

Students' perception of environmental sustainability (ES) exercises at higher education institutions (HEIs) in Bangladesh

Sustainable
environmental
management

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Abstract

Purpose – Environmental sustainability (ES) is a vital issue in recent times as higher education institutions (HEIs) are expected to have significant environmental impacts. This study aims to explore the ES attitudes in three different HEIs in Bangladesh based on student perception.

Design/methodology/approach – Primary data from 200 respondents of 3 HEIs through a questionnaire survey has been collected. The questionnaire was designed to collect data on six criteria: awareness, concern, attitude, willingness to participate and recommendations about campus ES. Pearson's chi-square (χ^2), Fisher's exact test statistic, one-way analysis of variance and Spearman's correlation have been used to measure difference and correlation in SPSS.

Findings – Though students are aware of ES, only 21% are concerned about the issue. In total, 68% of respondents agreed that campus ES is not a responsibility of authority alone and that others have a role to play; 24% of students do not even know about recycling practices; and 73% of the respondents suggested that knowledge-sharing seminars/conferences could be the best way to improve the campus's ES.

Practical implications – A top-down planning approach excludes students from decision-making and direct engagement in Sustainable Campus building. Including student perceptions in planning assists policymakers and smooths the path to a more sustainable campus.

Originality/value – This study contributes to the existing literature by providing insight into students' perceptions of sustainability practices in the campus environment.

Keywords Sustainability, Campus, Environment, Perception, Bangladesh

Paper type Research paper

1. Introduction

In recent decades, the topic of sustainable development (SD) in higher education institutions (HEIs) has become more widely discussed due to a rising understanding of the university's role in

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promoting SD (Yuan and Zuo, 2013). According to Nejadi and Nejadi (2013), a sustainable university can be defined as a university that, through an ongoing commitment to sustainability and monitoring, promotes and implements sustainable practices in learning, research, community engagement, waste, energy management and land use and planning. Additionally, via research, teaching and practices, HEIs play a significant role in fostering sustainability understanding and developing the next generation of leaders to secure a sustainable future for all (Emanuel and Adams, 2011; Shiel *et al.*, 2016). To assure sustainable development, a variety of international university alliances have been developed, including the Bologna Charter, Halifax Declaration, Talloires Declaration and Copernicus Charter for Sustainable Development (Alam *et al.*, 2020; Mulà *et al.*, 2017).

The United Nations created 17 Sustainable Development Goals (SDGs) in the context of SD in 2015, and they must be accomplished globally by the year 2030 (United Nations, 2016). HEIs have huge potential to help accomplish the SDG's objectives. When it comes to promoting awareness about SD, HEIs are quite powerful (Griebeler *et al.*, 2022). In order to accomplish the SDGs within their institutions, many universities worldwide are now embracing and putting into practice various sustainability programs and approaches (Brafler and Sprenger, 2021; Brudermann *et al.*, 2019; Dżimińska *et al.*, 2020; Fourati-jamoussi *et al.*, 2021). According to studies conducted in Austria (Brudermann *et al.*, 2019), the USA (Jung *et al.*, 2019) and the UK (Chen and Price, 2020), the majority of students are extremely aware of and willing to support sustainable efforts at their colleges and universities. Similar studies have recently been conducted in developing nations. These studies include an evaluation of students' perceptions of some factors contributing to higher education for SD in a university in China (Wang *et al.*, 2020), a research study about students' perceptions and attitudes toward sustainability in universities of Malaysia (Abd-Razak *et al.*, 2011), and studies on sustainability awareness among students and faculty members in Saudi Arabia (Abubakar *et al.*, 2016; Alkhayyal *et al.*, 2019; Alsaati *et al.*, 2020).

A university that receives most of its funding from the state is known as a public University, and a national university is primarily a university founded or governed by a government. However, it may also simultaneously function independently without being directly supervised by the state (Akther, 2019). Many academics have advocated for a "whole-of-university" approach to sustainability and a rethinking of how higher education might address sustainability challenges through community outreach, cooperation and involvement of the many university stakeholders, in addition to curriculum and research (Beringer and Adomßent, 2008; Mcmillin and Dyball, 2009; Wright, 2002). Universities have a significant role in treating and spreading knowledge through instruction and communication. Education may transform people's perceptions of and attitudes toward sustainability, which is necessary to achieve sustainability goals (Kanapathy *et al.*, 2019). This is significant because a university's ability to develop its academic infrastructure by defining the proper faculty priorities and practices depends on its campus's sustainability (Msengi *et al.*, 2019).

Environmental resources are suffering greatly due to climate change and human interference in Bangladesh, one of the most climate-vulnerable nations (Ishtiaque *et al.*, 2020). Salequzzaman and Stocker (2001) contend that Bangladesh might combat environmental degradation in two ways: by promoting environmental education and opening up career opportunities in fields related to SD (Hoque *et al.*, 2017). However, whether the time, effort and resources devoted to sustainability programs will be effective depends on students' desire to put in the work necessary to benefit from them. SDGs cannot be successfully implemented without the participation and support of numerous stakeholders (Ghosh, 2011). Strong cooperation of many stakeholders including student organizations, cafeteria operators, staff, students and senior management to promote and grow environmental preservation is needed to accomplish the ultimate aim of an ES campus (Chan *et al.*, 2022).

