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Research Paper

Assessing littering-centric environmental literacy of university graduates in Bangladesh

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ABSTRACT

To create a sustainable society, this study aims to assess the littering centric environmental literacy and impact of socio-demographic variables on environmental literacy among university graduates in Bangladesh. By using multistage sampling technique, we collect 209 responses from bachelor and master level students from different higher educational institutions from Khulna city. Descriptive statistics, ANOVA and weighted mean index has been used to trace out the research objective. This study finds that students have a moderate level of environment literacy (3.67 in a scale of 5.00). Students have a higher score on environmental knowledge (3.77 in a scale of 5.00) and a lower score on environmental attitude and concern (3.62). Noticeable, students have the most positive attitude in the affective tendency but least positive attitude in the cognitive tendency. It also finds that students are aware about the environmental issues but did not perform that responsibility in their daily life. ANOVA analysis reports that parental education and income has a significant impact on environmental literacy and its components. Alternatively, number of highly educated member in family and hometown status has significant impact on knowledge, attitude and environmental literacy. This finding helps stakeholders to understand the students' literacy about a pro-environmental issue.

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1. INTRODUCTION

Environmental pollution, a pressing global issue, poses significant threats to ecosystems, public health, and overall sustainability. Littering, a widespread environmental problem, refers to the improper disposal of waste in public areas, contributing to environmental harm, health hazards, and visual pollution (McBride et al., 2013). This behavior typically involves the intentional or careless discarding of items such as plastic, paper, or food packaging, which leads to environmental pollution, harms wildlife, and degrades the aesthetic value of public areas [1].

Ensuring sustainable cities and communities (SDG-11) is one of the key focus of UNs Sustainable Development Goals. It is high time to improve littering behavior of citizens and vindicate deft waste management system to achieve this goal [2]. Along with degrading public areas' aesthetic appeal, littering poses serious risks to the environment, economy, and public health [1]. It impedes water movement, clogs drainage systems, and causes street flooding [3]. Moreover, 8 million tons of plastic debris entering the ocean annually, which creates long-term environmental problems, disrupts marine ecosystems, and kills species [4].

To protect environment, researchers advised about environmental education as a means of reforming people's attitudes and behaviors. Environmental literacy, defined as the capacity to understand environmental issues, engage in problem-solving, and adopt sustainable practices, is increasingly recognized as a crucial tool in combating pollution (Hazel et al., 2023). It increases the likelihood that people will understand the origins and effects of pollution and take action to lessen its effects [1]. Besides, through encouraging critical thinking, awareness, and responsible action, environmental literacy encourages people and communities to take proactive measures to reduce pollution by minimizing waste generation and supporting cleaner energy practices.

Bangladesh is confronted with a significant challenge in tackling environmental degradation and littering, which is increasingly concerning for citizens and policymakers' alike. Every citizen should come forward to combat environmental degradation, but the behavior of educated citizens like university graduates is more significant in this regard. Addressing the gap between environmental awareness and actual littering behavior can provide insights into how environmental education and literacy programs could be improved to promote better environmental stewardship. Thus, this study focuses on evaluating the littering centric environmental literacy of university graduates in Bangladesh, and examines the influence of socio-demographic factors on their environmental literacy.

2. RELATED WORK

In order to reduce littering and promote environmental responsibility, educational initiatives and awareness campaigns must take into account for university graduates [5]. According [6], a number of studies have highlighted the need for educated people, especially those who have graduated from university, to embrace sustainable practices including efficient trash disposal and become more aware of their impact on the environment. Research on the behavior of littering indicates that a range of factors influence waste disposal habits: demographics, personality factors, cognitive factors, and external factors [5].

But when it comes to add knowledge about littering behavior into practice, there are still gaps in understanding notwithstanding educational attainment [7]. There has been much discussion on the topics of environmental education and promoting environmental principles in higher education [5]. Numerous research investigations have been undertaken to assess the degree of environmental literacy within different universities worldwide. For instance, [8] examined the exercise of an "environmental literacy requirement" within the university setting.

