive anti-littering attitude (0.074, $p<0.10$). In addition, increase in the father’s income and attending environmental program raise the probability of positive anti-littering attitude (positive anti-littering behavior) (0.088, $p<0.05$; 0.136,

$p<0.01$). Noticeable, increasing score of environmental attitude and sensitivity to the environment raises the probability of positive anti-littering attitude (0.014, $p<0.01$; 0.013, $p<0.01$). We assess multicollinearity using the Variance Inflation Factor (VIF) test. A VIF value of **1.550** indicates that there is no significant multicollinearity among the explanatory variables, as it is well below the commonly accepted threshold of **10**.

Table 6: Logistic Regression Model

Variable Name	Unit of Measurement	Coefficient	Marginal Effect
Age	Years	0.300 (0.223)	0.011 (0.008)
Gender	0=Female, 1=Male	-0.176 (1.073)	-0.006 (0.038)
Marital Status	0=Married, 1= Unmarried	2.245 (2.005)	0.080 (0.069)
Family Type	0=Joint, 1=Nuclear	2.086* (1.217)	0.074* (0.041)
Number of Family Members	Number	0.0331 (0.312)	0.001 (0.011)
Number of Siblings	Number	-0.178 (0.364)	-0.006 (0.013)
Number of Siblings at School	Number	0.596 (0.570)	0.021 (0.020)
Number of Highly Educated Member	Number	-0.436 (0.507)	-0.015 (0.018)
Fathers Education	Years of Schooling	-0.189 (0.159)	-0.007 (0.005)
Log Father’s Income	BDT/Month	2.475** (0.978)	0.088** (0.030)
Following Environmental Page	0=No, 1=Yes	-0.744 (0.473)	-0.026 (0.016)
Attending any Environmental Program	0=No, 1=Yes	3.838*** (1.317)	0.136*** (0.037)
Environmental Knowledge	Composite Score	-0.0879 (0.109)	-0.003 (0.004)
Environmental Attitude	Composite Score	0.387*** (0.138)	0.014*** (0.004)
Environmental Concern	Composite Score	0.165 (0.174)	0.006 (0.006)
Sensitivity to the Environment	Composite Score	0.379*** (0.130)	0.013*** (0.004)
KU (Base)			
K.U.E.T.	-	-5.601** (2.757)	-0.121** (0.060)
N.W.U.	-	-8.495*** (2.652)	-0.239*** (0.038)
B.L.C.	-	-5.041** (2.053)	-0.102** (-6.340)
Constant		-43.30*** (12.40)	-
Observations		209	209

Source: Author’s Compilation

Robust standard errors in parentheses, *** $p<0.01$, ** $p<0.05$, * $p<0.1$

Discussion

According to the findings of this research, the respondents in the study area have a moderate level of attitude toward littering, with some variation across different dimensions, as measured by the LAS Index. The high Cronbach's Alpha value suggests that the LAS Index is a reliable measure and also indicates good internal consistency. The findings of this paper are in agreement with the earlier investigation.

According to Ojedokun (2015), the study offers important insights into how to comprehend and address the attitudes of the Nigerian population toward littering. Since the LAS is typically used to assess attitudes toward littering, the findings shed light on whether people have positive or negative attitudes and beliefs about littering.

Nonetheless, a number of earlier studies have suggested that attitude serves as the best indicator of anti-

littering behavior (Singh and Kaur, 2022.). One of the study's most important conclusions is that an increase in environmental attitude and sensitivity to the environment increases the likelihood of positive anti-littering behavior. The outcomes of earlier studies on health behaviors and littering behavior (Porter et al., 1995) are consistent with this result. Moreover, the present study shows that students from nuclear families are more likely to have an anti-littering attitude that is positive. This outcome is consistent with the previous study which has shown that friends and family are considered for not littering behavior. That means; small families have positive anti-littering behavior (McCool and Merriam, 1970; Singh and Kaur, 2021).