SDG deployment at HEIs in Bangladesh is quite difficult. There's also a paucity of sustainability strategies in Bangladesh's HEIs (Filho *et al.*, 2022). Understanding how

concerned, interested and eager students are participating in sustainability programs may help contextualize how much sustainability a university and its students are likely to practice. In educational contexts, student perceptions offer a crucial perspective. To ensure that target groups' demands are considered during the planning process, feedback from these groups is crucial (Abd-Razak *et al.*, 2011). Though many studies have been conducted on sustainability in HEIs in Bangladesh and beyond, little work has given insight into students' perceptions of campus ES performance. This research intends to fill that gap. This study attempts to measure and compare the awareness, concern, attitude, willingness to participate and recommendation of students toward a sustainable campus environment of three campuses in Khulna on sustainability issues – which will be helpful for university policymaker authority to get an insight into students' perception about campus ES, their demands and feedback to develop policymaking and planning process.

2. Materials and methods

2.1 Study area

Though several studies have been done on HEI students' perceptions of ES practices in western countries, Global South, especially the southern part of Bangladesh, lacks this study. Khulna is located near the southwestern coastal strip, at 22.49° north latitude and 89.34° east longitude. This city is regarded as the regional headquarters, and it is traditionally acknowledged as a divisional megacity in Bangladesh (Islam and Moniruzzaman, 2019). This city is disaster-prone because of its location near the Bay of Bengal and Sundarbans and is vulnerable to climate change. In Khulna city, several climate issues such as salt intrusion, biodiversity decline, flood, water logging and so on occur. Understanding student perceptions of Khulna city must be understood so that university authorities may include these in their planning and make the campus environment more sustainable in this climatically vulnerable area. Three HEIs in Khulna city were taken as the study area as they are three major HEIs in southwestern part of Bangladesh and, students who are studying in these universities are from all over the country. Two public universities, Khulna University of Engineering and Technology (KUET) and Khulna University (KU), as well as a national university, Government Brajalal National University (BLNU), situated in Khulna, were chosen for this study. Figure 1 depicts these three HEIs inside the Khulna district.

2.1.1 Khulna University of Engineering and Technology (KUET). KUET is located in the north-west corner of Khulna City, 12 km from the city center (Abdullah *et al.*, 2005). Under 3 faculties, there are 20 departments. The total area of the campus is 101 acres. There are seven residential halls and about 4,800 students.

2.1.2 Khulna University (KU). KU is around 5 km from the city center of Khulna (Roy *et al.*, 2016). There are 8 faculties and 29 disciplines at this university. There are five residential halls for students with a combined campus area of 105.75 acres. At KU, there are 6,965 students.

2.1.3 Govt. Brajalal National University (BLNU). BLNU is 8 km away from Khulna city center. The total area is 42 acres. There are about 30,000 students. From higher secondary level to post-graduation, 18 subjects at the graduate level and 21 subjects at the post-graduate level are being taught.

2.2 Survey design

The research is based on primary and secondary data. A questionnaire survey (online and physical) was used to collect primary data. A semi-structured questionnaire was prepared based on relevant literature and consultations with experts. The questionnaire was evaluated, and a pilot survey was conducted before finalizing the questionnaire. The questionnaire was distributed to the three university students via social networking sites to

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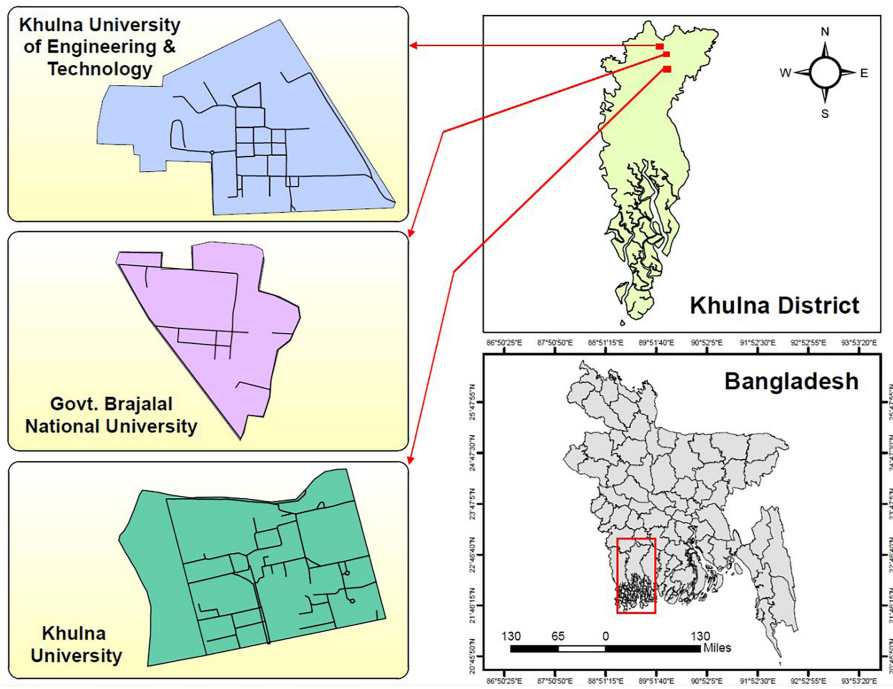


Figure 1.
Study area

Source(s): Three Selected Universities from Khulna Bangladesh; Illustrated by the 2nd author

reach a larger audience. Besides, since classes are the best means of reaching students, we distributed the questionnaires through them.