Bangladesh a developing country in South-Asia, where waste management infrastructure is often inadequate. [9] Report that daily 23,688 tons waste are generated by urban areas. The main sources of municipal waste, according to Ahmed and Huq-Hussain [10], are residential areas (52.1%), commercial areas (21.9%), and industrial locations (18.2%).

3. MATERIALS AND METHODS

3.1 Study Area and Sampling Strategy

Mainly, this study purposively selects 4 institutions from Khulna city in Bangladesh. Two public universities, one private universities and colleges under national universities are chosen as a study area. Approximately 50,000 students engaged in these institutions with multidisciplinary combination.

This study follows multistage sampling strategy to collect responses. Firstly, four educational institutions purposively choose as a study area. By using random sampling technique, we choose three departments/ disciplines from each institution. Further, we use systematic random sampling and provide 320 questionnaires among the bachelor and masters level students in the selected departments. Among 320 questionnaires, we get response from 209 students which comprises 65% of the total responses.

3.2 Variable Measurement and Methods

This study focuses on the four key major components of environmental literacy used by Veisi et al. 2019; Varsili, 2009. First, we construct an interview schedule where all aspects are addressed properly. This includes for major components: environmental knowledge (9 items), environmental attitude (9 items), sensitivity to the environment (8 items) and environmental concern (6 items). The items are presented in Table 1, Table 2, Table 3, Table 4. It also includes several socio-demographic variables like age (years), fathers' education (years of schooling), mother's education (years of schooling), father's income (BDT/Month), number of highly educated member in family and hometown status. The initial version was developed by consulting faculties of environmental science discipline, economics disciplines and other studies related to environmental education. The questionnaire included multiple-choice questions to ask about many aspects of environmental literacy, such as knowledge, attitude, concern and sensitivity. For each category, a Likert-type scale is used, allowing participants to provide their opinions on a range of 1 (strongly disagree) to 5 (strongly agree). Finally, Cronbach's alpha test is performed to check the statistical reliability of the index.

3.3 Analytical Strategy

The responses from the survey were organized into an Excel worksheet and coded based on the Likert-type scale by using different sections related to knowledge, attitude, sensitivity, and concern. Once coded, the data were imported into STATA 13.0 to conduct statistical analysis. Then, compound scores were calculated for each section and for the entire survey. Basically, summary statistics and weighted mean index are used to measure the mean value of each component of environmental literacy. ANOVA analysis has been used to assess differences in environmental literacy among students based on age, parent educational level, parental income and others. Pearson's correlations were also calculated to check for multicollinearity among the environmental literacy variables.

4. RESULTS AND DISCUSSION

4.1 Descriptive Characteristics

The sample of 209 students included a diverse range of academic majors. Approximately 60% of the surveyed students are male and the mean age of the students is 21.91 with standard deviation 2.03. Nearly about 72% of the students comes from nuclear family and 37% of the students comes from rural area. This survey comprises 37% social science students, 38% business & pure science students and 25% engineering students.

4.2 Students' Environmental Knowledge

We focus on students' environmental knowledge about littering by using 9 components following [5]. It mainly comprises environmental knowledge about littering that included local issues like littering

effect on soil, water, air, animal and ecological issues like carbon di-oxide emission, ecosystem balance & chain reactions.

The summary statistics (Table 1) provided the results of a survey measuring the mean value of environmental knowledge across nine different dimensions among a sample of 209 individuals.

The mean value of Environmental Knowledge across all dimensions is 3.77, which suggests that, on average, the respondents have a relatively high level of environmental knowledge. The standard deviation is relatively low, ranging from 1.10 to 1.24 across the different dimensions, indicating that there is relatively little variability in the scores. Among the individual dimensions of environmental knowledge, EK9 has the highest mean score of 3.94, indicating that respondents have the highest level of knowledge in the local level effect of littering. On the other hand, EK1 has the lowest mean score of 3.60, indicating that respondents have the lowest level of knowledge in the ecological issues. The other dimensions (EK2-EK8) fall within the range of 3.61 to 3.85, suggesting moderate levels of environmental knowledge.

In conclusion, the summary statistics suggest that, on average, the respondents have a relatively high level of environmental knowledge, as indicated by the mean value of 3.77. However, there are some differences in knowledge levels across the local impact and ecological issues. The Cronbach's alpha value is 0.89 which indicates an excellent reliability among the components.

