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Analysis of Environmental Awareness Among University Students Through Online Community Participation

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Abstract

This study examines the role of online community participation in promoting environmental awareness among students of higher educational institution of Pakistan. With rising environmental challenges, digital platforms have become important in raising discussions, spreading awareness, and inspiring collective action. This research was conducted in higher education institutions of District Charsadda, Pakistan, using a quantitative methodology, where a structured questionnaire was used to assess the relationship between online engagement of students and their environmental awareness. A sample of 374 respondents was selected multistage random sampling method. The findings of the study show a significant positive association between online community participation and environmental awareness. Strong associations were found particularly with factors like **community collaboration, effective leadership, influence of social media, and future student involvement,** all showing high T^c values (up to 0.56). **Multivariate analysis shown gender and age differences,** Kendal T^c value for male gender indicated spurious relationship while for female gender found non- spurious relationship. The association between online community participation and environmental awareness in context of controlling age of the respondents shows highly significance and weak association for all three age groups. The study highlights the requisite of participating in digital tools, improving community collaboration, and establishing leadership to drive sustainable environmental engagement of citizens. These visions highlight the growing importance of online communities in shaping public attitudes and actions toward environmental protection.

Keywords: Online community participation, social media, environmental awareness, students

1. Introduction

In recent times, the global environment has experienced significant environmental changes due to human activities. These changes include poor water, air, and soil quality, increased water pollution, wildlife damage, loss of biodiversity, and more common natural disasters, leading to the loss of lives, properties, and the spread of diseases like cancer (Abbas, 2013). It is essential to raise awareness about the importance of our environment and the need to protect it, as well as the consequences of human actions. The goal of environmental education is to change human behavior toward responsible environmental protection and promote responsible citizenship in communities (Abbas & Singh, 2014).

Pakistan, is the fifth most populous country, faces water scarcity challenges due to its quickly growing population, climate change, insufficient infrastructure, and poor water management.

Water is a vital resource for survival and economic development, yet its proper handling and protection are very essential. Worldwide, about 43,000 km³ of renewable freshwater is available annually, with the majority used by agriculture (Mehmood et al., 2022).

Environmental sufferings have become a global issue, with countries and organizations wants to working together to talk about these environmental challenges (Scholtz et al., 2016). Raising environmental awareness and educating of the citizens are important ways to solve these issues. Media especially social media plays an important role in increasing environmental awareness (Haq et al., 2025; Scholtz et al., 2016).

Online communities have become an important part of people's lives, contributing a platform for discussion shared interests and goals. These online communities help to foster cooperation and collaboration, particularly on environmental issues like environmental protection (Bishop, 2003; Figallo, 1998). In order to achieve environmental sustainability, it is necessary to increase environmental awareness (Khan, 2021), and public participation of the environment in protection efforts. This study focuses on studying environmental awareness, approaches, and participation among students at Government Post Graduate Collage Charsadda and Bacha Khan University Charsadda, providing valuable understandings into how students engage with environmental issues.

2. Literature review

Across the world, environmental movements involve collective action, where individuals and communities work together to fight against deforestation, pollution, overpopulation, global warming and climate change (Dalton et al, 2003). This movement seeks to promote policies that address both human needs and the protection of the planet through social justice and resource sustainability (Castells, 2009; Dutta, 2012).

Digital tools play an important role in raising awareness and mobilizing communities. Online networks allow the coordination of campaigns, distributing of information, and policy modification. This is especially crucial in place where traditional activism is restricted such as in China where digital spaces enable civic engagement (Yang, 2005). Environmental organizations use both offline and online strategies, for Social media campaigns to protests demonstrating the power of new media in activism (Best & Kellner, 2001; Stanoevska-Slabeva & Schmid, 2001; Kahn & Kellner, 2004)

In developing countries like Pakistan, environmental problems are severe, with Pollution significantly impacting public health. The government has introduced policies such as the National Clean Air Policy (NCAP) 2023 to combat pollution. However, critics argue that these policies lack public engagements and collaboration with society and media, limiting their effectiveness (Ministry of Climate Change, 2023). Increasing public participation and awareness can strengthen environmental regulations and improve enforcement (Stern, 2000).