2.3 Sample and sampling technique

Data for the study were collected via online and physical surveys from May to July 2022. The snowball sampling method was used to collect responses from online surveys. Random sampling was used to collect responses from physical surveys. Easily accessible locations were chosen where student availability is higher (e.g. cafeteria, tea stalls, playground, etc.). Two hundred people were surveyed using a questionnaire, 113 responses were from an online survey, and 87 others were from the physical survey. We have followed [Wang et al. \(2020\)](#) to determine the sample size. He used a sample size that is 1.6% of the total population of Guangzhou College of South China University of Technology. For our study, 1.6% of the total population of KUET, KU and BLNU is, respectively, 77, 110 and 480. We obtained 74, 71 and 50 responses from KUET, KU and BLNU, respectively. As the response rate from BLNU was less than the author's expectation, we have further consulted with the experts to fix the sample size in the context of Khulna, Bangladesh, and appropriate statistical tests according to sample size. The expert panel included University teachers, NGO representatives, policymakers and statisticians.

2.4 The survey questionnaire

The questionnaire was divided into eight segments. The first segment focused on the respondents' demographic background, including the name of the university campus, gender,

age, years of studying and residency. The second, third, fourth, fifth and sixth portions employed a Five-point Likert scale to assess students' awareness, concern, attitude and willingness to participate in campus sustainability-related issues. These elements in the sections were intended to investigate the students' perception. The seventh section of the survey included two additional questions meant to elicit students' suggestions on addressing environmental difficulties at their university. A separate section contained semi-structured questions. The section was intended to discuss whether any SDGs might be achieved by understanding students' perceptions. For preparing this section of the questionnaire, secondary data were used. Please see [Table S1](#) in the supplementary file for the questionnaire contents.

2.5 Data analysis

This study used multiple statistical approaches to process the collected data. The Statistical Package for the Social Sciences (SPSS) software Version 17 and Microsoft Excel 2016 were used to collect, process and statistically analyze the data, which were then included in the text, tables and graphs of this study. The ordinal data were examined using descriptive statistics, which not only explained the primary variables of the study but also allowed for further analyses. Pearson's chi-square (χ^2), Fisher's exact test, one-way analysis of variance (ANOVA) and Spearman's correlation were conducted in SPSS. Please see the Data Analysis part in the [supplementary file](#) for the description of test statistics and please see Figure S1 in the supplementary file for the conceptual framework of the study.

3. Results and discussion

3.1 Demographic characteristics of the respondents

The demographic composition is almost the same for the institutions. About 38%, 36% and 26% of the respondents are from KUET, KU and BLNU, respectively. In total, 65% of respondents are male and 35% are female. This could indicate that male undergraduates are more eager to participate in volunteer activities. From the total number of respondents, the majority live in residential halls of their respective institutions' campuses, with a percentage of 53%.

3.2 Feedback categories: environmental managerial insights in residential Halls

Evaluating the waste and water management systems in residential halls is crucial because most students live there on every campus. These are essential for improving the campus environment and the students' welfare. A section of the questionnaire asked respondents to rate the state of the waste and water management systems in their residential halls on a Five-point Likert scale. The results are shown in [Table 1](#).

The outcome in [Table 1\(a\)](#) demonstrates that most respondents mentioned a good waste management system in KUET. Overall, 39% claimed the system is good, and 27% of

Study area	Very good (%)	Good (%)	Moderate (%)	Bad (%)	Very bad (%)	Fisher's value	<i>p</i>
<i>(a) Condition of waste management system</i>							
KUET	27	39	32	0	1	41	0
KU	14	62	20	3	1		
BLNU	12	20	48	18	2		
<i>(b) Condition of the water management system</i>							
KUET	16	38	38	7	1	37	0
KU	6	59	23	11	1		
BLNU	6	14	48	26	6		

Source(s): Author's insight from the feedback, 2022

Table 1. Condition of (a) waste and (b) water management system in the residential halls according to students

respondents claiming it is very good. However, 32% claimed the system is in a moderate state, and 1% claimed it is in a bad or extremely bad state.

According to the respondents, the KU residential hall's waste management system is in good shape. In total, 62% said the system is in good condition, 14% said it is in very good condition and 20% said it is in moderate condition. Most students at BLNU (48%) said their system is in moderate condition, while only 20% said it is in good condition and only 12% said it is in very good condition. However, 20% claimed that the hall's waste management system was terrible. A significant difference in the three campuses' waste management systems was revealed by Fisher's value "41" ($p < 0.05$). According to the students, the waste management systems are generally in good shape in the residence halls of KUET and KU, while they are in moderate condition in BLNU. This outcome is expected because KUET and KU have waste management plants, whereas BLNU does not. But Fisher's value "37" ($p < 0.05$) of water management systems ranked the three campuses with less significance. Table 1(b) shows that in KUET, most respondents indicated a good and moderate water management system. About 38% of them said the system is good, while 16% of the respondents indicated the system is very good. Even though salinity is a major issue in this area, the presence of a water treatment plant has improved the water management system at KUET.

According to the respondents, the water management systems in KUET and KU are good compared to BLNU. In KU, the majority (59%) of respondents rated the system as good, 6% as very good and 23% said it is in moderate condition for them. In BLNU, the majority (48%) of them said their system is in moderate condition, while only 14% said it is in good condition and only 6% said it is in very good condition. This result is expected because there is salinity in the water at BLNU and there is no water treatment plant. On the other hand, KU has no salinity in its water, and KUET has a water treatment plant to deal with its salinity problem.

