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Article

Digital behavior, mental health, and environmental attitudes among undergraduate students: A data-driven study

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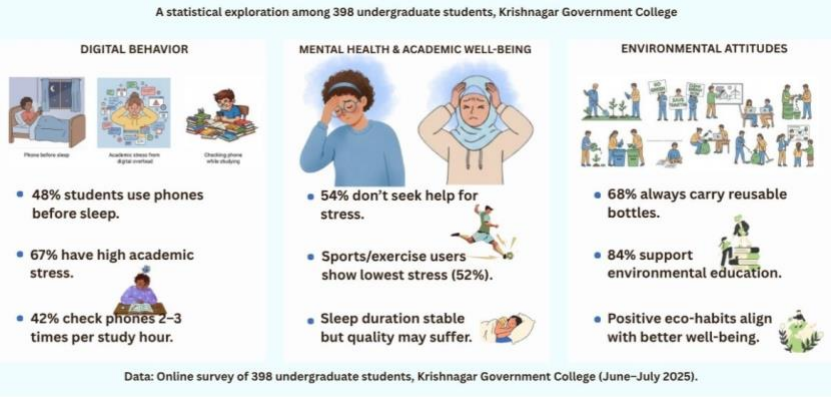

Highlights

- *Excessive screen time and frequent mobile phone use are strongly related to reduced focus and concentration during study.*
- *Students who regularly exercise or participate in outdoor activities experience lower stress than others.*
- *A large proportion of students support environmental education and possess environmental attitudes.*
- *Targeted intervention is needed for better mental well-being.*

Abstract

In the present era, environmental attitudes and awareness, along with digital behavior among the youth, play a crucial role in ensuring the sustainability of natural resources and societal well-being. This study examined the digital behavior, mental health, and environmental attitudes among the undergraduate students at Krishnagar Government College, West Bengal, India. A structured questionnaire-based survey was conducted using a 'Google Form' to collect the responses anonymously. A total of 398 responses were received from the surveyed students, which is approximately 16 to 18% of the enrolled college student population. Key findings suggest that excessive screen time was associated with poorer sleep, increased academic stress, and concentration difficulties. Students who seldom sought support were significantly more likely to report severe stress, while eco-conscious behaviors, such as using reusable drinking water bottles, were associated with more positive overall well-being. Clustering of the responses revealed distinct student profiles based on usage and stress metrics, suggesting targeted interventions. This study provided a comprehensive statistical overview of college students' well-being in the digital age and offered evidence-based recommendations for college campus policies and support programs.

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1 Introduction

The rapid integration of digital technologies into everyday life has significantly shaped the behavioral patterns, psychological well-being, and value systems of undergraduate students. As one of the most digitally immersed population groups, undergraduate students exhibit diverse digital behaviors—ranging from academic engagement to intensive social media use—that can have both beneficial and adverse implications for mental health (Abueva et al., 2025). The digital behavior, especially among students, has drastically changed after the COVID-19 pandemic compared to pre-pandemic times. Concurrently, growing global environmental challenges have intensified interest in understanding how young adults perceive and respond to sustainability and environmental responsibility. In the contemporary educational environment, smartphone use and screen-based activities have become ubiquitous among college students (Kumban et al., 2025). While digital connectivity offers unprecedented access to information and social engagement, concerns have emerged about its potential impact on sleep quality, academic performance, and mental health (Cabral et al., 2022; Gull and Sravani, 2024). To achieve sustainability, developing strong environmental attitudes and behaviors among college students is crucial (Müderrisoglu and Altanlar, 2010). Müderrisoglu and Altanlar (2010) conducted a study in a university in Turkey and examined whether the primary subject of study, gender, and societal behavior of the university students have an effect on environmental attitudes and behaviors. The authors found that while students support positive environmental attitudes, these do not necessarily translate into responsible environmental behaviors at a satisfactory level. Also, environmental attitudes do not depend on the courses they study.