3. Research Methodology

The study adopted a quantitative research methodology, using a well-structured questionnaire for primary data collection which was developed in the light of the objectives of the study. It was conducted in higher education institutions in District Charsadda, Khyber Pakhtunkhwa, with a multi-stage random sampling procedure. Initially, the universe was set as District Charsadda, followed by the random selection of Bacha Khan University Charsadda and Government Post Graduate College Charsadda in the second stage. In the third stage, a sample of 374 students was drawn using Slovin's (1960) formula, ensuring proportional representation to both institutions (153 students from Bacha Khan University and 153 from Government Post Graduate Collage Charsadda) as the procedure adopted by (Nisar et al., 2022; Zia et al., 2022; Ullah, 2021; Nisar et al., 2021) . The conceptual framework focused on background variables such as gender and age as controlled variables, online community participation as independents variable and environmental

awareness as dependent variable. Data were collected using a Likert scale, the reliability of which was assessed through Cronbach's alpha, yielding values of 0.662 for online community participation and 0.630 for environmental awareness. SPSS version 25 was used for data analysis, including chi-square and Kendal T^c tests to examine the association between variables and multivariate analysis to account for gender and age as control variables. A pre-test with 25 respondents was conducted to polish the questionnaire and confirm clarity before the final data collection.

4. Data analysis

The data were analyzed into bivariate and multivariate as given below;

Bivariate analysis

Association between online community participation and environmental awareness

Online community participation improves environmental awareness by enabling sharing of information, fosters discussion about environmental issues, and promotes sustainable behavior. By connecting individuals from different backgrounds, these platforms can help us understand topics like climate change and pollution. Additionally, they also help to raise awareness of environmental campaigns by inspiring memberships to adopt a more sustainable lifestyle. Online communities play a crucial role in spreading awareness and powering global environmental movements. Table 1 shows associations between variation statements of online community participation and environmental awareness.

A significant and strong positive association was found between environmental awareness and community participation ($p=0.003$, $T^c=0.34$). Online discussions, particularly in digital communities, can significantly increase awareness of environmental issues and encourage greater participation in advocacy and policy dialogues. Environmental awareness may be slightly elevated through environmental activism, but knowledge or lack of motivation may impede the transformation into sustained action. In this chapter of the book, climate change is discussed in terms of how it is presented in media, including online forums. It explores the linking between online talks and increased environmental awareness, which can foster greater engagement in environmental advocacy and policy discussions (Moser, 2010).

Additional, a significant and week positive association was found between contribute in any environmental activism initiative in community and environmental awareness ($p=0.005$, $T^c=0.054$). Obstacles such as insufficient knowledge or lack of motivation can hinder individuals from converting their environmental consciousness into action, which results in a weak relationship between participation in activism and awareness. The challenges that stop individuals from turning their environmental awareness into action and suggest that the limited positive correlation between active involvement and environmental awareness may be result of these knowledge or motivation gaps. It points out that engaging in community activism can marginally enhance awareness but also emphasizes that awareness does not necessarily lead to greater activism or changes in behavior (Kollmuss & Agyeman, 2002).

Furthermore, collaboration among community members is important for successful environmental action had a significant and positive association with environmental awareness ($p=0.004$, $T^c=0.037$). Moreover, a significant and positive association was found between environmental awareness and working together as a community is effective in addressing environmental challenges ($p=0.004$, $T^c=0.56$). Engaging in community collaboration improves both environmental consciousness and the capacity to address local environmental issues, as collective efforts promote a deeper comprehension of problems and effective solutions. The work of Pretty on social capital demonstrates that cooperation among residents can boost both environmental understanding and the ability to confront local environmental challenges. When communities unite, they enhance their grasp of environmental problems and create viable solutions, which are

consistent with your findings that teamwork is linked to increased awareness and more successful environmental actions (Pretty, 2003). The individuals who work together on environmental matters are more inclined to feel a stronger sense of responsibility for the environment, reinforcing the positive correlation between collaboration and awareness identified in your study (Stern, Dietz & Guagnano, 1995).

Similarly, a significant and positive association ($p=0.003$, $T^c=0.54$) was found between environmental awareness the involvement of students in environmental awareness in future. Environmental awareness serves as a significant driver for pro-environmental behaviors, motivating individuals to take part in efforts aimed at tackling environmental issues. A heightened sense of awareness is strongly associated with intentions to act pro-environmentally in the future, leading individuals to become more inclined to join environmental initiatives. Environmental awareness is crucial in inspiring people to adopt pro-environmental behaviors. It indicates that those who have a greater understanding of environmental problems are more likely to show interest in engaging in environmental activities later on; as such awareness often heightens concerns regarding the condition of the environment (Kollmuss & Agyeman, 2002). Environmental awareness is closely linked to future intentions regarding environmental action. Those people who become increasingly conscious of environmental issues tend to be more willing to engage in pro-environmental actions in the future, such as participating in environmental initiatives (Gifford & Nilsson, 2014).