On the other hand, according to the present study data, fathers who engage in positive anti-littering behavior are more likely to have higher education levels than those who engage in negative anti-littering behavior. Higher education levels are also linked to higher frequencies of positive anti-littering efforts and lower frequencies of negative anti-littering behavior. Similar research by Herdiansyah et al. (2021) demonstrated that positive parenting practices and parental education have a positive influence on children's behavior and sustainability of littering. By teaching kids at a young age about the dangers of littering and the importance of proper waste disposal, environmental responsibility can be instilled in them. While Arafat et al. (2007) explained that socio-economic factors, such as age, type of residence, and education level, significantly influenced the Middle Eastern region's street litter generation. Additionally, more positive anti-littering efforts and less harmful anti-littering behavior are associated with higher levels of education. Mothers who are engaged in effective anti-littering behavior tend to have higher levels of education. Additionally, there is a link between education level and littering behavior, with those higher levels of education exhibiting fewer littering tendencies (Eastman, 2013). Additionally, Ong and Sovacool (2012) presented a comparative study looking at waste and littering in Singapore and Japan. Due to strict laws and enforcement, Singapore exhibits lower levels of littering than Japan, which focuses on community involvement and public education to encourage responsible waste disposal.

Furthermore, according to the study's findings, fathers' income levels and their participation in positive anti-littering behavior are positively correlated, with higher income levels being linked to higher percentages of positive anti-littering efforts and lower percentages of negative anti-littering behavior. The prior paper shows that environmental attitude and quality towards students depend on their father's income as well as family income (Teal and Loomis, 2000; Taskin, 2009). In addition, this present study finding suggests that variations in littering behavior may be influenced by differences in disciplinary attitudes, values, and norms. This is consistent with previous study (Singh and Kaur, 2022; Webler et al., 2022). According to the study's data, there is variation in students' littering behavior across university years, with some years exhibiting higher percentages of effective anti-littering efforts and lower percentages of ineffective anti-

littering behavior. Students from various institutions exhibit varying levels of anti-littering efforts, with some showing higher percentages of positive anti-littering efforts and others showing lower percentages. The information also suggests that there are differences in the anti-littering efforts made by various faculties, with some showing higher percentages of positive anti-littering efforts and lower percentages of negative anti-littering behavior. Similarly, some research papers reveal that university and college students are more conscious of ensuring environmental quality (Wang et al., 2023; Chao et al., 2023; Khuc et al., 2023).

Conclusion

To sum up, the executed study deals with anti-littering behavior among university students in Khulna City. To conduct this research, researchers have gathered data from four universities. Among them, two are public; one is private; the other one is national. The nature of the data is cross-sectional consisting of 209 samples by applying a multistage sampling technique. Some basic statistical tools and techniques have been applied to reach the core objective of this study. The obtained outcomes reveal that if environmental attitude among students at university increases by one score, then the likelihood of anti-littering behavior will, on average, increase by 1.4 percent, which is statistically significant at 5 percent. Furthermore, the LAS scale shows that university graduates are environmentally literate at a moderate level regarding anti-littering attitudes. In addition, the regression model reveals that family type especially in a nuclear family, and the father's income of the respondents affect positively in anti-littering behavior. Overall, the students of the university are moderately concerned about anti-littering behavior. In addition, pure science and engineering students have the highest level of positive anti-littering attitude. These findings provide valuable insights, suggesting that the effective dissemination of environmental knowledge can contribute to creating a litter-free environment. Thus, this study recommends the implementation of environmental awareness campaigns, training programs on pro-environmental issues, and the dissemination of knowledge through social media, newspapers, and other electronic platforms. This research is not beyond the limitation. There exists a gap between the actual behavior of the respondents and the estimated behavior. Furthermore, due to the cross-sectional nature of the study, it is challenging to determine the respondents' actual behavior concerning anti-littering over time.

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Conflict of Interest

The authors confirm that there is no conflict of interest with the publication of this article.