3.3 Students awareness, concern and attitude toward environmental sustainability (ES)

The responsibility to preserve natural resources and maintain global ecosystems to support health and well-being today and in the future is known as ES. This section asked questions about sustainability to test students' awareness, concern and attitude toward ES. This is crucial because it may help to understand how much a university and its students are involved in sustainable practices by considering students' awareness, concern, attitude and willingness to contribute to sustainability initiatives. The results are shown in Table 2. Table 2(a) shows the students' awareness about ES and recycling. The results of Fisher's exact tests revealed a significant difference between students' awareness of ES in these HEIs ($p < 0.05$). Most respondents (47% of KUET, 59% of KU and 36% of BLNU) said they are aware of ES and give it moderate attention. In total, 28% of KUET respondents, 16% of KU respondents and 16% of BLNU respondents are aware of it and take it seriously. And 70% of respondents in those study areas are familiar with it. As ES awareness campaigns are not common in these HEIs, the remaining 30% of students are unaware of them and do not participate in efforts to create a sustainable campus environment.

Chi-square test reveals that there is no statistically significant difference between students' awareness of recycling among these three HEIs ($p > 0.05$). According to Table 2(a), most of the respondents in all three HEIs (KUET-38%, KU-32% and BLNU-28%) are aware of recycling and give it some consideration. However, a significant portion of the respondents were found to be not aware of it and not giving it any kind of attention. In this category, BLNU has the highest percentage with 28%, followed by KU with 25% and KUET with 20%. Overall, 11% of the respondents are aware of recycling but do not pay attention to it, 24% are unaware of it and do not pay attention. This is a clear sign that most respondents are unaware of the importance of recycling and do not practice recycling in their daily lives. This outcome might suggest that the HEIs failed to adequately convey the value of recycling to the students.

(a) HEIs students' awareness	KUET	KU	BLNU	Total	Fisher's value	<i>p</i>
<i>Awareness about ES</i>						
Aware and serious about the matter (%)	28	16	16	21	17	0
Aware and pay moderate attention (%)	47	59	36	49		
Neutral (%)	19	18	32	22		
Aware but do not pay attention (%)	4	6	4	5		
Not aware and do not pay attention (%)	1	1	12	4		
<i>Awareness about recycling</i>						
Aware and serious about the matter (%)	8	7	10	8	5	1
Aware and pay moderate attention (%)	38	32	28	33		
Neutral (%)	27	23	20	24		
Aware but do not pay attention (%)	7	13	14	11		
Not aware and do not pay attention (%)	20	25	28	24		
(b) HEIs students' concern toward ES						
	KUET	KU	BLNU	Total	χ^2	<i>p</i>
<i>Campus ES is only concern of authority</i>						
Strongly Agree (%)	4	6	8	6		
Agree (%)	15	11	20	15	7.123	0.523
Neutral (%)	18	7	10	12		
Disagree (%)	16	18	16	17		
Strongly Disagree (%)	47	58	46	51		
(c) HEIs students' attitude towards ES						
	KUET	KU	BLNU	Total	χ^2 value/	<i>p</i>
<i>Doing after eating a packet of chips or drinking a pack of juice</i>						
Save it until I find a dustbin (%)	70.3	62	46	61	8.172	0.068
Save it until I find clustered dusts (%)	25.7	35.2	50	35		
Dump anywhere (%)	4.1	2.8	4	4		
<i>Contribution to building a more environmentally friendly sustainable campus</i>						
Donation (%)		4.2	8	4	9.19	0.327
Work voluntarily (%)	18.9	21.1	30	23		
Follow publications related to sustainability (%)	18.9	15.5	14	16		
Raise awareness (%)	28.4	28.2	26	28		
Do nothing (%)	33.8	31	22	30		
<i>View about the preservation of natural resources</i>						
Very Necessary (%)	54.1	47.9	40	48	21.422	0.003
Necessary (%)	20.3	36.6	14	25		
Neutral (%)	17.6	8.5	38	20		
Little bit Necessary (%)	5.4	5.6	4	5		
Not Necessary (%)	2.7	1.4	4	3		
<i>Usual reaction against polluters</i>						
File formal complaints (%)	5.4	5.6	18	9	21.415	0.006
Warn them personally (%)	68.9	71.8	52	66		
No reaction at all (%)	25.7	22.5	30	26		

Source(s): Author's calculation, 2022

Table 2.
HEIs students' (a)
awareness; (b) concern
and (c) attitude
toward ES

Table 2(b) shows the concern of the students toward ES. In KUET, most respondents (about 47%) strongly disagreed with the statement "Campus environmental sustainability is only concern of authority," while 16% disagreed slightly and 18% were neutral when the

question was asked. The same outcome for that statement has also been seen at KU and BLNU. While most respondents at KU (58%) and BLNU (46%) strongly disagreed. Overall, most respondents disagree with the statement. They think that campus ES concerns everyone, not only authorities, which indicates their positive concern about the environment. They may improve the campus environment's sustainability if given the right direction. The chi-square test does not reveal any significant difference between the student's concern about this matter of these three HEIs ($p > 0.05$). A series of questions were used to gauge students' attitudes toward ES. This section is important because it may contain information about students' habits, behaviors and lifestyles at residence, university and public places.

Table 2(c) represents some other students' attitudes regarding ES. A question was asked about the student's preference after consuming a packet of chips or drinking a bottle of juice. The majority (61%) of respondents (70% in KUET, 62% in KU and 46% in the BLNU) said they keep the packets and bottles until they find trash cans. In overall, 50% of the BLNU survey respondents, 35% of KU survey respondents and 26% of KUET survey respondents said they keep it until they find clustered dust. A small percentage (4% in KUET, 3% in KU and 4% in BLNU) of respondents said they dump packets or bottles anywhere. It indicates that most students have a positive attitude as they keep the packets or bottles until they find trash cans. The respondents' involvement in creating a more sustainable and environmentally friendly campus was questioned. In KUET, most respondents (34%) take no action, while 28% raise awareness of the issue. Most respondents (31%) to the KU survey do nothing, but about 28% of them raise awareness. However, in BLNU, about 28% of respondents work voluntarily, which is significantly better than the attitudes of KU and KUET. Overall, most (30%) students do not contribute to building a more environmentally friendly and sustainable campus, which is alarming.