Rising awareness of environmental sustainability has prompted inquiries into students' eco-friendly behaviors on campus—such as the use of reusable water bottles and willingness to join green initiatives. Environmental attitudes, digital behavior among the college students, and its impact on their mental health become a serious concern. Levine and Strube (2012) studied environmental attitudes and behaviors among college students and described that knowledge and intentions are related to the attitudes. Varah et al. (2020) discussed about measuring the environmental attitudes and behaviors among the undergraduate students in Delhi using the Environmentally Responsible Behavior Index (ERBI). They found that most of the students, whether reside in urban or in rural area, were well informed about the current critical status of the natural resources and they perceived themselves to have responsible environmental behaviors. Arshad et al. (2021) conducted a comparative study on environmental awareness, concern, attitudes, and behavior of university students across five different academic disciplines and concluded that background academic knowledge has a significant impact on attitudes and behavior.

The importance of perception, knowledge, attitude, and behavior towards the environment among college and university students is extremely crucial for environmental sustainability, as researchers have conducted similar studies in different regions in the world, like China (He et al., 2011), Chile (Heyl et al., 2013), and African American college students (Lee, 2008). Arpaci et al. (2024) conducted a study on 662 emerging adults to study the interrelationship between environmental attitudes, global social responsibility, digital literacy, and green purchasing intention. They considered a machine learning technique to analyze the data and found that green purchase intention is significantly influenced by these factors they considered in their study. Most of the college students experience a change in the pattern in their digital behavior related to the use of smartphone and laptop. Also, college students were increasingly reporting common mental health problems. Poor mental health among college and university students was a serious public health issue (Worfel et al., 2016).

The increasing pattern of screen time and active engagement in social media sometimes creates academic pressure, which results in mental health issues. Many studies have been conducted on this issue by researchers (Lattie et al., 2019; Harith et al., 2022). In Nigeria, Ogundipe et al. (2025) found that most of the study respondents were unaware of the digital health platforms for mental health promotion, although they showed significant potential about their attitudes towards the use of the digital health platforms for their mental health promotion. Ou et al. (2025) discussed the factors that influence the mental health of college students based on their digital behaviors. They found that behavioral factors like sleep quality, physical exercise and self-management variables like self-assessment, planning, and execution of planned tasks were the key factors that influence their mental health. Most of these studies either consider environmental perspectives along with digital habits or digital habits along with mental health. A study considering the three aspects of digital behavior, mental health, and environmental attitudes has not been conducted earlier. In the present study, all these three aspects have been considered for college students of Krishnagar Government College, situated in a district headquarters in West Bengal state in India. Most of the students in this college come from rural and suburban backgrounds. Data

have been collected using an online survey during June and July 2025. The inter-relationship among these issues, comparison among different disciplines, is discussed in subsequent sections using appropriate statistical techniques.

This research aims to: i) characterize digital behavior by measuring daily phone usage, frequency of checking phones during study, and bedtime phone use, ii) assess sleep patterns and examine their association with screen time habits, iii) quantify academic stress levels, concentration difficulties, and support-seeking behaviors, iv) evaluate environmental attitudes and practices, including use of reusable water bottles, interest in eco-clubs, and waste disposal methods, v) compare responses across different academic streams and departments to identify subgroups at higher risk of negative outcomes, and vi) understand the associations between screen time and stress, phone use and sleep, and environmental attitudes with eco-friendly behaviors.

2 Methodology

2.1 Questionnaire survey

This study employed a structured questionnaire-based survey in online mode focusing on digital behavior, health and academic well-being, social and emotional support, environmental attitudes, and demographic and academic identifiers. The template of the questionnaire is given in supplementary information (**Table S1**). The questionnaire was administered in both English and the vernacular language, namely Bengali, and it was framed using the Google Form platform. The questionnaire was circulated among students using a social media platform to ensure a well-representative sample response. It was circulated among the students from all the disciplines or subjects that are being taught in the Krishnagar Government College, West Bengal, India. The sampling procedure used in this study was convenience sampling (Stratton, 2021). Complete responses from 398 undergraduate students (approximately 16 to 18% of the total student population of the college) were recorded after removing partial or missing records. Responses were collected anonymously to reduce the response bias.