References

- Abalansa, S., El Mahrad, B., Vondolia, G.K., Icely, J. and Newton, A., 2020. The marine plastic litter issue: a social-economic analysis. *Sustainability*, 12(20), p.8677.
- Ahmed, A. and Huq-Hussain, S., 2013. Solid waste management system of Narayanganj city: An environmental study. *African Journal of Environmental and Waste Management Vol*, 1(2), pp.028-034.
- Al Masud, M. M., Al Marin, A., Islam, M. K., & Chowdhury, S. (2024). Evaluation of the Government Stipend Program for Students with Disability: Evidence from Khulna District of Bangladesh. *Khulna University Studies*.
- Alam, M.J., Ahmed, K.S., Nahar, M.K., Akter, S. and Uddin, M.A., 2020. Effect of different sowing dates on the performance of maize. *Journal of Krishi Vigyan*, 8(2), pp.75-81.
- Alam, O. and Qiao, X., 2020. An in-depth review on municipal solid waste management, treatment and disposal in Bangladesh. *Sustainable Cities and Society*, 52, p.101775.
- Al-Khatib, I.A., Arafat, H.A., Daoud, R. and Shwahneh, H., 2009. Enhanced solid waste management by understanding the effects of gender, income, marital status, and religious convictions on attitudes and practices related to street littering in Nablus–Palestinian territory. *Waste management*, 29(1), pp.449-455.
- Allamuratov, M. and Tlepbergenova, P., 2023. Atmosfera's pollution as an actual global problem. *Innovative developments and research in education*, 2(14), pp.42-48.
- Alpizar, F., Carlsson, F., Lanza, G., Carney, B., Daniels, R.C., Jaime, M., Ho, T., Nie, Z., Salazar, C., Tibesigwa, B. and Wahdera, S., 2020. A framework for selecting and designing policies to reduce marine plastic pollution in developing countries. *Environmental Science & Policy*, 109, pp.25-35.
- Arafat, H.A., Al-Khatib, I.A., Daoud, R. and Shwahneh, H., 2007. Influence of socio-economic factors on street litter generation in the Middle East: effects of education level, age, and type of residence. *Waste management & research*, 25(4), pp.363-370.
- Balestra, V. and Bellopede, R., 2022. Microplastic pollution in show cave sediments: First evidence and detection technique. *Environmental pollution*, 292, p.118261.
- Batista, M., Caiado, R.G.G., Quelhas, O.L.G., Lima, G.B.A., Leal Filho, W. and Yparraguirre, I.T.R., 2021. A framework for sustainable and integrated municipal solid waste management: Barriers and critical factors to developing countries. *Journal of Cleaner Production*, 312, p.127516.
- Campbell, M.L., Slavin, C., Grage, A. and Kinslow, A., 2016. Human health impacts from litter on beaches and associated perceptions: A case study of 'clean' Tasmanian beaches. *Ocean & coastal management*, 126, pp.22-30.
- Chao, C.M., Yu, T.K. and Yu, T.Y., 2023. Understanding the factors influencing recycling behavior in college students: the role of interpersonal altruism and environmental concern. *International Journal of Sustainability in Higher Education*, 24(5), pp.969-985.
- Chaudhary, A.H., Polonsky, M.J. and McClaren, N., 2021. Littering behaviour: A systematic review. *International Journal of Consumer Studies*, 45(4), pp.478-510.
- Chaudhary, S., Kumari, M., Chauhan, P. and Chaudhary, G.R., 2021. Upcycling of plastic waste into fluorescent carbon dots: An environmentally viable transformation to biocompatible C-dots with potential prospective in analytical applications. *Waste Management*, 120, pp.675-686.
- Chowdhury, P.R., Medhi, H., Bhattacharyya, K.G. and Hussain, C.M., 2023. Emerging plastic litter variants: A perspective on the latest global developments. *Science of the Total Environment*, 858, p.159859.
- Chowdhury, S., & Haider, M. Z. (2021). Pattern of School Absenteeism in Some Selected Countries. *Khulna University Studies*, 78-89.
- Chowdhury, S., Haider, M. Z., Keya, S.K., Paul, P. (2024). Assessing Littering Centric Environmental Literacy of University Graduates in Bangladesh. *Journal of Environmental Impact and Management Policy*, 4(46), 42-52.
- Eastman, L.B., Núñez, P., Crettier, B. and Thiel, M., 2013. Identification of self-reported user behavior, education level, and preferences to reduce littering on beaches—A survey from the SE Pacific. *Ocean & Coastal Management*, 78, pp.18-24.
- Ellen, P.S., Wiener, J.L. and Cobb-Walgren, C., 1991. The role of perceived consumer effectiveness in motivating environmentally conscious behaviors. *Journal of public policy & marketing*, 10(2), pp.102-117.
- Farrow, K., Grolleau, G. and Ibanez, L., 2017. Social norms and pro-environmental behavior: A review of the evidence. *Ecological Economics*, 140, pp.1-13.
- Hansmann, R. and Steimer, N., 2017. Subjective reasons for littering: A self-serving attribution bias as justification process in an environmental behaviour model. *Environmental Research, Engineering and Management*, 73(1), pp.8-19.
- Herdiansyah, H., Brotosusilo, A., Negoro, H.A., Sari, R. and Zakianis, Z., 2021. Parental Education and Good Child Habits to Encourage Sustainable Littering Behavior. *Sustainability*, 13(15), p.8645.
- Hondo, D., Arthur, L. and Gamaralalage, P.J.D., 2020. Solid Waste Management in Developing Asia: Prioritizing Waste Separation.
- Ibrahim, A. and Habibu, U.A., 2021. Isolation and Characterization of Multidrug-resistant Escherichia coli from Poultry Litter samples from Selected Farms in Kano metropolis, Nigeria. *Nigerian Journal of Microbiology*.
- Johannes, H.P., Maulana, R. and Herdiansyah, H., 2021. Prevention of Littering through Improved Visual Design. *Environmental Research, Engineering and Management*, 77(4), pp.86-98.
- Kaur, R. and Singh, J., 2022. Perceived determinants for modifying littering behavior—a study testing the influence of perceived behavioral control, environmental factors and intention. *Social Responsibility Journal*.

