

Environmental Change Communication in The Digital Age: Social Media, Misinformation, and Mobilization among University Students in Punjab, Pakistan

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ABSTRACT

Social media has rapidly changed how university students receive, understand, and react to information on environmental change. Digital platforms offer a space for environmental awareness and public engagement, but misinformation can also jeopardize trust in such platforms and hinder action. This study aims to explore the role of social media in environmental change communication, focusing specifically on environmental awareness, misinformation, information credibility, digital literacy, and environmental mobilization among university students in Punjab, Pakistan. The survey method was adopted as the quantitative and cross-sectional survey design was adopted, and a structured questionnaire on a five-point Likert scale was used. The students of the universities of different regions of Punjab who were from both public and private universities were sampled. Descriptive statistics, reliability analysis, correlation, multiple regression, and mediation and moderation analysis were conducted. The results show that students have a high level of environmental awareness and often get environmental information from social media. But environmental mobilization is still relatively low, with a huge disparity between awareness and active involvement in environmental activities. The results also show moderate levels of environmental misinformation, such as inaccurate information, overstated information, contradictory sources, and manipulated visuals. Information credibility was found to be positively related to environmental engagement, and misinformation was negatively related to mobilization, but digital literacy was not. Digital literacy was not found to be associated with either environmental engagement or mobilization, whereas information credibility was positively related to environmental engagement and misinformation was negatively related to mobilization. Social media environmental communication and digital literacy partially mediated the relationship between environmental awareness and mobilization, and misinformation negatively affected environmental participation through environmental awareness. The study finds that social media is very effective at creating awareness about environmental issues and also, to a lesser extent, effective at inducing collective action towards environmental issues, but not very effective at sustaining the action. To close the awareness-action gap among the youth in Pakistan, digital and environmental literacy can be reinforced, the credibility of the online environmental communication can be enhanced, and interactive campaigns can be designed to promote action offline.

Keywords: environmental change communication; social media; environmental misinformation; environmental awareness; digital literacy; environmental mobilization; university students; Punjab; Pakistan

INTRODUCTION

In today's society, environmental change is one of the most important challenges. Climate change, extreme temperatures, flooding, high levels of air pollution, water scarcity, loss of biodiversity, deforestation, and environmental degradation are impacting communities and public institutions more and more. But environmental change is not just a scientific/ecological issue; it is also a communications issue. Individuals require information that is easy to access, credible, understandable, and timely to allow them to identify environmental hazards and make decisions about what to do.

Social media has revolutionized the way we communicate about the environment. Facebook, YouTube, Instagram, TikTok, X (also known as Twitter), and WhatsApp are all platforms that allow people to be almost instantly reached with environmental information. These platforms, unlike traditional mass media, permit their viewers to comment, share, remix, discuss, and produce content. The communication about the environment has thus become more participatory and decentralized.

University students are a particularly important group in this context of changing communication. Youth are one of the most active groups when it comes to using digital platforms, and they are seeing environmental information more and more via social platforms. Research in Pakistan has also shown that social media is a key source of climate and environmental information for youth and university students.

More access to environmental information does not always lead to more understanding of the environment. Credible information and misinformation exist within social media environments. Sometimes, misleading environmental claims spread quickly through sharing networks, sometimes along with sound scientific information. Users are likely to find images that have been manipulated, exaggerated claims, misleading statistics, inaccurate descriptions of environmental events, and unsupported explanations of climate phenomena. This means that there is a communication paradox. Social media can be used to raise awareness of the environment but also expose people to unreliable information.

The second important one is between awareness and action. Often in environmental communication campaigns it is assumed that disseminating information will create an incentive for individuals to change their behavior or engage in environmental activities. But just because people are aware doesn't mean they will mobilize. People might know about environmental issues, but they are still not taking action because they feel not a single thing they can do or because there are no opportunities for them to act, or because they are not trusted, or because there is not enough institutional support, or because they can't see how to become involved.

In the present study, however, the three dimensions of digital environmental communication are of mutual interest, namely, awareness, misinformation, and mobilization. In particular, it examines students of universities in Punjab, Pakistan, and explores whether social media environmental communication is more likely to raise awareness and mobilize students and if misinformation is a constraint to meaningful environmental engagement.