The results of the chi-square and Fisher's exact tests revealed a significant difference between students' perceptions of the preservation of natural resources, typical responses to polluters and willingness to take part in campus environmental initiatives between the HEIs ($p < 0.05$). When asked about their opinions on the preservation of natural resources, the majority (48%) of the KUET, KU and BLNU respondents said that it is necessary for the sustainability of the environment. This was deemed to be extremely necessary by more than half of the respondents (54%) in KUET, as well as by 48% of KU respondents, 40% of BLNU respondents, which indicates their positive attitude. The majority (69% in KUET, 72% in KU and 52% in BLNU) of respondents said they warn polluters when asked how they react to them. This indicates their positive attitude toward the environment. While some (26% in KUET, 23% in KU and 30% in BLNU) react indifferently, others formally complain to the appropriate authority.

Figure 2(a) shows the comparison of students' ES practices. The findings are based on multiple-choice questions in which students could select more than one answer. Most of the respondents practice energy conservation. By having 80% of its students practice energy conservation, BLNU takes the top spot, followed by KU (70%) and KUET (65%). The highest rate of water conservation practices was observed at BLNU with 10%, followed by KU with 10% and KUET with 8%. Few respondents engage in recycling and environmentally sustainable landscaping. In total, 20% of respondents from KUET, 10% from KU and 8% from BLNU reported not participating in any practices. Overall, compared to KU and BLNU, the students at KUET are falling behind in sustainability practices. The lack of approaches to the HEIs can be why the students lack sustainability practices. Figure 2(b) shows the comparison of the respondents' transportation mode choice inside campus. The most popular mode of transportation across all study areas has been non-motorized transportation. Walking, cycling and human-powered transit modes such as rickshaws and non-motorized vans are examples of non-motorized forms of

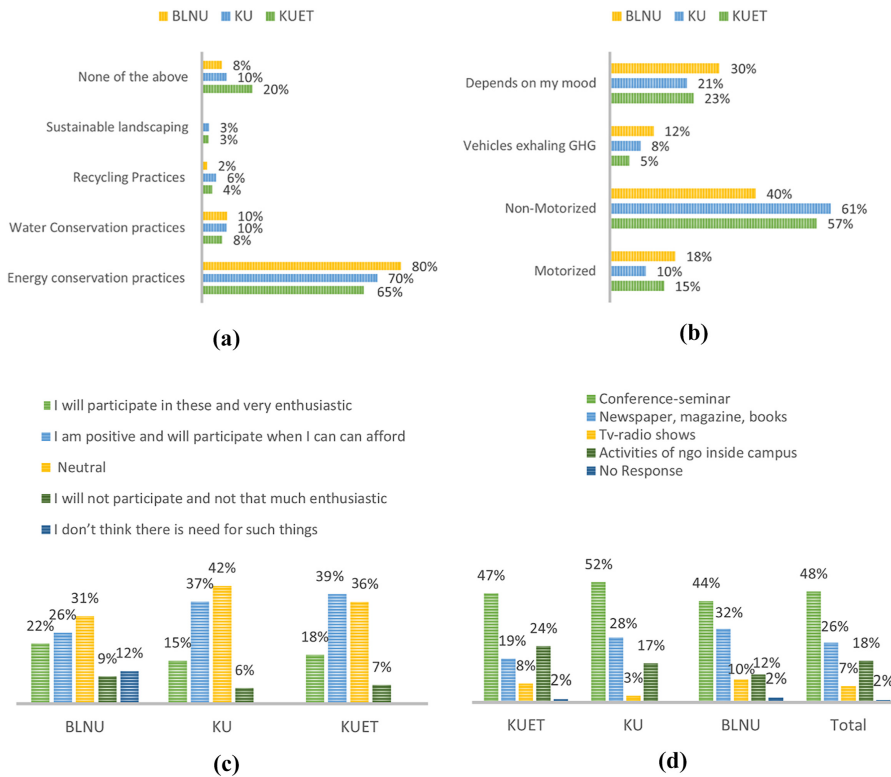


Figure 2. (a) Students' sustainability practices in campus; (b) Transportation mode choice inside campus; (c) Willingness to participate in campus environment-friendly activities; (d) Recommendations to attract students' and authorities' attraction

Source(s): Author's insight from the feedback, 2022

transportation. Non-motorized vehicles are used on campus by 61% of respondents at KU, 57% at KUET and 40% at BLNU. It is expected because most students live in campus residential halls and the availability of non-motorized vehicles is higher. According to their mood (by choice), many respondents vary their mode of transportation (KUET – 23%, KU – 21% and BLNU – 30%). Motorized mode and vehicles emitting GHG are the least common modes as most students live on campus or nearby campus and the availability of motorized vehicles is lower inside the campus.

3.4 Dependency of attitude on student's demographic characteristics

Concerning years of studying, age group and participation in environmental seminars, the results of ANOVA were used to determine whether there were any significant differences in the students' attitudes toward ES. The findings in Table S4 (Supplementary) show that there were statistically significant differences in the attitudes between the student groups who attended environmental-related seminars and those who did not ($p < 0.05$). It is expected because the environment-related seminars create awareness among students, which, as a result, shapes the attitudes of the students who participate in them in comparison to the other students who do not participate in them. On the other hand, the findings indicate that years of university studies could not shape the students' attitudes ($p > 0.05$). Also, age does not significantly affect students' attitudes ($p > 0.05$).