Furthermore, effective leadership inspire and empower community members to get involved in environmental awareness had a significant and strong association with environmental awareness ($p=0.001$, $T^c=0.54$). Similarly, a significant and positive association was found between environmental awareness the provision of opportunities and support for environmental awareness by local organizations ($p=.001$, $T^c=0.44$). Transformational leadership motivates joint efforts and heightens environmental consciousness by harmonizing the objectives of followers with ecological priorities. Arnstein (2019) framework underscores that strong leadership enables communities, resulting in enhanced participation and active involvement in environmental matters. Northouse's analysis of leadership theory illustrates how transformational leadership can motivate individuals to participate in collaborative actions, particularly for environmental initiatives. Transformational leaders empower their followers by supporting their aspirations with ecological goals, which increases environmental awareness and engagement (Northouse, 2025). The leaders have the ability to enable communities and promote their involvement in social and environmental issues, strengthening the connection between leadership and sustainability (Arnstein, 2019).

Moreover, a highly significant and positive association ($p=0.000$, $T^c=0.35$) exhibited between environmental awareness and social media has the power to mobilize communities for environmental action. While a significant and positive association was found between taking action on environmental issues after seeing them on social media and environmental awareness ($p=.004$, $T^c.52$). By promoting awareness of social and environmental concerns, social media enables the connection between people economy. It explores how social networks contribute to environmental communications, foster relationships, and inspire greater political and environmental engagement. Specifically speaking, Social media can play an essential role in raising awareness about social issues, such as environmental impact, and inspire individuals to come together for environmental action (Boulianne, 2015). By using social media platforms, individuals can gain information about political issues and the environment by increasing their connections and engaging with topics they learn about (Gonzalez-Bailon, Kaltenbrunner & Banchs, 2010).

Finally, a significant and week association ($p=0.002$, $T^c.011$) was found between environmental awareness and the involvement of students in online discussion or campaigns related to environmental issues. Similarly, a significant and weak association was found between online

communities or groups devoted to environmental issues and environmental awareness (p=0.001, T^c =0.012). Online communities focused on topics such as environmentalism help to raise awareness and encourage collaboration among people. These communities can discreetly increase environmental awareness and political participation, as stated by Tufekci and Wilson (2012). Those who engage in online discussions that highlight particular subjects, like those related to the environment, are more likely to possess a deeper understanding of these topics. Online groups are crucial for raising environmental awareness and advocating for collective action. The participation of individuals in online organizations that support specific causes, such as environmentalism, can enhance their comprehension of these topics (Gonzalez-Bailon, Kaltenbrunner & Banchs, 2010).
This study underlines the important effect of community partnerships, leadership, and social media in improving environmental consciousness. Even though engaging in activism and online conversations can slightly raise awareness, barriers such as gaps in knowledge or insufficient motivation could hinder meaningful action. Effective leadership and community involvement play a crucial role in promoting pro-environmental behaviors and encouraging future participation. Additionally, social media enhances environmental messages, promoting collective efforts and raising awareness.

Table 1 Association between Online community participation and environmental awareness

STATEMENTS	**Dependent variable**	**Statistics**
Do you believe community participation is important for environmental awareness?	Environmental awareness	χ^2 =40.56 P=0.003 T^c= 0.34
Have you participate in any environmental activism initiatives in your community?	Environmental awareness	χ^2 =4.66 P=0.005 T^c=0.054
Do you believe that collaboration among community members is important for successful environmental action?	Environmental awareness	χ^2 =3.34 P=0.004 T^c=0.037
Would you be interested being more involve in environmental awareness in the future?	Environmental awareness	χ^2 = 40.5 P=0.003 T^c= 0.54
Do you believe that working together as a community is effective in addressing environmental challenges?	Environmental awareness	χ^2 = 63.00 P=0.004 T^c= 0.56
Do you believe that effective leadership inspire and empower community members to get involved in environmental awareness?	Environmental awareness	χ^2 =68.65 P=0.001 T^c=0.54
Do you believe that local organizations provide opportunities and support for environmental involvement?	Environmental awareness	χ^2 =55.87 P=0.001 T^c= 0.44
Do you believe that social media has the power to mobilize communities for environmental action?	Environmental awareness	χ^2 =46.54 P=0.000 T^c= 0.35
Have you ever taken action on environmental issues after seeing them on social media?	Environmental awareness	χ^2 =9.23 P=0.004 T^c=0.52
Have you ever participated in online discussions or campaigns related to environmental issues?	Environmental awareness	χ^2 = 6.32 P=0.002

		T^c=0.011
Have you ever joined online communities or groups dedicated to environmental issues?	Environmental awareness	χ^2 =30.6 P=0.001 T^c= 0.012

Multivariate analysis

Association between online community participation and environmental awareness among students while controlling (gender).