Background of the Study

Digital Transformation of Environmental Communication

Government agencies, scientists, journalists, and environmental organizations dominated traditional environmental communication. The current structure has been transformed by digital media, which provides the opportunity for ordinary users to engage in environmental communication.

Social media enables rapid spread of environmental messages, environmental awareness campaigns, public discussion, citizen reporting, environmental advocacy, online petitions, fundraising,

community mobilization and coordination of offline environmental activities. Social media has a participatory nature, and recipients are no longer just receivers of environmental messages. They are able to be consumers, producers, interpreters, and distributors of information at the same time.

Social Media and Environmental Awareness

Environmental awareness is the awareness of environmental issues, their causes, their effects, and solutions.

Social media can help by providing users with, climate-related news, scientific information, environmental documentaries, infographics, videos, government warnings, environmental campaigns, expert discussions and affected communities' experiences.

These sources can be used by the university students as a tool for supplementing their formal learning in the classroom and as a source of constant exposure to environmental issues. Exposures should not be equated with knowledge, however. Equally, the quality, credibility, and interpretation of information are important.

Environmental Misinformation

Environmental misinformation is information that is incorrect, misleading, distorted, or unsupported regarding environmental and climate-related matters.

Examples may include, false information on climate change, misleading environmental statistics, Photographs that have been manipulated to show environmental disasters, fabricated scientific claims, exaggerated environmental threats, false information about government environmental policies and false statements regarding climate-related events or their implications. It is a big issue in social media contexts because algorithms and social networks can help spread emotionally compelling information quickly.

Awareness to Mobilization

Environmental mobilization is the level of people's behavior of going from passive awareness to participation and action. It can include, sharing environmental information, learn to engage in online conversations, supporting environmental campaigns, signing petitions, joining environmental groups, attending environmental activities, promoting environmental policies and incorporating environmentally friendly practices.

One of the key hypotheses that are explored in this study is that awareness must lead to mobilization, but this link is not necessarily a given.

Problem Statement

The opportunities of social media are unparalleled in the field of communication in Pakistan about the environment. University students have access to environmental information via various digital platforms and are able to discuss environmental issues without relying solely on conventional communication channels. The simultaneous presence of credible information and misinformation is, however, a great challenge. Students may be very conscious of the issues they face with the environment and at the same time be presented with incorrect information. Furthermore, the consciousness about the environment does not guarantee environmental mobilization.

Thus, it becomes important to see how well digital environmental communication is achieving either an informed and active student population or primarily an awareness but relatively passive audience.

This study fills this gap by investigating social media environmental communication, misinformation, environmental awareness, and environmental mobilization among the university students of Punjab.

Objectives of the Study

The study aimed to:

- To examine the relationship between social media environmental communication and environmental awareness.
- To study the association between environmental awareness and environmental mobilization.
- To assess the relationship between social media environmental communication and environmental mobilization.
- To understand the association between environmental misinformation and perceived environmental information credibility.
- To evaluate the influence of environmental misinformation on the environmental mobilization.
- To study the relationship between perceived credibility of environmental information and environmental mobilization.
- To assess the influence of social media environmental communication on environmental mobilization.
- To examine the influence of digital media literacy on the exposure to misinformation.

Research Questions

- **RQ1:** What is the relationship between social media environmental communication and environmental awareness?
- **RQ2:** Is environmental awareness positively related to environmental mobilization?
- **RQ3:** Is there a relationship between social media environmental communication and environmental mobilization?
- **RQ4:** Is exposure to environmental misinformation negatively correlated with perceived environmental information credibility?
- **RQ5:** Is there an influence of environmental misinformation on the environmental mobilization?
- **RQ6:** What is the relationship between perceived credibility of environmental information and environmental mobilization?
- **RQ7:** Does social media environmental communication influence environmental mobilization.
- **RQ8:** Does digital media literacy has an influence on the exposure to the environmental misinformation.

HYPOTHESES

- **H1:** There is a positive relationship between social media environmental communication and environmental awareness.
- **H2:** Environmental awareness is positively related to environmental mobilization.
- **H3:** There is a positive relationship between social media environmental communication and environmental mobilization.
- **H4:** Exposure to environmental misinformation is negatively correlated with perceived environmental information credibility.
- **H5:** Environmental misinformation is negatively correlated with environmental mobilization.
- **H6:** Perceived credibility of environmental information is positively related to the environmental mobilization.
- **H7:** Social media environmental communication influences environmental mobilization.
- **H8:** Digital media literacy has an influence the exposure to the environmental misinformation.

