Paper Title: Study on Knowledge and Awareness of Recycling Activities among Public and Private University Students of Dhaka

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Study on Knowledge and Awareness of Recycling Activities among Public and Private University Students of Dhaka

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Abstract: ***This study investigates the knowledge and awareness of recycling activities among students attending both public and private universities in Dhaka, Bangladesh. The research aims to assess the level of understanding regarding recycling practices, as well as the extent of engagement and awareness among university students, who represent a significant segment of the population. A mixed-methods approach incorporating surveys and interviews was employed to gather data from a diverse sample of students. Statistical analysis techniques, including descriptive statistics, correlation analysis, and chi-square test were applied to examine the relationship between various demographic factors and recycling knowledge and behaviour. Preliminary findings suggest significant variations in recycling awareness and engagement between students from public and private universities, with potential socioeconomic and educational influences at play. The study underscores the importance of targeted interventions to enhance recycling education and promote sustainable practices among university students in Dhaka, contributing to broader efforts aimed at environmental conservation and waste management in urban settings.***

Survey and Questionnaire: ***The University students of Dhaka were involved as stakeholders in this survey. We selected Jagannath University and Dhaka University as a group of public universities. We selected Bangladesh University and University of Liberal Arts Bangladesh as a group of private universities. We were inspired by a research paper to choose our questionnaire, which was titled- "*** **A Study of High School Students Awareness towards Recycling Activity and Its Relationship with their Attitude and Behaviors related to Recycling Practices. Recent Trends in Civil Engineering and Built Environment. 2022** ***" [4]. Twenty Two questions made up the survey, which probed respondents' views on recycling knowledge, recycling attitudes, and recycling behaviour.***

Keywords— Recycling Awareness, University Students, Recycle, Recycle Materials, Sustainability, Data Analysis, Public and Private, Socioeconomic, Survey, Literature Review.

I. INTRODUCTION

The awareness and practice of recycling activities among public and private university students in Dhaka, Bangladesh, have become increasingly critical with the growing urbanization in the region. Dhaka, being the epicenter of rapid urban growth, faces numerous challenges, one of which is the management of waste and promotion of sustainable practices. As urban areas expand, so does the volume of waste generated, putting immense pressure on existing waste management systems. The lack of awareness and knowledge about recycling exacerbates this issue. Despite efforts to improve waste management infrastructure, including recycling facilities, there remains a significant gap in understanding and participation in recycling activities among the youth population, particularly university students. This is concerning as they represent a significant demographic with the potential to drive change and influence sustainable practices within their communities. The study aims to delve into the knowledge and awareness levels of recycling activities among university students in Dhaka. Specifically, it focuses on understanding their perceptions, attitudes, and behaviors towards recycling, as well as identifying any barriers or challenges that may hinder their engagement in recycling initiatives. By assessing the knowledge and awareness gaps, the study seeks to develop targeted strategies to promote and enhance recycling practices among the youth population.

II. OBJECTIVE

The paper aims to assess recycling knowledge and awareness among public and private university students in Dhaka, Bangladesh. Through a mixed-methods approach, it seeks to understand the extent of engagement and demographic influences on recycling behavior. Statistical analyses will examine variations between public and private university students, highlighting socioeconomic and educational factors. Ultimately, the study aims to inform targeted interventions for enhancing recycling education and promoting sustainable practices among university students in Dhaka, contributing to urban waste management efforts.

III. Literature Review:

The literature review highlights various studies investigating students' knowledge, attitudes, and behaviours towards recycling and waste management practices across different educational levels and regions. Findings indicate a generally high level of awareness and positive attitudes towards recycling among students, but moderate to low levels of actual participation in recycling activities. Factors such as environmental concern, motivation, place attachment, and subjective norms have been identified as significant predictors of recycling behaviour. Educational interventions, including informational campaigns and educational games, have shown promise in increasing students' awareness and understanding of waste management practices. However, there remains a need for ongoing efforts to bridge the gap between knowledge and behaviour and to encourage greater engagement in recycling activities among students to address environmental challenges effectively.