2.2 Analytical tools and statistical techniques

All data processing, summarization, and data analysis were conducted using Python 3.x. For data visualization, the matplotlib and seaborn libraries were used (Hunter, 2007; Waskom, 2021). For testing the independence of two variables, the chi-square test for independence was used. To find out the association between two continuous variables, the correlation coefficient was used if the distribution of the corresponding variables was close enough to the normal distribution; Spearman's rank correlation was used. Also, the corresponding hypothesis was tested to determine whether the correlation was significant or not. The hypothesis testing was done using scipy.stats library. For comparing the equality of means of more than two groups, a non-parametric testing method was adopted, and the Kruskal-Wallis test was used as it was more appropriate for this data set. In the data visualization part, most of the comparative diagrams, such as comparisons among different disciplines for some attitudes or behaviors, were represented as bar plots. A heatmap of correlation coefficients was used suitably represent the relationships between pairs of variables in a comparative manner across different factors examined in the study. Parametric and non-parametric hypothesis tests were applied to determine statistical significance.

3 Results

3.1 Digital behavior

To measure the digital behavior of students, information on daily phone use duration, preferred application types, and phone checking frequency during the study was collected and analyzed. It was observed that the majority of students (182 out of 398) used their phones for 3–6 hours per day, indicating moderate but sustained level of engagements, 93 students reported using phones 6–8 hours daily, pointing toward high usage levels, and 60 students reported more than 8 hours of daily phone use, raising concerns about potential overuse or screen addiction (**Fig. S1**). The majority of the students have dedicated a substantial portion of their day to mobile device use, suggesting a significant time investment that could impact study and rest. Considering phone checking habits for a 1-hour study session, a large number of students (42%) were mildly distracted (**Fig. 1**), but nearly 1 in 4 experienced frequent interruptions during their study time — potentially affecting focus and

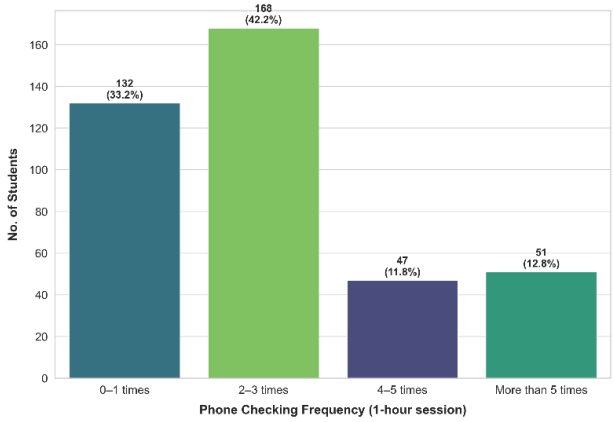

Figure 1. *Phone checking frequency during 1-hour study session.*

productivity. The data indicated a clear need to promote better study habits and digital discipline.

Figure S2 showed the preferred application types used by the students, and it was observed that the dominance of social media (40%) and entertainment applications (41.5%) may contributed to prolonged screen engagement and potential distractions during study.

3.2 Health and academic well-being

The perception towards the change in students' digital habits, its impact on their well-being, as well as on their academic stress, was captured and analyzed. The data on the perceived change in screen time over the last year indicated nearly 69% of students experienced a rise in screen time over the last year, among them 35.7% of students felt their screen time increased "a lot", indicating a growing dependency on digital devices (**Fig. S3**). The 'phone uses before sleeping' results showed a strong tendency toward screen exposure right before sleep (**Fig. S4**). The data showed that 48% of students always used their phone before sleeping. The screen exposure may negatively affect the sleep quality, mental rest, and circadian rhythm. The 'uses of screen time management tools' results showed that despite rising concerns about screen time, most students lacked proactive strategies to manage it (**Fig. S5**).

Respondents were also asked about the impact of pre-bedtime phone use and excessive screen time on their sleep quality, attention, and focus during the study. The data showed the impact of these digital habits on their quality of life (**Fig. S6**). A clear majority (7 in 10) of students acknowledged that screen time was negatively affected their daily routines, possibly in areas like productivity, mental health, sleep, and physical well-being. Among them, 41.5% students acknowledged this impact as severe. This suggests a critical need for structured interventions, such as time management workshops, screen time awareness sessions, or promotion of healthier digital habits and boundaries. Although over half of the students achieved the recommended sleep duration, a concerning 1 in 3 reported sleeping less than 6 hours (**Fig. S7**). The data also indicated that academic stress is a pervasive issue, affecting more than two-thirds of students on a weekly to daily basis (**Fig. 2**). A substantial portion of students (35.5%) experienced academic disruption due to mental exhaustion, with 13.1% reported that it occurred repeatedly (**Fig. 3**). These findings highlight a critical area of concern that, though the mental fatigue affects only a small percentage of students, but have significantly affected their academic engagement.