This result aligns with previous studies suggesting that individuals, particularly in more educated populations, are increasingly aware of environmental issues [1]. High environmental knowledge is often associated with improved understanding of key ecological concepts, such as waste management, pollution, and sustainability (McBride et al., 2013).

Table 1. Environmental Knowledge

Code	Statements	Mean	Stdev.
EK1	Improper burning of litter releases carbon dioxide gas, contributing to the greenhouse effect.	3.60	1.26
EK2	Litter items like plastic bags, bottles, and cigarette butts can take hundreds of years to decompose in the environment.	3.73	1.20
EK3	Litter can release harmful chemicals (e.g., heavy metals) affecting wildlife animals.	3.90	1.24
EK4	Litter can create breeding grounds for pests and insects, increasing the risk of diseases.	3.85	1.13
EK5	Domestic discharge of waste in an improper place is a significant source of environmental pollution.	3.77	1.10
EK6	Litter can disrupt the delicate balance of ecosystems by contaminating soil and water.	3.74	1.17
EK7	Littering can cause chain reactions, leading to far-reaching consequences for species' survival.	3.61	1.10
EK8	Litter damage aquatic habitats and makes them unsafe for human consumption.	3.79	1.12
EK9	Litter can contaminate the soil, affecting the growth of plants and crops.	3.94	1.24
Mean value of Environmental Knowledge	3.77		
Cronbach's Alpha Value	0.89		

4.3 Students' Environmental Attitude

Environmental attitude includes three broader dimensions like cognitive tendency (thoughts and ideas about environment), affective tendency (positive or negative feelings towards environment), behavioral tendency (action towards environment) or a combination of any of these psychological tendencies. Table 2 represents the mean value of environmental attitude across nine different dimensions (EA1-EA9) among a sample of 209 individuals.

The mean value of environmental attitude across all dimensions is 3.62, which suggests that, on average, the respondents have a moderately positive attitude towards the environment. The standard deviation ranges from 1.10 to 1.39 across the different dimensions, indicating that there is some variability in the scores . In addition, the Cronbach's alpha value of 0.87 indicates a high level of internal consistency among the dimensions of environmental attitude.

Among the individual dimensions of environmental attitude, EA9 has the highest mean score of 3.95, indicating that respondents have the most positive attitude in the affective tendency. On the other hand, EA7 has the lowest mean score of 3.39, suggesting that respondents have the least positive attitude in the cognitive tendency. The other dimensions (EA1-EA6, EA8) fall within the range of 3.48 to 3.79, suggesting moderate levels of environmental attitude. The results align with previous research that emphasizes the robust positive affective tendency and suggests that emotional engagement significantly influences the environmental attitudes of people. Environmentally conscious people are more likely to accept personal responsibility for their activities and adopt environmentally friendly practices [11].

Table 2. Environmental Attitude

Code	Statements	Mean	Stdev.
EA1	I think human has a responsibility to preserve natural resources for future generations.	3.94	1.20
EA2	I try to reduce my environmental impact by reducing waste.	3.66	1.10
EA3	I support laws and regulations that protect the environment.	3.76	1.22
EA4	I feel positive when I take any steps that might protect the environment.	3.79	1.20
EA5	I try to buy products which generally environment friendly.	3.66	1.29
EA6	I feel that climate change is a serious problem and that urgent action is needed to address it.	3.48	1.39
EA7	I feel that it is important to educate others about the importance of environmental conservation.	3.39	1.35
EA8	I am willing to take action to protect the environment, such as participating in environmental activism or volunteer work.	3.35	1.29
EA9	I feel guilty when I engage in activities that harm the environment.	3.95	1.20
Mean value of Environmental Knowledge	3.62		
Cronbach's Alpha Value	0.87		

4.4 Students' Sensitivity to the Environment

The sensitivity to the students includes 8 different components focusing students' awareness and responsiveness to the natural world. The summary statistics in Table 3 measure the mean value of sensitivity to the environment across eight different dimensions among a sample of 209 individuals.