Abdullah et al. (2023) explored the knowledge and practice of the 'No Plastic Bag Campaign' among undergraduate students at Universiti Putra Malaysia (UPM), finding high awareness but moderate practice levels.

Dixon and Parker (2022) highlighted potential sustainability gaps among university students, with lower recycling rates compared to households, indicating a need for further investigation into students' attitudes and behaviors towards recycling.

Chao et al. (2023) developed a model to predict factors influencing student recycling behavior, emphasizing the significant relationships between environmental concern, motivation, interpersonal altruism, and place attachment in shaping recycling behavior among college students.

Asri and Daud (2022) assessed high school students' awareness, attitude, and behavior towards recycling, revealing a high level of awareness but lower participation rates in recycling activities, suggesting a need for interventions to boost recycling behaviors among students.

Wardhana (2022) examined the impact of environmental awareness on university students' sustainable consumption and recycling behaviors, indicating a positive correlation between environmental consciousness and active participation in recycling activities.

Studies by Wu et al. (2022) and Demir & Öteleş (2023) further explored the factors influencing recycling behaviors among students, including environmental knowledge, personal norms, and social expectations, highlighting the importance of these factors in promoting recycling engagement.

Mohamad Yusof et al. (2023) and Nawawi et al. (2022) investigated factors influencing recycling intentions and practices among university students, identifying subjective norms and awareness as significant predictors of recycling behavior.

Additionally, Taghdisi et al. (2022) and Altunbey and Çelikler (2023) evaluated the effectiveness of educational interventions, such as the Health Promoting Schools model and educational games, in enhancing students' recycling awareness and participation.

Harman and Yenikalayci (2022) emphasized the role of education and awareness campaigns in fostering sustainable waste management practices among students, highlighting the need to bridge the gap between recycling knowledge and active participation.

Finally, Şeker (2024) and Erguvan (2024) assessed students' knowledge levels and attitudes towards recycling, providing insights into the potential engagement and positive outlook for future recycling efforts among students.

Conclusion from reviewed literature:

Overall, studies show that while many students have knowledge about recycling and environmental issues, their actual recycling practices are often moderate. Efforts to boost engagement and awareness, especially through educational interventions and campaigns, are crucial for fostering sustainable waste management practices among students.

IV. METHODOLOGIES

A. Survey Design

B. A combination of purposive and stratified sampling was employed to collect data on the recycling knowledge and awareness among public and private university students in Dhaka, Bangladesh. The research utilised in-person interviews conducted within the general population.

A.1 In-Person Survey

The in-person survey component of the study was designed to gather firsthand insights from university students in Dhaka regarding their knowledge, attitudes, and behaviours towards recycling activities. A structured questionnaire was administered to participants in various locations within university campuses, ensuring a diverse representation of students from both public and private institutions.

C. Data Collection

In-Person Interview Responses

- N number of individuals participated in in-person interviews, contributing qualitative data that complemented the quantitative findings from the offline survey.

A. Data Analysis

C.1 Descriptive Statistics

Descriptive Statistics were calculated to summarise and analyse the central tendency and variability of responses. Mainly, we worked with the Nominal values, as most of the question answers were related to recycling behaviour, such as gender, age, awareness of recycling, behaviours related to recycling, and participation in recycling activities, among others.

- Mean ($\bar{X}$): $\bar{X} = \frac{\sum_{i=1}^{N} Xi}{N}$
- Mode = most frequently occurring value
- Standard Deviation (SD):

$$SD = \sqrt{\frac{\sum_{i=1}^{N} (Xi - \bar{X})^2}{N}}$$

- Variance (Var):

$$Var = \frac{\sum_{i=1}^{N} (Xi - \bar{X})^2}{N}$$

C.2 Chi-Square Test

The chi-square test will be employed to investigate associations between different categorical variables, such as the relationship between such as the relationship between knowledge of recycling material and awareness of recycling also Familiarity with Recycling benefits and awareness of recycling.

D. Ethical Considerations

Ethical guidelines were strictly maintained throughout the research process. Informed consent was obtained from all participants, ensuring confidentiality and anonymity.