- Kaur, R. and Singh, J., 2023. Social marketing framework for anti-littering behavior: an integrated serial mediation model. *Journal of Social Marketing*.
- Keenan, R.J., Prescott, C.E., Kimmins, J.P., Pastor, J. and Dewey, B., 1996. Litter decomposition in western red cedar and western hemlock forests on northern Vancouver Island, British Columbia. *Canadian journal of botany*, 74(10), pp.1626-1634.
- Khawaja, F.S. and Shah, A., 2013. Determinants of littering: An experimental analysis. *The Pakistan Development Review*, pp.157-168.
- Khuc, Q.V., Tran, M., Nguyen, T., Thinh, N.A., Dang, T., Tuyen, D.T., Pham, P. and Dat, L.Q., 2023. Improving energy literacy to facilitate energy transition and nurture environmental culture in Vietnam. *Urban Science*, 7(1), p.13.
- Landon-Lane, M., 2018. Corporate social responsibility in marine plastic debris governance. *Marine pollution bulletin*, 127, pp.310-319.
- Lev, N., Negev, M., & Ayalon, O. (2023). Sometimes Littering Is Acceptable—Understanding and Addressing Littering Perceptions in Natural Settings. *Sustainability*, 15(18), 13784.
- Liu, J.H. and Sibley, C.G., 2004. Attitudes and behavior in social space: Public good interventions based on shared representations and environmental influences. *Journal of environmental psychology*, 24(3), pp.373-384.
- Madhani, J., Dawes, L. and Brown, R., 2009. A perspective on littering attitudes in Australia. *Environmental Engineer: Journal of the Environmental Engineering Society, Institution of Engineers Australia*, 10(1), pp.13-20.
- Mamun, T. M., Chowdhury, S., & Sumi, N. S. (2022). Determinants Of Satisfactory Public Health Care Services In Rural Bangladesh. *Khulna University Studies*, 128-140.
- McCool, S.F. and Merriam, L.C., 1970. Factors associated with littering behavior in the Boundary Waters Canoe Area.
- Mintz, K.K., Henn, L., Park, J. and Kurman, J., 2019. What predicts household waste management behaviors? Culture and type of behavior as moderators. *Resources, Conservation and Recycling*, 145, pp.11-18.
- Moqbel, S., El-Tah, Z. and Haddad, A., 2020. Anti-littering in developing countries: Motivating the people of Jordan. *Waste Management & Research*, 38(7), pp.726-733.
- Nepal, M., Cauchy, M., Karki Nepal, A. and Goodrich, G., 2022. Household waste management and the role of gender in Nepal. In *Environmental Economics in Developing Countries*. Taylor & Francis.
- Neumann, J. and Brudermann, T., 2023. Littering in Municipal Public Places: The Role of Personal Factors and Intentions. In *Shaping Tomorrow Today—SDGs from multiple perspectives* (pp. 47-71). Wiesbaden: Springer Fachmedien Wiesbaden.
- Novotny, T.E., Lum, K., Smith, E., Wang, V. and Barnes, R., 2009. Cigarettes butts and the case for an environmental policy on hazardous cigarette waste. *International journal of environmental research and public health*, 6(5), pp.1691-1705.