Table 2 indicates a significant association between online community participation and environmental awareness among students in context of gender of the respondents which a highly significant and weak positive association (P = 0.000, T^c = 0.02) for male respondents. Similarly, the association between online community participation and environmental awareness shows highly significant and weak positive association (P=0.000, T^c = 0.12). The results emphasize the critical role of online community participation in fostering environmental awareness, with notable differences in engagement and awareness across gender groups. Value of level of significance and T^c for entire table show highly significance and weak positive (P=0.000, T^c =0.03) association between online community participation and environmental awareness for both the genders. Kendal T^c and Chi-square significance values for male gender indicated that association of online community participation and environmental awareness was spurious (P=0.000, T^c =0.02), while for female respondents the association was non-spurious (P=0.000, T^c =0.12). Thus the relationship of digital advocacy skills and environmental awareness was not similar for both the genders. The disparity probably arises from differences in engagement and responsiveness based on gender. Males might be affected by external influences, such as peer or societal expectations, which cloud the clear relationship between online involvement and environmental consciousness. In contrast, females may experience a more straightforward association between their participation and awareness, indicating distinct engagement behaviors or perspectives regarding environmental matters.

Additionally, community Participation use significantly enhanced the level of awareness on environmental awareness in the society since it statistically exhibited a positive relationship with the dependent variable (Murungi, 2018). According to the findings of Zeel & Alam (2016), social media usage is an essential element that can be utilized to raise environmental awareness. Zelezny & Aldrich, (2000) and others have shown that online participation may promote advocacy and improve environmental attitudes and behaviors by drawing attention to gender differences. Individuals in online communities with significant digital activity can use advocacy tools to improve their environmental practices (Macagnon & Walton, 2014). Perceptions and actions about their environment are influenced by gender differences. Why? Research suggests however, such measures of concern for environmental issues are often very different from one gender to the other and vary depending on social upbringing as well as educational experience in environmental engineering or education. Online communities and advocacy channels may either strengthen or weaken the gender-based divide in environmental perspectives, as per the researchers (Zelezny, Chua & Aldrich 2000).

The combination of these research efforts demonstrates the power of participation in online communities to significantly enhance environmental awareness. Furthermore, gender differences in environmental attitudes and behaviors that are emphasized in digital media are strongly correlated with your research findings. These comments highlight the need to consider gender-related factors when examining how digital activities affect environmental inclusion and understanding.

Table 2 Association between online community participation and environmental awareness among students while controlling (gender)

Gender	Relationship with Online community participation	Level of Environmental awareness			Total	Statistics	Overall statistics of Entire table
		High level of Environmental awareness	Moderate level of Environmental awareness	Low level of Environmental awareness			
Male	High level of online community participation	69 (62.6%)	11 (10.0%)	30 (27.4%)	110 (100%)	χ^2=63.32 P=0.000 T^c=0.02	χ^2 =65.48 P =0.000 T =0.03
	Moderate level of online community participation	66 (69.9%)	00 (0.0%)	29 (30.1%)	95 (100%)		
	Low level of online community participation	22 (39.3%)	29 (51.7%)	05 (8.0%)	56 (100%)		
Female	High level of online community participation	24 (54.4%)	06 (13.7%)	24 (32.8%)	44 (100%)	χ^2 =50.006 P=0.000 T = 0.12	
	Moderate level of online community participation	30 (71.3%)	12 (28.7%)	00 (0.0%)	42 (100%)		
	Low level of online community participation	10 (37.0%)	14 (51.8%)	03 (11.2%)	27 (100%)		

Association between online community participation and environmental awareness while controlling (Age).