E. Limitations

Recognizing the limitations of this study, potential biases may exist due to the self-reported nature of survey responses and the geographical focus on Dhaka. Moreover, for some confidential and personal issues, we couldn't collect a large amount of data.

V. DATA ANALYSIS

To complete this project, we conducted a survey on the knowledge and awareness of recycling activities among Public and Private University students of Dhaka. We got about 100 respondents in our survey where 51% were female and 49% were male.

Male	Female
49%	51%

Table1: Our Respondents Variance

Most of the respondents' are in the range of 20-22 years. Here is the data:

Mean Age	21.79
Mode Age	21
Standard Deviation	1.782604
Variance	3.177677
Range	15

Table2: Mean, Mode and Standard Deviance

In this survey, we had about 22 questions for the respondents and all the questions helped us to analyse the knowledge and awareness of recycling activities among Public and Private University students of Dhaka.We calculated the standard deviation, variance, mean, and mode value of some particular data from our respondents.

F. Descriptive Statistics:

In our survey, we collected the samples directly from the students. Most of the samples have nominal data. And this categorical data is analysed in different ways. There were opinion based answers, age groups, time limits, rankings, etc. Firstly we tried to know about the interest of recycling among students. We got the below data:

Interested in Recycling			
Interested	Very Interested	Neutral	Not Interested
50	32	17	1

Table3: Interested in Recycling

Here, the mode categorical value is "Interested". Most of the students in all 4 universities never participated (62%) in recycling activities and they did not volunteer in recycling activities as most of the participants say that they did not participate (76%) in any volunteer activities. Also most of the students do not know about recycling materials (58%) and are not aware of promoting recycling (63%).But we found these interesting and informative samples from the questions. We got the below data:

Question	Yes	No
Awareness in Recycling	82%	18%
Familiar with recycling benefits	85%	15%
Understand about impact of improper waste disposal	89%	11%
Recycling waste positively affects the environment	89%	11%
Feeling satisfied after recycling	90%	10%
Open to learn more about recycling benefits	92%	8%
Use recycle bins	78%	22%
Follow social media pages	50%	50%
Faced ads, articles	64%	36%

promoting recycling		
Discussed recycling practices with peers	54%	46%
Encouraged by friends to recycle more	60%	40%

Table 4: Informative data

Question	Always	Sometimes	Never
Reusing items	22%	5%	73%

Tab. 5. Reusing Items

Most of the students are really concerned about recycling. But, still we tried to know what factors are resisting students from actively participating in recycling. We have the below problems, that the students are struggling.

- Not enough participation in recycling activities
- Insufficient volunteering activities for recycling
- Insufficient knowledge about recycling materials

These are the main problems students face in recycling. We did a chi-square test to check if knowledge about recycling materials is relevant to awareness of recycling. The results are shown below-

The Chi-Square Test: 10.214
Degree of Freedom: 1
P- value: 0.001394

Tab. 6. The Chi-Square Test

We did a chi-square test to check if knowledge about recycling materials is relevant to familiarity with recycling benefits. The results are shown below-

The Chi-Square Test: 7.14181
Degree of Freedom: 1
P- value: 0.006457

Since the p-values are (0.001394) and (0.006457) is less than the significance level (typically 0.05), we reject the null hypothesis. In other words, the awareness of recycling and familiarity with recycling benefits are associated with the knowledge of recycling material in the dataset. The variables are not independent of each other.

<u>In the context of a chi-squared test of independence:</u>

The variable Known(Recycling material) and Familiarity(Recycling material) are considered as the independent variable. And the variable Awareness(Recycling) is considered as the dependent variable. This indicates that there is a statistically significant association between the variables Known(Recycling material),Familiarity(Recyclingmaterial)andAwareness(Recycling). So students need proper knowledge of recycling materials and must be familiar with recycling benefits then they will be fully aware of recycling. Without knowing about recycling materials and its benefits it is not possible to be fully aware. We also asked them if they consider recycling as a responsible behaviour. And most of the students agree with that.