3.5 Willingness to participate in campus environment-friendly activities

A question was asked about students' willingness to participate in campus environment-friendly activities including seminars. [Figure 2\(c\)](#) shows that most of the students remain neutral. In total, 39% of KUET respondents, 37% of KU respondents and 26% of BLNU respondents said they are positive about it and participate when they can afford it. And 18% of KUET respondents, 15% of KU respondents and 22% of BLNU respondents said they participate in campus environmental-friendly activities and are very enthusiastic about them. This indicates that most respondents are unwilling to participate in campus eco-friendly activities.

3.6 Recommendations of students to improve ES on campus

A question was asked on the recommendation to attract students' and authorities' attention to build a more sustainable campus environment. [Figure 2\(d\)](#) shows about 47%, 52% and 44% of respondents from KUET, KU and BLNU, respectively, recommended environment-related knowledge-sharing conferences and seminars to draw attention from students and authorities. In comparison, 19%, 28% and 32% of respondents from KUET, KU and BLNU, respectively, suggested the spread of newspapers, magazines and books about ES can improve campus conditions. In total, 24% of KUET, 17% of KU and 12% of BLNU respondents suggested that student clubs arrange TV-radio shows. It indicates that environmental seminars are the best means to attract students and authorities.

Also, please see [supplementary file](#) for further results and discussion related to Major Environmental Issues, Correlation between Student's Awareness, Concern and Attitude and Student Perception and Attainment of SDGs in the Results and Discussion section.

4. Conclusion and recommendations

Understanding the students' perception of campus ES is vital for developing countries like Bangladesh to achieve SDGs. This study aims to get an insight into awareness, concern, attitude, willingness to participate and recommendations of university students regarding ES issues on campus to get a clear view of their perception. Though the students are aware of sustainability, they lack involvement regarding ES issues. Students believe that achieving sustainability on campus is not only the responsibility of the authority alone. But they lack sustainability practices (e.g. recycling, water conservation and sustainable landscaping). In total, 30% of respondents do not contribute to creating a better sustainable campus. The top-down decision-making process that leads to lower citizen engagement in the design and execution of campus projects may cause the students' lack of involvement. Though university authorities implement many programs intended for achieving sustainability, it is necessary to respect the perception of the students as they are key campus stakeholders. Administrators' efforts will unavoidably be ineffective if students choose not to participate. As a result, it is unsuitable for administrators to design programs that should benefit the environment; ultimately, student conduct will determine whether a program is successful. University authorities must try to understand students' perception and act accordingly to implement sustainability plans and thus try to achieve SDGs. University authorities need to engage students more in sustainability to change their perception. The Ministry of Education should require university administrations to embrace sustainability by incorporating it into the HET's policies and plans and set up an office or center for SD with trained staff and financial resources. Putting more emphasis on teaching and training the young people is important – who will be the nation's future leaders on how to act sustainably and think strategically, enabling them to develop and plan more sustainable communities. Universities in developed countries are very conscious about the matter. So, Bangladeshi university authorities should follow them for better

implementation. This research is limited by sample size and a limited number of factors. There is also a need for research that covers a larger range of sustainability programs and best practices, as well as inclusive factors and criteria. The study only considered students' perception, but more stakeholders are available in campus sustainability programs. Besides, the role of any specialized education (engineering and medical) can be examined for its implication and importance on sustainability.

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Supplementary file

I. Materials and methods

The survey questionnaire

Data analysis:

Criteria	Contents
Demographic Characteristics	The Name of the University Age Gender Years of Studying Residence
Awareness Judgement	Awareness about ES Awareness about recycling
Concern Categories	Individual concern about ES Authorities' concern about ES Major environmental problems
Feedback Categories	Invitation to seminars/workshop Authority Investment Hall condition
Attitude Typology	Sustainability Practices Contributions Transport choice View about Natural resources Recycling Practices Reaction against polluters
Willingness to Participate	Participation to environmental seminars Participation in environment-related activities
Recommendations (Traditional way)	Recommendations to attract students and authorities' attention
Associated SDGs	Students' perception on attaining SDGs

Source(s): Author's insight and expert opinions, 2022

Table S1.
Contents of the
questionnaire

Pearson's Chi-Square Test and Fisher's Exact Test: Pearson's chi-square (χ^2) and Fisher's exact test statistic are used to determining whether there is a relationship between categorical variables. The chi-square test is performed if fewer than 20% of expected cell counts are less than 5, and Fisher's exact test is used if more than 20% of expected cell counts are less than 5. The χ^2 -statistic or Fisher's exact test indicates a statistically significant difference between the categorical variables evaluated when the probability is 0.05 or less. The greater the value of chi-square (χ^2) and Fisher's exact test, the greater the

degree of difference between categorical variables. These test statistics were used to determine whether there were any differences in the students of HEIs in terms of awareness, concern and attitude.

Spearman's rho Correlation: The Spearman's rho is a measure of the degree of relationship between two ordinal variables. There is a statically meaningful connection between the two ordinal variables if the p -value is less than 0.05. Higher rho coefficients indicate that the magnitude of the association between variables is stronger. Negative correlations indicate a relationship that moves in opposite directions, whereas positive correlations indicate a relationship that follows the same direction. The association between students' awareness, concern and attitude was examined using Spearman's rho correlation. [Figure S2](#) displays the study's simplified conceptual framework.