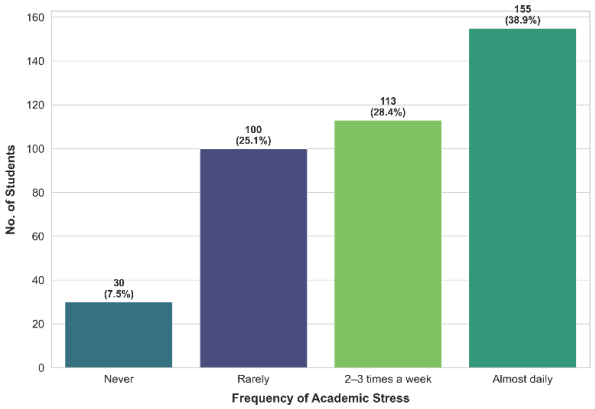

Figure 2. *Academic stress frequency.*

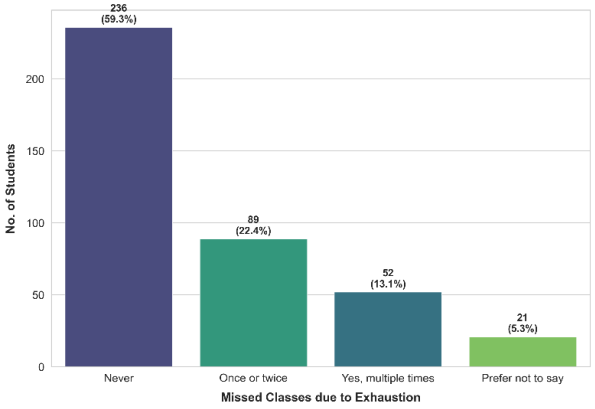

Figure 3. *Missed classes and assignments due to exhaustion.*

The cognitive focus and concentration difficulties reported by students indicated that a majority (53.3%) "Sometimes" experienced trouble concentrating, while 25.1% (n = 100) reported frequent concentration difficulties (**Fig. 4**). These findings highlight a widespread problem with sustained attention during study sessions. The data revealed a strong association between phone-checking frequency and difficulty focusing. Students who checked their phones four or more times per hour reported substantially higher concentration struggles. The observed academic stress and cognitive focus challenges suggest the need for interventions such as institutional mental health support, flexible academic schedules, and workshops on stress management and resilience building.

Despite high academic pressure, the majority of students (54.3%) did not seek mental health support for anxiety or stress (**Fig. 5**). Only a small proportion consulted professionals, indicating a major gap in mental health outreach and accessibility. This lack of support was associated with more frequent academic stress, suggesting that limited emotional outlets may exacerbate stress.

The data further showed that 40.7% (*n* = 162) of students primarily relaxed through sleeping, while 32.7% (*n* = 130) preferred talking to friends or family (**Fig. 6**). A small proportion of students (10.6%, *n* = 42) engaged in exercise or sports for relaxation. The remaining 16.1% (*n* = 64) used phones, social media, or music. Although sleeping was the most commonly reported relaxation strategy, it did not strongly correlate with lower stress levels; in contrast, students who engaged in exercise or sports reported a significantly lower frequency of stress.