Question	Yes	No
Recycling is a responsible behaviour	97%	3%

Tab.7. Consider recycling as a responsible behaviour

G. Data Visualization:

According to our data collection, different ages of students filled out the survey form. There were both male and female in our respondents. The data of male and female, and the age variance is shown below.

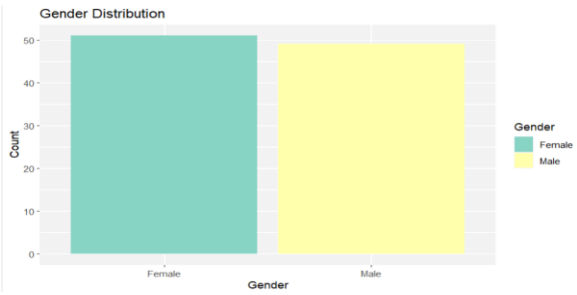


Figure 2: Gender of Respondents

In our respondents, the number of people from the age of 20-22 was maximum. We collected data from four Universities - Dhaka University, Jagannath University, ULAB and Bangladesh University. Two of them were Public and Two of them were Private.

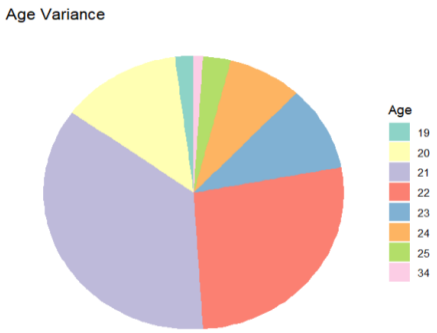


Figure 3: Age Variance

We collected data from four Universities - Dhaka University, Jagannath University, ULAB and Bangladesh University. Two of them were Public and two of them were Private. The data of the Universities are shown below.

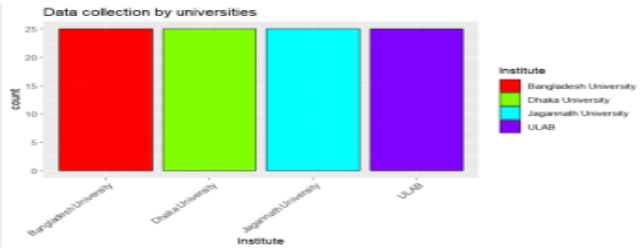


Figure 4: University Names

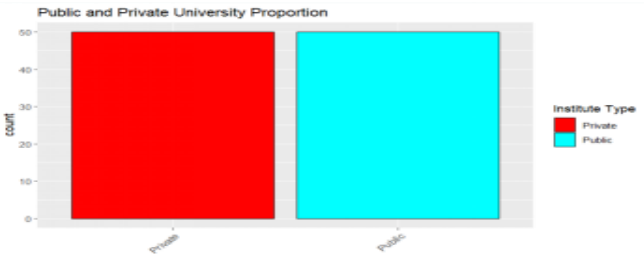
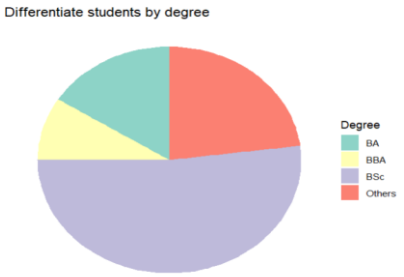


Figure 5: University Type

We collected equal data from each public and private university. Most of the students were doing honours in Bachelor of Science (BSc).**Below is Figure 6:**



As mentioned above, we first tried to know about the interest level of recycling among the students, which can be seen in the graph below.

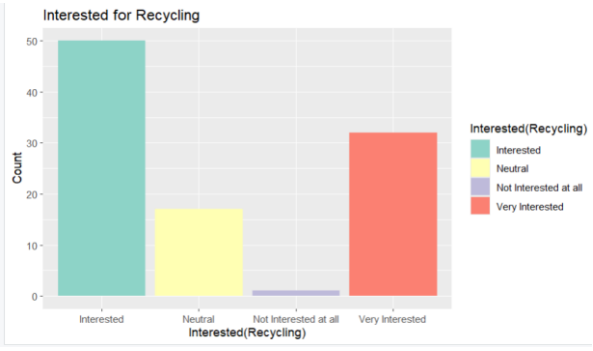


Figure 7: Recycling Interest Level

The respondents said that most of them are interested in recycling. Determining their data in Figure 7, we come to a point that, on average, students are interested in recycling. Here, the mode value is 50.