The mean value of sensitivity to the environment across all dimensions is 3.67, which suggests that, on average, the respondents have a moderate level of sensitivity towards the environment. The standard deviation ranges from 1.08 to 1.30 across the different dimensions, indicating that there is some variability in the scores .

Among the individual dimensions of sensitivity to the environment, SE4 has the highest mean score of 3.79, indicating that respondents have the highest level of sensitivity in the environmental issues. On the other hand, SE1 has the lowest mean score of 3.36, suggesting that respondents have the least sensitivity in individual responsiveness. The other dimensions [2], [5], [7], [8], [12], [13] fall within the range of 3.55 to 3.73, suggesting moderate levels of sensitivity to the environment. It indicates that students are aware about the environmental issues but did not perform that responsibility in their daily life. However, the Cronbach's alpha value of 0.82 indicates a reasonably high level of internal consistency among the dimensions of sensitivity to the environment. Supporting previous studies findings, this study also suggests that environmental sensitivity is essential for fostering environmental awareness and pro-environmental actions [13].

Table 3. Sensitivity to the Environment

Code	Statements	Mean	Stdev.
SE1	I perform my everyday business activities in an environmentally friendly manner.	3.36	1.30
SE2	I feel that everyone should be aware of environmental problems.	3.72	1.22
SE3	I perceive myself as a sensitive person about waste management.	3.73	1.28
SE4	I pay attention when I hear about environmental issues.	3.67	1.22
SE5	I feel personally responsible for helping to solve environmental problems.	3.77	1.25
SE6	I think people should be held responsible for any damages they cause to the environment.	3.79	1.14
SE7	I perceive myself as very concerned about environmental issues in my community.	3.76	1.08
SE8	I seek out information about environmental issues.	3.55	1.16
Mean value of Environmental Knowledge	3.67		
Cronbach's Alpha Value	0.82		

4.5 Students Environmental Concern

Students' environmental concern focuses emotional connection to nature and a sense of responsibility to take care of the planet. It includes 6 different statements denoted as (EC1-EC6) among a sample of 209 individuals where higher scores indicating higher levels of concern towards the environment. The mean value of environmental concern across all dimensions is 3.62, which suggests that, on average, the respondents have a moderate level of concern towards the environment. The standard deviation ranges from 1.13 to 1.20 across the different dimensions, indicating that there is some variability

in the scores. The Cronbach's alpha value of 0.74 indicates a moderate level of internal consistency among the dimensions of environmental concern.

Table 4. Sensitivity to the Environment

Code	Statements	Mean	Stdev.
EC1	I try to properly dispose of plastic products to reduce environmental impact.	3.45	1.19
EC2	I try to reduce such pollution which relates to global warming.	3.65	1.13
EC3	I try to reuse the waste as much as possible.	3.73	1.19
EC4	I try to use reusable bags in my daily life.	3.60	1.18
EC5	I make an effort to reduce my carbon footprint by using public transportation or walking whenever possible.	3.70	1.20
EC6	I try to participate in community clean-up efforts for environmental causes.	3.60	1.19
Mean value of Environmental Knowledge	3.62		
Cronbach's Alpha Value	0.74		

Table 5 analyze the correlation among different components of environmental literacy. The analysis reports that environmental attitude has the strongest correlation (r=0.809) with the environmental knowledge. It supports the previous findings [5]. The weakest correlation exists between environmental attitude and environmental concern of (r=0.675) the students about littering. All the components of environmental literacy are statistically significant at one percent significance level.

Table 5. Pairwise Correlations among Components of Environmental Literacy

Variables	EK	EA	SE	EC
Ek	1.000			
EA	0.809***	1.000		
SE	0.775***	0.741***	1.000	
EC	0.746***	0.675***	0.743***	1.000
*** p<0.01				

4.6 Factors Affecting Environmental Literacy

Table 6 represent factors that affect the different component of environmental literacy. Multivariate analysis of variance is used to find out the factors. The dependent variable is the four components of environmental literacy and the composite measure of the four variables named environmental literacy. Predictors' variables include age, fathers' education, mothers' education, fathers' income, number of highly educated family member and hometown status. This study finds that parental education and income has a significant impact on environmental literacy and its components. Alternatively, number of highly educated member in family and hometown status has significant impact on knowledge, attitude and environmental literacy.