- Ojedokun, O., 2011. Attitude towards littering as a mediator of the relationship between personalities attributes and responsible environmental behavior. *Waste management*, 31(12), pp.2601-2611.
- Ojedokun, O., 2015. The littering attitude scale (LAS) development and structural validation using data from an indigenous (Nigerian) sample. *Management of Environmental Quality: An International Journal*, 26(4), pp.552-565.
- Ong, I.B.L. and Sovacool, B.K., 2012. A comparative study of littering and waste in Singapore and Japan. *Resources, Conservation and Recycling*, 61, pp.35-42.
- Oosterhuis, F., Papyrakis, E. and Boteler, B., 2014. Economic instruments and marine litter control. *Ocean & coastal management*, 102, pp.47-54.
- Porges, S.W., 2003. Social engagement and attachment: a phylogenetic perspective. *Annals of the New York Academy of Sciences*, 1008(1), pp.31-47.
- Porter, M.E. and Linde, C.V.D., 1995. Toward a new conception of the environment-competitiveness relationship. *Journal of economic perspectives*, 9(4), pp.97-118.
- Provencher, J.F., Borrelle, S.B., Bond, A.L., Lavers, J.L., Van Franeker, J.A., Kühn, S., Hammer, S., Avery-Gomm, S. and Mallory, M.L., 2019. Recommended best practices for plastic and litter ingestion studies in marine birds: Collection, processing, and reporting. *Facets*, 4(1), pp.111-130.
- Raffoul, L.O.L.I.T.A., Mahon, R.O.B.I.N. and Goodridge, R., 2006. Roadside litter in Barbados: Sources and solutions. Centre for Resource Management and Environmental Studies (CERMES).
- Ray, A., 2008. Waste management in developing Asia: can trade and cooperation help? *The Journal of Environment & Development*, 17(1), pp.3-25.
- Ryan, P.G., Maclean, K. and Weideman, E.A., 2020. The impact of the COVID-19 lockdown on urban street litter in South Africa. *Environmental Processes*, 7(4), pp.1303-1312.
- Sahabuddin, M., Tan, Q., Hossain, I., Alam, M.S. and Nekmahmud, M., 2021. Tourist environmentally responsible behavior and satisfaction; Study on the world's longest natural sea beach, Cox's Bazar, Bangladesh. *Sustainability*, 13(16), p.9383.
- Salgado-Hernanz, P.M., Bauzà, J., Alomar, C., Compa, M., Romero, L. and Deudero, S., 2021. Assessment of marine litter through remote sensing: recent approaches and future goals. *Marine Pollution Bulletin*, 168, p.112347.
- Schultz, P.W., Bator, R.J., Large, L.B., Bruni, C.M. and Tabanico, J.J., 2013. Littering in context: Personal and environmental predictors of littering behavior. *Environment and Behavior*, 45(1), pp.35-59.
- Schuyler, Q., Hardesty, B.D., Lawson, T.J., Opie, K. and Wilcox, C., 2018. Economic incentives reduce plastic inputs to the ocean. *Marine Policy*, 96, pp.250-255.