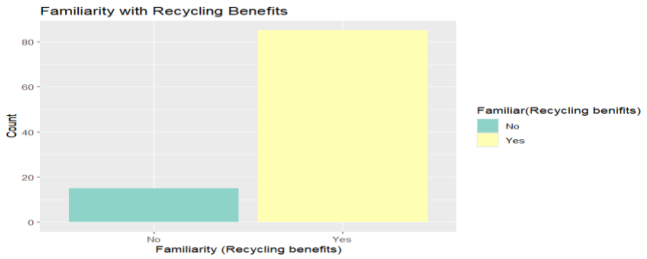


Figure 8: Familiarities with recycling benefits.

According to **Figure 8**, 82% of students are familiar with the environmental benefits of recycling.

According to **Figure 9**, almost 89% of students understand the impact of improper waste disposal.

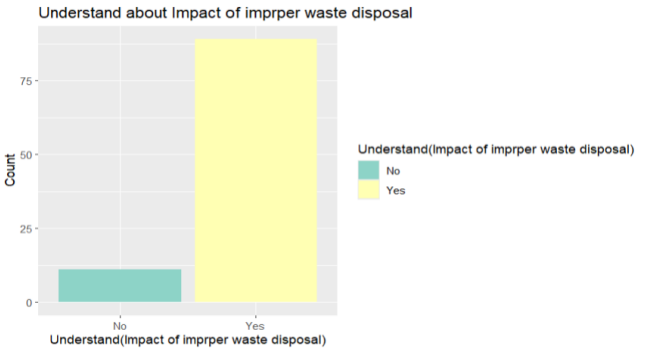


Figure 9: Understand(Impact of improper waste disposal)

According to **Figure 10**, 89% of students think recycling waste has a positive effect on the environment.

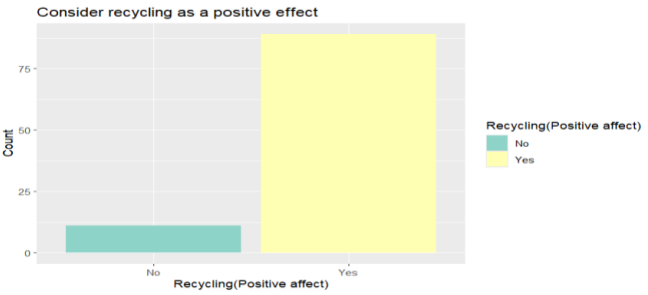


Figure 10: Positive effect of recycling waste

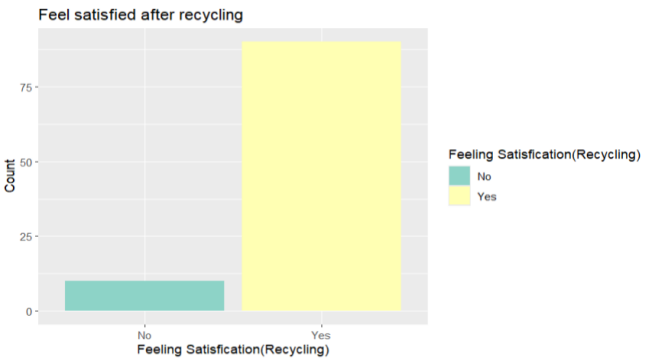


Figure 11: Feeling Satisfaction after Recycling

According to **Figure 11**, 90% of the students feel satisfied after recycling. This shows that recycling has a positive effect on the students' minds.