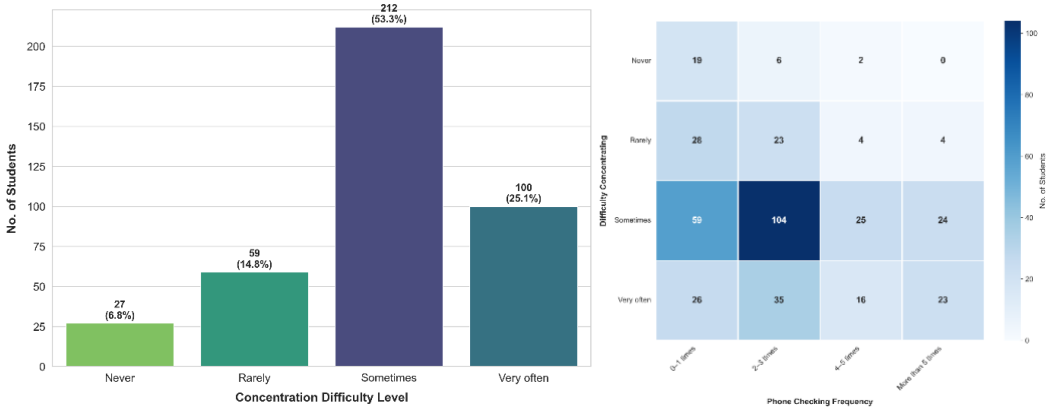

Figure 4. *Cognitive focus and distractions.*

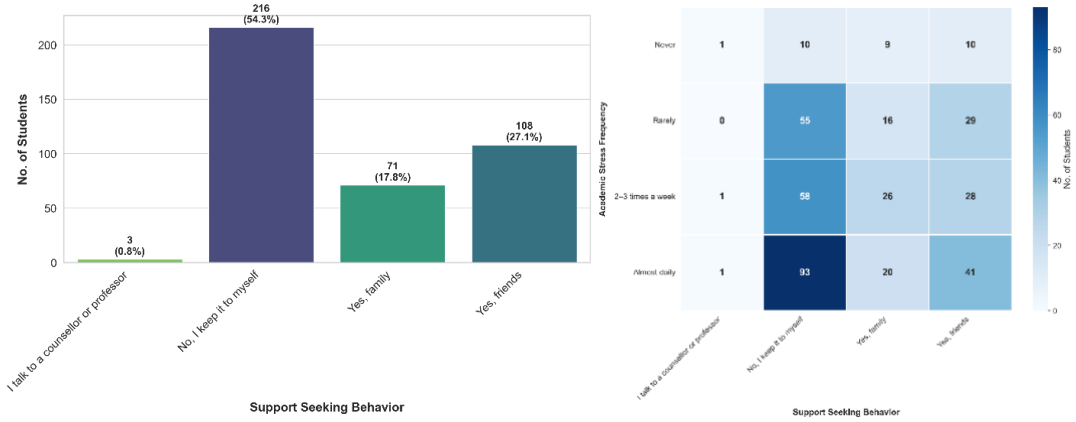

Figure 5. *Mental health support patterns and their link to academic stress.*

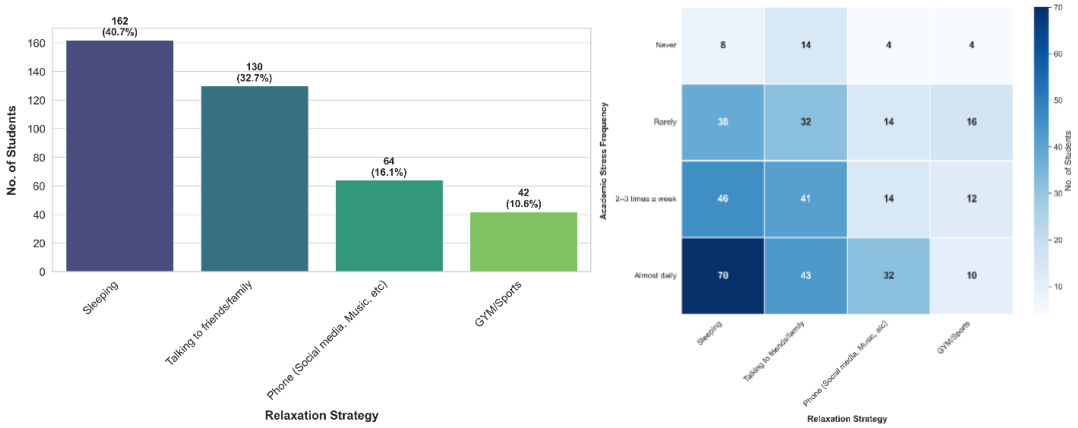

Figure 6. *Relaxation strategies and their relationship to stress levels.*

3.3 Environmental attitudes and behavior

Sustainable environmental habits such as bringing a reusable water bottle to the college, waste disposal method, joining an eco-club, and perceptions about the necessity of environmental education support were considered, and responses were collected from the students. The data showed a strong latent potential for student-led sustainability initiatives: while only 40.5% firmly committed to eco-club involvement (**Fig. 7**), nearly 9 in 10 students expressed a clear support for environmental education (**Fig. S8**). The high level of openness ("Maybe" responses) suggests that targeted outreach, visibility, and relevance may significantly increase engagement in both areas.

The majority of students reported a positive attitude toward the sustainable practice of using reusable water bottles. These behaviors were associated with broader environmental attitudes (**Fig. 7**). Students who consistently used reusable water bottles were more likely to participate in eco-clubs and engage positively with environmental education (**Fig. 7**). In contrast, students who rarely or never used reusable water bottles showed minimal involvement in environmental clubs or education programs.

Figure 8 shows the frequency of different waste disposal habits and their association with the use of reusable water bottles. A strong positive relationship was observed between the consistent use of reusable water bottles and responsible waste disposal practices.

Discipline-wise comparisons are shown in **Figures S9 to S12**. Students from the Political Science department experienced the greatest impact of excessive screen time on daily life activities. The habit of frequent phone checking while studying was most prevalent among students from the Geography department. Academic stress was highest in the Statistics department, followed by the Economics and English departments. Students from the Zoology department reported the least difficulty concentrating while studying, whereas students from the Botany department, followed by the Political Science department, experienced the greatest concentration difficulties among all departments.

Figures 9 and 10 depict environmental attitudes and behaviors among students from different disciplines. Most students showed positive attitudes toward green initiatives, with the exception of a few students from the Political Science and Philosophy departments. Müderrisoglu and Altanlar (2010) reported that environmental attitudes among college students at Abant Ýzzet Baysal University of Turkey did not depend on their field of study, and the present findings for most students at Krishnagar Government College in West Bengal, India, are consistent with this observation. However, some students from the Political Science and Philosophy departments exhibited