Table 6. Impact of Different Variables on Components of Environmental Literacy

Variable Name	Knowledge		Attitude		Sensitivity		Concern		Environmental Literacy	
	Test	Sig.	Test	Sig.	Test	Sig.	Test	Sig.	Test	Sig.
Age	F=0.88	0.45	1.16	0.32	1.86	0.13	1.14	0.33	1.30	0.27
Fathers Education	F=14.66	0.00	15.16	0.00	16.38	0.00	12.28	0.00	18.75	0.00
Mothers Education	F=14.30	0.00	16.81	0.00	14.43	0.00	14.98	0.00	19.45	0.00
Fathers Income	F=26.58	0.00	39.79	0.00	33.40	0.00	25.10	0.00	42.27	0.00
No. of Highly Educated Member in Family	F=2.82	0.02	3.01	0.01	0.68	0.61	1.09	0.36	2.26	0.06
Hometown Status	F=3.46	0.03	2.86	0.05	1.95	0.14	1.46	0.23	2.91	0.05

Environmental information and values that parents can instill in their children is frequently linked to higher levels of parental education [12]. Higher educated parents are more likely to emphasize environmental education, support eco-friendly practices, and have conversations with their kids about sustainability [14]. Families with higher incomes might have easier access to materials that promote environmental knowledge and awareness, like books, outdoor activities, and educational programs (Aini et al., 2002). Furthermore, wealthier families might be more likely to live in communities with improved access to green spaces and environmental programs that place a strong emphasis on sustainability [15]. Besides, having several family members with advanced degrees positively impacted environmental literacy. Family members with more education are more likely to act as role models, setting an example of environmentally conscious conduct and encouraging an eco-aware culture in the home. Lastly, a person's hometown status also has a big influence on their level of environmental literacy. Urban dwellers can have a better grasp of environmental issues since they are frequently exposed to more environmental education programs, awareness campaigns, and green initiatives [16]. Conversely, those living in rural areas could have more direct experiences with nature, which might promote a particular sort of environmental literacy based on firsthand knowledge of natural resources and ecosystems [17].

5. CONCLUSION

This study aimed to assess the environmental literacy regarding the littering behavior of university graduates in Bangladesh. By considering the participants' knowledge, attitudes, sensitivity, and concern, the findings offer important insights into how prepared they are to handle environmental challenges and support sustainable development. With empirical evidence on the environmental literacy of Bangladeshi university graduates, this study adds insights for advancing sustainable development in Bangladesh. The results of this study imply that we may raise a generation of environmentally conscious people who actively work to preserve and defend our world by imparting environmental knowledge, positive attitudes, sensitivity, and concern. Socioeconomic factors play a key effect in molding people's knowledge of the environment. The study also found that parents' income and level of education had a substantial impact on environmental literacy and its components.

The results emphasize how crucial it is for higher education institutions to implement environmental education and awareness programs in order to improve students' environmental knowledge, attitudes, sensitivity, and concern. These findings can be used by stakeholders, educators, and policymakers to create educational programs and initiatives that will increase environmental literacy and support sustainable development practices. It is necessary to do more research to examine other variables that can affect environmental literacy and its constituent parts among Bangladeshi university graduates. Longitudinal studies can provide a deeper understanding of the dynamics and changes in environmental literacy throughout time.

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Author Contribution Statement

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Pranto Paul		✓			✓		✓			✓				

C : **C**onceptualization
M : **M**ethodology
So : **So**ftware
Va : **Va**lidation
Fo : **Fo**rmal analysis
I : **I**nvestigation
R : **R**esources
D : **D**ata Curation
O : Writing - **O**riginal Draft
E : Writing - Review & **E**diting
Vi : **Vi**sualization
Su : **Su**pervision
P : **P**roject administration
Fu : **Fu**nding acquisition

Conflict of Interest Statement

No conflict of interest.

Informed Consent

Not Applicable.

Ethical Approval

Not Applicable.

Data Availability

The data that support the findings of this study are available from the corresponding author on reasonable request.

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