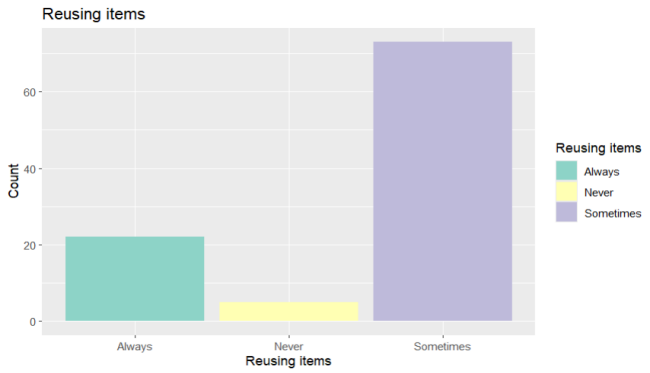
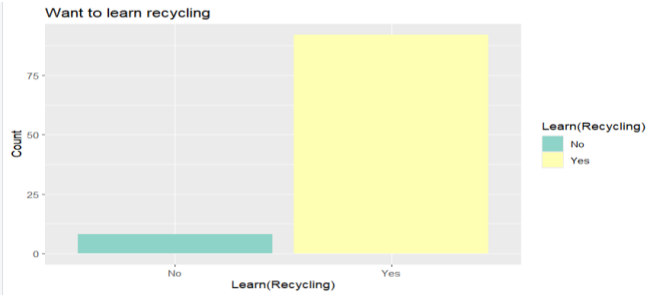


Figure 12: Reusing items

According to **Figure 12** most of the students reuse items often. But the proportion of never reusing items is very low which is pretty satisfactory. Below is **Figure 13**



According to **Figure 13**, 92% of the students want to learn more about the benefits recycling has on the environment.

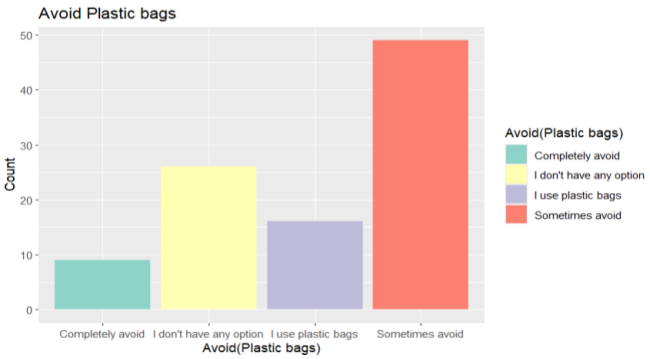


Figure 14: Avoid plastic bag

According to **Figure 14,** most of the students often avoid using plastic bags. But the portion of students that completely avoid using plastic bags is very low.

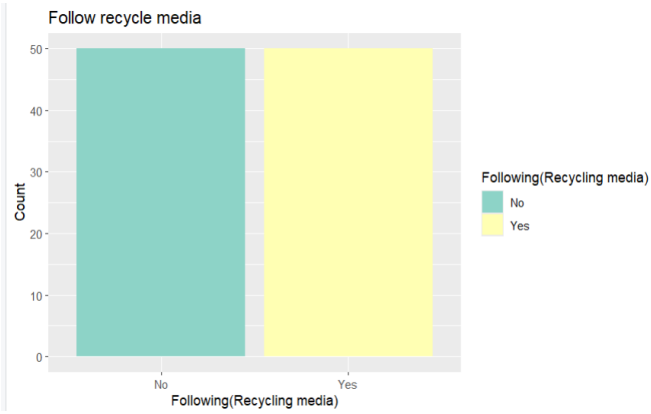


Figure 15: Follow social media that shares info about recycling

According to **Figure 15,** 50% of the students follow recycling media while the other 50% do not.

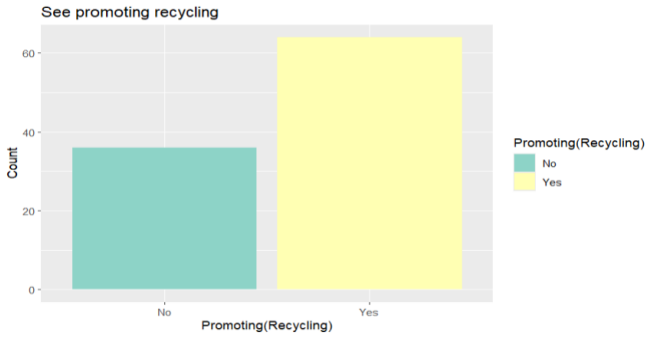


Figure 16: Promoting (Recycling)

According to **Figure 16,** 64% of the students have seen recycling being promoted on news articles and advertisements.