- Sibley, C.G. and Liu, J.H., 2003. Differentiating active and passive littering: A two-stage process model of littering behavior in public spaces. *Environment and Behavior*, 35(3), pp.415-433.
- SIBLEYis, C.G., 2003. Differentiating Active And Passive Littering. *Environment And Behavior*, 35(1).
- Sikdar, P., Hamid, F., & Chowdhury, S. (2023). Does Dysfunctional Presenteeism Affect Academic Performance? Evidence from Undergraduate Students in Khulna Region. *Khulna University Studies*, 370-380.
- Singh, J. and Kaur, R., 2021. Influencing the Intention to adopt anti-littering behavior: An approach with modified TPB model. *Social Marketing Quarterly*, 27(2), pp.117-132.
- Singh, J. and Kaur, R., 2022. Factors influencing the attitude toward anti-littering behavior. *Journal of Applied Social Science*, 16(1), pp.88-106.
- Tesfaldet, Y.T., Ndeh, N.T., Budnard, J. and Treeson, P., 2022. Assessing face mask littering in urban environments and policy implications: The case of Bangkok. *Science of the Total Environment*, 806, p.150952.
- Vanapalli, K.R., Sharma, H.B., Anand, S., Ranjan, V.P., Singh, H., Dubey, B.K. and Mohanty, B., 2023. Cigarettes butt littering: The story of the world's most littered item from the perspective of pollution, remedial actions, and policy measures. *Journal of Hazardous Materials*, 453, p.131387.
- Veisi, H., Lacy, M., Mafakheri, S. and Razaghi, F., 2019. Assessing environmental literacy of university students: A case study of Shahid Beheshti University in Iran. *Applied Environmental Education & Communication*, 18(1), pp.25-42.
- Wagner, T.P. and Broaddus, N., 2016. The generation and cost of litter resulting from the curbside collection of recycling. *Waste Management*, 50, pp.3-9.
- Wang, Z., Nie, L., Jeronen, E., Xu, L. and Chen, M., 2023. Understanding the environmentally sustainable behavior of chinese university students as tourists: an integrative framework. *International Journal of Environmental Research and Public Health*, 20(4), p.3317.
- Wanjohi, P.N., 2016. An assessment of attitude and behaviour towards littering among the citizens of Nairobi City (Doctoral dissertation, University of Nairobi).
- Weber, B., Belnap, J., Büdel, B., Antoninka, A.J., Barger, N.N., Chaudhary, V.B., Darrouzet-Nardi, A., Eldridge, D.J., Faist, A.M., Ferrenberg, S. and Havrilla, C.A., 2022. What is a biocrust? A refined, contemporary definition for a broadening research community. *Biological Reviews*, 97(5), pp.1768-1785.
- Webler, T. and Jakubowski, K., 2022. Attitudes, beliefs, and behaviors about cigarette-butt littering among college-aged adults in the United States. *International Journal of Environmental Research and Public Health*, 19(13), p.8085.
- Zambezi, F.M., Muisa-Zikali, N. and Utete, B., 2021. Effectiveness of community participation as anti-litter monitors in solid waste management in metropolitan areas in a developing country. *Environment, Development and Sustainability*, 23, pp.747-764.
- Zhou, Z., Zhang, Z., Zha, T., Luo, Z., Zheng, J. and Sun, O.J., 2013. Predicting soil respiration using carbon stock in roots, litter and soil organic matter in forests of Loess Plateau in China. *Soil Biology and Biochemistry*, 57, pp.135-143.
- Zolotova, N., Kosyreva, A., Dzhalilova, D., Fokichev, N. and Makarova, O., 2022. Harmful effects of the microplastic pollution on animal health: a literature review. *PeerJ*, 10, p.e13503.