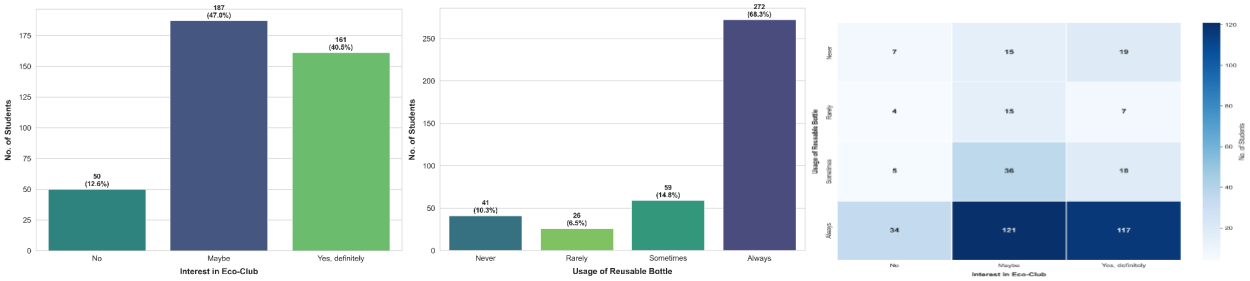

Figure 7. *Sustainable habits and environmental attitudes.*

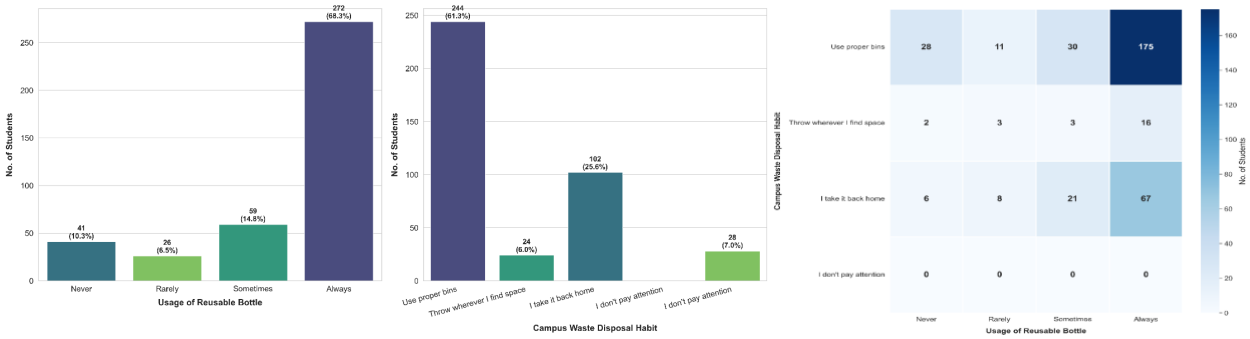

Figure 8. *Campus waste disposal practices and their association with sustainable habits.*

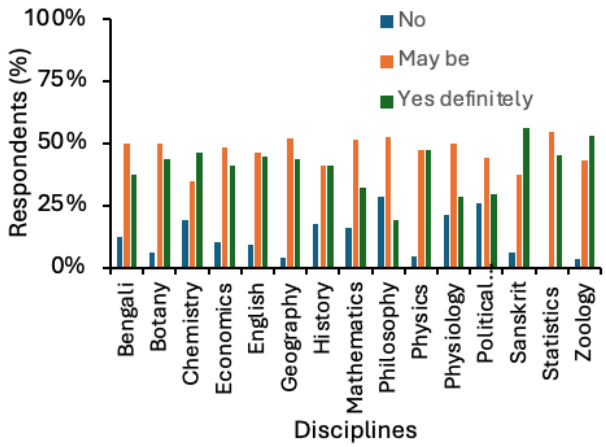

Figure 9. *Department wise comparison of responses, indicating the interest to join eco-club or green initiative.*

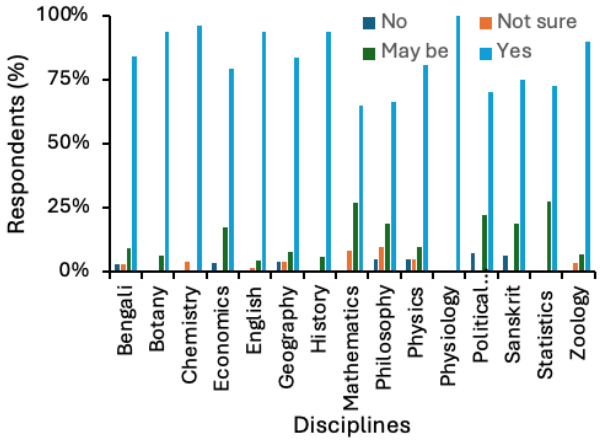

Figure 10. *Department wise comparison of responses, indicating the need for environmental education in the curriculum.*

different behaviors. Given that students from the Political Science department experienced the greatest impact of excessive screen time on daily life activities, this factor may have had a confounding effect on their environmental attitude.

3.4 Digital behavior vs health and academic well-being

To investigate whether screen time and academic stress were associated, a Chi-Square test of independence was performed, which resulted in a *p*-value of 0.006. This indicates a significant association between screen time and academic stress. To examine the monotonic relationship between the frequency of phone checking habit and reported difficulty in concentrating, a Spearman's rank correlation analysis was performed. The correlation coefficient (ρ) was 0.26 with a *p*-value of <0.0001, indicating a significant positive monotonic relationship. As phone-checking frequency increased, so did the difficulty in maintaining concentration. To assess whether sleep duration differed based on the level of bedtime phone use, a Kruskal–Wallis H test (non-parametric ANOVA) was conducted. The resulting *p*-value of 0.6026 indicated no significant difference in sleep duration across groups based on bedtime phone use.