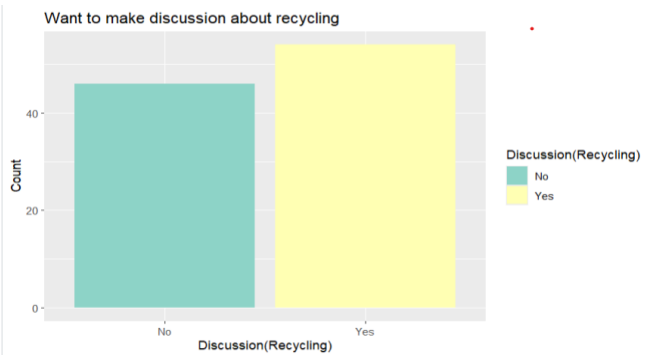


Figure 17: Discussion of Recycling among Peers

According to **Figure 17,** 54% of the students have discussed recycling with their friends or classmates.

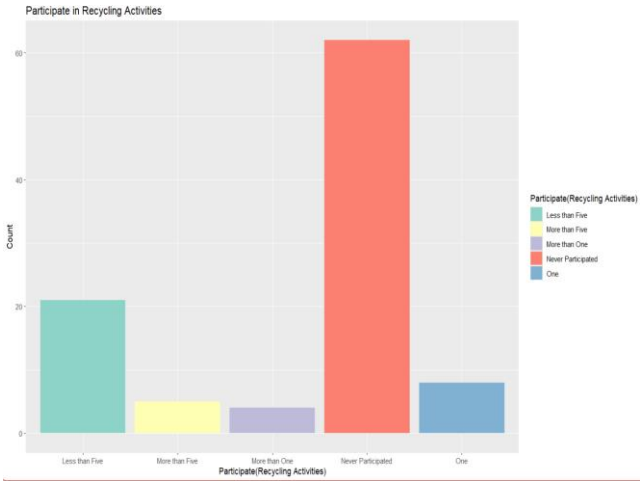


Figure 18: Participate Recycling Activities

According to **Figure 18**, 62% of the students never participated in recycling activities which has a big impact on recycling awareness.

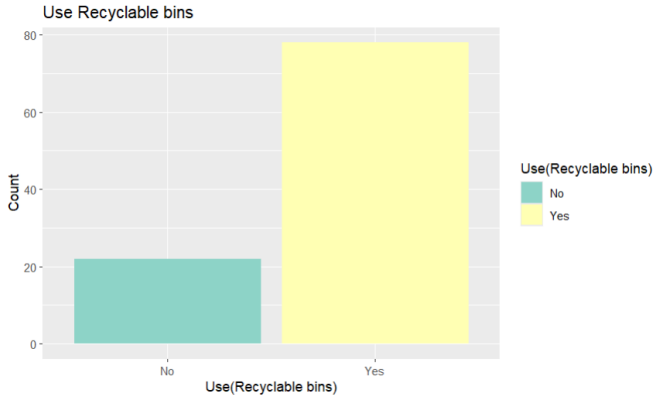


Figure 19: Use Recycle bins

From **Figure 19,** we see that 78% of the students use recycle bins which has a very positive effect on the environment and society.