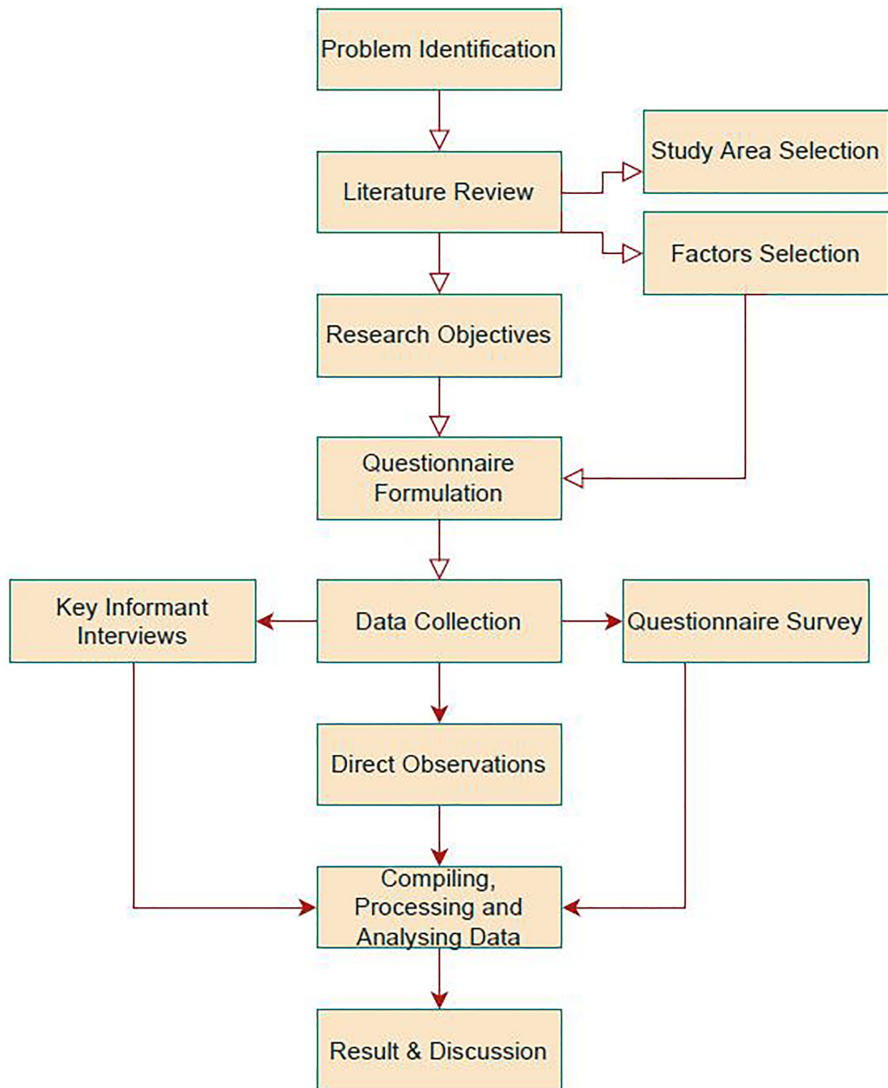


Figure S1.
Conceptual framework

Source(s): Illustrated by the 3rd author

One-way Analysis of Variance (ANOVA): ANOVA evaluates the means of two or more independent groups to see if there is statistical evidence that the related population means differ substantially. The ANOVA indicates a statistically significant difference between the groups evaluated when the probability is 0.05 or less. To ascertain whether there were any statistically significant differences in the attitudes of the students in relation to some demographic variables, a ANOVA was used.

II. Results and discussion

Major environmental issues

This section includes inquiries about major environmental issues on the campuses. A list of the campuses' environmental problems was identified and included in the questionnaire, along with a Five-point Likert scale.

Table S2: shows the students' response patterns, which highlight the key environmental problems on their campuses. According to the findings in **Table S2**, salinity is the most severe problem at KUET. The excessively salty water is a result of KUET's location in a suburb of Khulna, where groundwater salinity is high. Then the respondents identified the issue of extreme weather as the second most serious issue. It could be due to the campus's geographical location or a lack of vegetation. Deforestation is the third most serious issue in KUET. According to them, the number of trees has significantly decreased on campus because of ongoing road and building construction. Then they identified some other problems, including pollution of the water, noise, soil, as well as losses in biodiversity, air pollution and garbage disposal, respectively.

In KU, respondents identified rubbish disposal as their top problematic issue in the campus area. The campus is currently undergoing a significant amount of construction, and a significant amount of trash has been discovered there, polluting the area. The second most problematic issue at KU has been identified as extreme weather. Deforestation, which is also a problem for KUET, is the third most serious problem in KU. As a result of the extensive construction projects taking place on campus, many trees have been removed, making this the third most problematic issue. Then the respondents identified a few problems, including salinity, water pollution, declining biodiversity and noise, soil and air pollution.

Salinity, like in KUET, is the main issue at BLNU. This is because BLNU is located far from Khulna city, where groundwater salinity is high. The second major issue on campus is water pollution. Extreme weather was ranked as the third most serious problem by the respondents. This can be due to the geographical location or for lack of vegetation on the campus. Then the respondents identified some problems, including noise, soil and air pollution, as well as deforestation, garbage disposal and declines in biodiversity.