Results in table 3 shows the association between online community participation and environmental awareness in the context of controlling age of the respondents found significant and positive (P=0.000 and T^c = 0.133) for age group under 20 years. Likewise, the association between the above variables was found highly significant and positive (P=0.000 and T^c = 0.162) for the age group of 21-30. Similarly, the association between online community participation and environmental; awareness while controlling age was found significant and positive (P=0.000 and T^c =0.210) for the age group above 30 years. Value of level of significance and T^c for entire table show highly significance and weak (P=0.000, T^c =0.189) association between online community participation and environmental awareness for all three age groups. Kendal T^c and Chi-square significance values for under 20 years of the respondents indicated that association between access

to information and environmental awareness was non-spurious (P=0.000, T^c =0.133). Similarly, for age group of 20-30 and above 30 years of respondents was non-spurious (P=0.000, T^c =0.162, P=0.000, T^c =0.162) respectively. Thus the relationship of access to information and environmental awareness was similar for all the age group. The findings reveal a significant and positive link between online community's participation and environmental awareness across various age groups. For those younger than 20, the correlation is significant, with a T^c value of 0.143, reflecting a moderate relationship. In the 21-30 age brackets, the association intensifies, with a T^c of 0.172, indicating a more notable impact. The most robust positive correlation appears in individuals over 30, with a T^c of 0.220, suggesting that older individuals may be more affected by online communities regarding environmental consciousness.

Engagement in online communities has a beneficial effect on environmental awareness, with the influence becoming increasingly stronger as age rises. Online engagement fosters a sense of civic responsibility, which is crucial for raising awareness about environmental concerns. The influence of age on online participation is evident in the impact that attitudes towards the environment can and do, particularly with younger individuals (Boulianne, 2009). While younger adults are more common users of digital platforms, older adults are progressively attractive with online communities in expressive ways, particularly around issues like sustainability and the environment. According to Smith (2014), the data indicates a growing interest in environmental online communities among those aged 30 and above.

Study indicates that participation in online communities tends to increase environmental consciousness among different age groups, with the relationship becoming more positive as individuals aged. Those aged under 20 tend to be more active on the internet but may exhibit less consistent interest in environmental issues. In contrast, older adults tend to develop a stronger and more lasting commitment to environmental activism as they participate in these online communities.

Table 3 Association between Online community participation and environmental awareness while controlling (Age)

Age (in years)	Relationship with Online community participation	Level of Environmental awareness			Total	Statistics	Overall statistics of Entire table
		High level of environmental awareness	Moderate level of awareness	Low level of awareness			
Under 20	High level of Online community participation	32 (57.1%)	24 (42.9%)	0 (0.0%)	56 (100%)	χ^2=306.665 P=0.000 T^C =0.133	
	Moderate level of Online community participation	28 (31.5%)	46 (54.7%)	15 (16.9%)	89 (100%)		

	Low level of Online community participation	17 (39.5%)	23 (53.5%)	3 (7.0%)	43 (100%)		
21-30	High level of Online community participation	22 (68.8%)	10 (31.3%)	0 (0.0%)	32 (100%)	χ^2=222.4563 P=0.000 T^C =0.162	χ^2=628.011 P=0.000 T^C =0.189
	Moderate level of Online community participation	10 (16.1%)	39 (62.9%)	13 (21.0%)	62 (100%)		
	Low level of Online community participation	7 (36.8%)	6 (28.6%)	6 (32,6%)	19 (100%)		
30 and above	High level of Online community participation	09 (31.2%)	10 (34.4%)	10 (34.4%)	29 (100%)	χ^2=117.247 P=0.000 T^C =0.210	
	Moderate level of Online community participation	08 (34.9%)	09 (13.1%)	06 (26.0%)	23 (100%)		
	Low level of Online community participation	08 (38.9%)	06 (28.0%)	07 (33.3%)	21 (100%)		

5. Conclusions and recommendations

This study highlights the significant role of online community participation in promoting environmental awareness among students. Findings disclose a strong positive association between student's engagements in online communities and their level of environmental consciousness. Through digital channels like social media, we can share information about the environment while also mobilizing our communities and promoting sustainable behaviors. Leadership, community collaboration, and social networking sites play a vital role in inspiring students to take action toward environmental sustainability. However, barriers such as knowledge gaps, lack of motivation, and digital disparities among marginalized communities hinder the full realization of environmental awareness. Despite these challenges, online engagement remains a powerful avenue for enhancing students' understanding of environmental issues and encouraging their participation in pro-environmental initiatives. The study recommended that through training programs for students to improve their digital skills, including environmental education in curriculum,

collaboration among students and local organization and with the use of social media platform, the student's participation in environmental related issues could be improved.

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