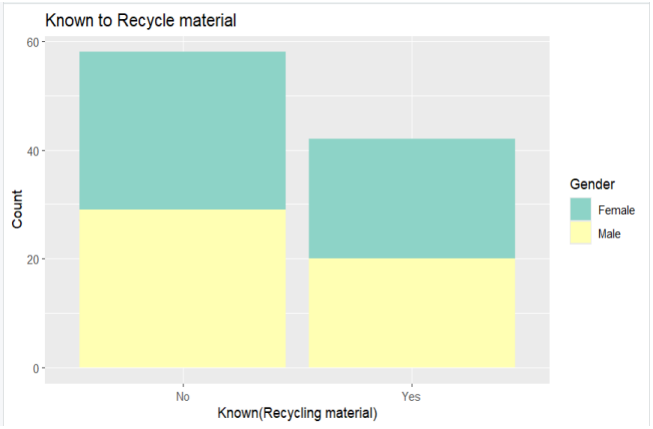


Figure 20: Knowledge on Recycle materials

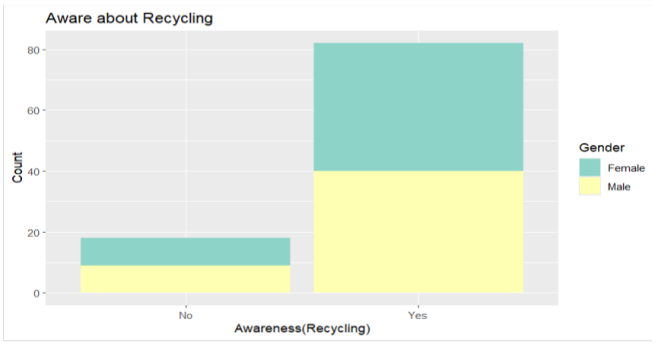


Figure 21: Awareness (Recycling)

According to Figure 20, we see that 58% of the students do not know about recycling material but on Figure 8, 82% of students are familiar with the environmental benefits of recycling and on Figure 21, we see that 82% of the students are aware of recycling. There is a strong relationship between the variables Known(Recycling material) with Awareness(Recycling) and Familiarity(Recycling Benefits). Students must need proper knowledge of recycling materials, then they will be fully aware of recycling.

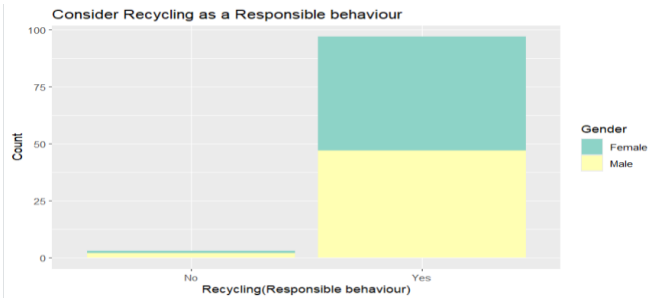


Figure 22: Recycling (Responsible Behaviour)

According to **Figure 22,** viewing recycling as a responsible action proves to be an efficient remedy for insufficient recycling practices. Recycling, being environmentally-friendly and relatively inexpensive, stands as a viable solution. Approximately 97% of students acknowledge recycling as a responsible behaviour.

VI. Result

The study on recycling awareness among university students in Dhaka, Bangladesh, revealed significant insights into the knowledge, attitudes, and behaviors towards recycling activities. A total of 100 respondents participated in the survey, with a nearly equal gender distribution (51% female, 49% male). The majority of respondents fell within the age range of 20-22 years, with a mean age of 21.79 years and a standard deviation of 1.78.Descriptive statistics indicated that while there was a generally high level of interest in recycling among students, actual participation rates in recycling activities were relatively low. For instance, only 22% of respondents reported reusing items, and 78% reported using recycle bins. However, there was a strong positive sentiment towards recycling, with 97% of students considering it a responsible behavior. The chi-square tests conducted revealed significant associations between knowledge of

recycling materials and awareness of recycling, as well as between familiarity with recycling benefits and awareness of recycling. This suggests that students who are knowledgeable about recycling materials and familiar with its benefits are more likely to be aware of recycling practices.

VII. CONCLUSIONS

The study concludes that while there is a generally high level of awareness and positive attitude towards recycling among university students in Dhaka, their actual participation and knowledge about recycling materials are moderate to low. The findings suggest a need for targeted interventions to enhance recycling education and promote sustainable practices among university students in Dhaka. Providing knowledge about recycling materials and benefits could be effective in increasing awareness and engagement in recycling activities. Overall, the study highlights the importance of bridging the gap between knowledge and behavior, and encouraging greater participation in recycling initiatives among university students to address environmental challenges effectively.

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