Correlation between student's awareness, concern and attitude

Table S3 and **Figure S2** show the correlation between students' awareness, concern and attitude. From Spearman's correlation coefficient, we can see a moderate level of correlation between awareness,

Problems	KUET Rank	KU Rank	BLNU Rank
Air Pollution	8th	9th	6th
Biodiversity Decrease	7th	6th	9th
Deforestation	3rd	3rd	7th
Extreme Weather	2nd	2nd	3rd
Noise Pollution	5th	7th	4th
Rubbish Disposal	9th	1st	8th
Salinity	1st	4th	1st
Soil Pollution	6th	8th	5th
Water Pollution	4th	5th	2nd

Source(s): Author's calculation, 2022

Table S2.
Major environmental
problems of the
campuses identified by
students

concern and the attitude of students. And the p value ($p < 0.5$) indicates the relationship between awareness and attitude; and awareness and concern are significant and associated with each other. By creating awareness, the attitude and concern of the students can be influenced. If awareness can be created among students, which will lead to positive concern and attitude and will contribute to making the campus environment more sustainable.

Student Perception and Attainment of SDGs

Semi-structured questions were used in this phase. There was a discussion about which SDGs are associated with students' perceptions of ES and which SDGs can be achieved after learning about students' perceptions.

The primary findings were that SDG 4, SDG 11, SDG 12, SDG 13, SDG 15 and SDG 16 relate to and may be achieved once students' perceptions of ES are known. [Table S4](#) depicts the associated SDGs with the perception of students.

A positive perception of campus sustainability can indicate that quality education is being provided by the university. In the case of this study, students show a positive mindset about sustainable development, which makes it easier to achieve SDG 4.7 (education for sustainable development and global citizenship). To build an inclusive community to achieve SDG 11.3 (inclusive and sustainable urbanization), perceptions of students must be considered, as they are important stakeholders in the community. Universities are a huge source of chemicals and waste and most of them are generated by students. So, to achieve SDG 12.4 (responsible management of chemicals and waste), their attitude toward the environment should be taken into consideration. Students are future leaders, and they can promote sustainability if they hold a positive mindset and thus help to achieve SDG 12.8 (Promote universal understanding of sustainable lifestyle). Student perception is most important in attaining SDG 13 (Climate Action). University authorities hold the key to educating students with sustainability

Table S3.
Correlation between student's awareness, concern and attitude

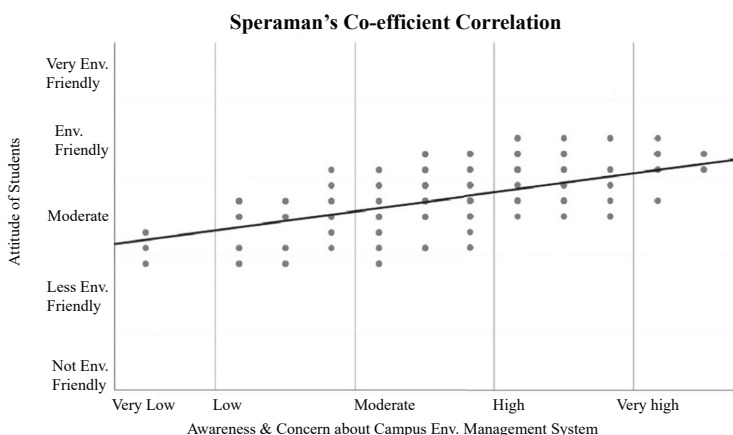
			Attitude	Awareness	Concern
Spearman's rho	Attitude	Correlation Coefficient	1	0.414	0.362
		Sig.	–	0.022	0.049
	Awareness	Correlation Coefficient	0.414	1	0.362
		Sig.	0.022	–	0.029
	Concern	Correlation Coefficient	0.362	0.362	1
		Sig.	0.049	0.029	–

Source(s): Author's calculation, 2022

Table S4.
ANOVA test of differences in attitude toward ES

		Sum of squares	Df	Mean square	F	P
<i>Years of studying</i>						
Attitude	Between Groups	0.217	2	0.109	0.483	0.618
	Within Groups	43.612	194	0.225		
	Total	43.830	196			
<i>Age</i>						
Attitude	Between Groups	0.186	1	0.186	0.830	0.363
	Within Groups	43.644	195	0.224		
	Total	43.830	196			
<i>Participation in environmental seminar</i>						
Attitude	Between Groups	1.176	4	0.294	2.810	0.043
	Within Groups	53.629	190	0.224		
	Total	54.805	194			

Source(s): Author's calculation, 2022



Sustainable environmental management

Figure S2.
Spearman's correlation

Source(s): Author's calculation, 2022

SDG 4: Quality Education	4.7- Education for sustainable development and global citizenship
SDG 11: Sustainable Cities and Communities	11.3- Inclusive and sustainable urbanization
SDG 12: Responsible Consumption and Production	12.4- Responsible management of chemicals and waste
SDG 13: Climate Action	12.8- Promote universal understanding of sustainable lifestyle
	13.2- Integrate climate change measures into policies and planning
	13.3- Build knowledge and capacity to meet climate change
	13.5- Promote mechanism to raise capacity for planning and management
SDG 15: Life on Land	15.5- Protect biodiversity and natural habitat
SDG 16: Peace, Justice and Strong Institution	16.7- Ensure responsive, inclusive, and representative decision-making

Source(s): Author's insight from the feedback, 2022

Table S5.
Related SDGs with student perception

knowledge and by implementing policies and measures, controlling the attitude and behavior of students, thus achieving SDG 13.2, 13.3 and 13.5 (Integrate climate change measures into policies and planning; build knowledge and capacity to meet climate change; promote mechanisms to raise capacity for planning and management). Biodiversity conservation in university territory depends on students' perception. If they are environmentally friendly in attitude, it helps to achieve SDG 15.5 (Protect biodiversity and natural habitat). Student perceptions must also be considered to achieve SDG 16.7 (Ensure responsive, inclusive and representative decision-making). The insight into students' perception is necessary, especially in respect of a developing country like Bangladesh to achieve its SDGs.

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