The results further showed that academic stress and concentration difficulty were positively correlated (ρ = 0.47, **Fig. S13**). Students with higher levels of academic stress tended to experience greater difficulty concentrating while studying, indicating a notable association between psychological strain and cognitive performance, consistent with the findings of Khan et al. (2024). Screen time and concentration difficulty were also positively correlated (ρ = 0.36), with participants reporting greater disruption from screen time experiencing more frequent challenges in sustaining focus during academic tasks, consistent with the findings of Feng et al. (2025). The correlation heatmap suggests the presence of a potential digital-stress-cognitive disruption loop, in which greater screen engagement contributes to subjective disruption, which in turn was associated with heightened academic stress and impaired concentration. Interestingly, sleep duration did not appear to mediate these relationships, suggesting that while students may preserve the number of hours slept, the restorative quality or cognitive benefits of sleep could be diminished—potentially due to pre-sleep phone use or psychological stress.

K-means clustering was applied to identify possible clusters within the dataset. The analysis revealed three clusters, in which the daily average phone use was similar across groups, approximately three hours. However, average concentration difficulty differed significantly among the clusters. These findings suggest that targeted interventions may be necessary to address concentration difficulties and support students' mental well-being.

4 Discussion

The results indicate that digital habits have a significant impact on students' mental well-being. Screen time duration was positive correlated with academic stress, consistent with the findings of Liu et al. (2022), who reported a significant positive association between screen time and academic stress in a longitudinal cohort study of students aged between 10 and 19 years in Shanghai, China. Similarly, phone-checking frequency was positively correlated with difficulty concentrating during study sessions. Regarding relaxation strategies, most students preferred sleeping, whereas only a small proportion engaged in sports activities.

Notably, bedtime phone use did not significantly affect sleep duration. Digital over-exposure and the resulting digital-stress-cognitive disruption were frequent across disciplines. Feng et al. (2025) observed a negative association between screen time and academic performance in Chinese, Mathematics, and English. Their findings indicated similar effects on Mathematics and English, with slightly lower impact on Chinese, aligning with the present study, which found that academic stress and cognitive disruption were frequent, irrespective of students' disciplines or subjects of study. These findings highlight the need for academic institutions to implement initiatives aimed at improving digital habits, promoting mental health, and fostering active stress-relief strategies. Awareness campaigns, structured programs for mental well-being, and interventions targeting digital overexposure may help reduce academic stress and enhance students' overall well-being.

The environmental attitudes among students and their habits towards sustainability practices did not depend on their subject of study. Students from multiple disciplines demonstrated high enthusiasm towards the necessity of environmental education. The findings were consistent with Müderrisoglu and Altanlar (2010), where they conducted the study on university students in Turkey. Environmental attitudes did not always ensure sustainable environmental habits. It is necessary to take initiatives for developing sustainable environmental habits along with environmental awareness by expanding environmental education and adopting a green initiatives campaign. In the study conducted by Bass et al. (2025) on medical students' attitudes towards healthcare sustainability in the USA, the authors reported comparable levels of student motivation regarding the need for policy implementation and participation in sustainability initiatives aimed at improving the environmental sustainability of healthcare practices.

This study was conducted based on responses from 398 students from 15 different subjects. The percentage of responses was almost 16% to 18% of the total student strength. From the findings of this study, it can be concluded that the nearby and comparable regional educational institutions may have a similar scenario. The findings may not be globally generalizable, as there may be regional differences among students.

5 Conclusion

College students and/or young adults are the driving force of our future. By arranging frequent awareness campaigns for improving digital habits and mental well-being, and increasing participation in sustainable environmental activities, we can ensure a healthier future for the students as well as environmental sustainability. The findings of this study gave a strategic blueprint for academic institutions seeking to foster more resilient, reflective, and responsible student communities. In the future, the effectiveness of strategic interventions may be studied, and if those strategic interventions are found to be effective, they may be globally implemented by taking appropriate policies.

6 Data availability statement

The data will be made available upon reasonable request from the corresponding author. Additional data can be found in the supplementary information.

7 Ethical statements

All data used were collected via an anonymized online survey through appropriate channels, with informed consent obtained where applicable.

8 Conflict of interest

The authors declare that there are no financial or personal conflicts of interest that could have influenced the results of this study.

9 Author contributions

I. Ukil: Writing – original draft, Investigation, Data curation, and Visualization. S. Rana: Conceptualization, Formal analysis, Supervision, and Writing – review & editing. All authors approved the final version of the manuscript.

10 Copyright statement

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