LITERATURE REVIEW

Environmental Change Communication in the Digital Age

The nature of environmental change communication has begun to move from mass media to interactive and participatory digital communication. Social media is no longer just a medium for sharing environmental information but a space where scientific information, public opinion, activism, and misinformation, as well as different interpretations of climate change, are all playing out. Earlier research, then, rethinks digital environmental communication as a process of multi-directional information exposure, discussion of information between people, credibility evaluation, participation, and mobilization.

Sultana et al. (2024) provide evidence for social media's increasing role within the context of climate change communication from a systematic review. After reading 1,057 publications and identifying 45 specifically relevant studies, the authors discovered that Twitter/X has been extensively studied in the past and that social media research has increasingly been focused on awareness, public perceptions, activism, polarization, and misinformation. In their review, they highlight the potential of social media to both position and pose problems of climate information, ideology, and disunity of public communication.

In line with Schäfer (2025), social media has become an increasingly salient medium for communicating about climate change, and generative artificial intelligence has brought new opportunities and communication risks. The media landscape has shifted, making climate communication more complex than ever before, with no longer being a one-way message from scientists or institutions to the audience. Rather, users interactively interpret, reproduce, comment on, remix, and challenge environmental information.

Jia et al. (2024) conducted a study of over one million posts on Weibo, highlighting the evolution of online environmental communication. Through their longitudinal analysis, they found that the topic of the impacts of climate change was the main focus of the conversation online, with celebrities, regular

users, and civil society actors also being significant actors as agenda setters. Importantly, however, attention was not given to action advocacy as much as to discussion of environmental impacts. In fact, the present study is relevant to this finding, as it implies that environmental information exposure does not necessarily correspond to environmental mobilization.

A similar finding was drawn by Elroy et al. (2024) on the basis of a computational analysis of 333,635 tweets associated with climate. They found four broad narrative clusters: human causation, scientific arguments, policy discussions, and conspiracy narratives. There is an overlapping information landscape in which social media users receive climate information, as shown by the scientific and conspiratorial narratives.

Therefore, current environmental communication studies are gaining a growing awareness of the dual nature of social media, as a platform for environmental awareness and public participation and as a medium for misinformation, contestation, and information disorder.

Social Media and Environmental Awareness

The value of digital environmental communication is frequently noted as its ability to raise environmental and climate awareness. Social media makes environmental information accessible in very easy-to-understand formats like short videos, infographics, photographs, hashtags, discussions, and influencer content to young people.

Food insecurity in Pakistan is especially relevant evidence provided by Hingorjo et al. (2024). They conducted a survey of 600 students from six public sector universities in Sindh and found that digital media was positively influencing the engagement of students in university in relation to climate change communication. Students were drawn to posts with videos and images that were relevant and with content that was based on research. The authors also discovered, however, that once again, engagement often was limited to “likes” and “shares.”

A total of 376 university students in Islamabad were examined by Younis and Ahmed (2024), and they discovered a significant positive association between social networking-site exposure and climate activism. They found that $r = .457$ and social networking exposure accounted for about 32% of the variance in climate activism. The results indicate that social media can have a long-term effect on climate-related information, which can go beyond awareness to environmental advocacy.

Ali and Muslim (2026) conducted a more recent study in Pakistan in which they found that digital and social media were the most frequently mentioned sources of climate information among the respondents of Punjab. However, research institutes and peer-reviewed journals continued to be the most trustworthy sources. This finding shows that there is an important difference between information reach and information credibility; audiences can primarily get environmental information from social media but assign higher epistemic authority to the scientific institutions.

Likewise, a 2026 study among university students in Islamabad revealed a significant relationship between media awareness and perceptions of climate change and the responses to adaptation. The study found that media awareness was positively associated with perceptions of climate change and that there was a need for increased climate journalism and social media advocacy.

This is confirmed by international evidence. A study by Arnot et al. (2024), which included 500 young Australians (aged 15-24), showed that social media was seen as an important communication space for climate awareness and climate action by the young people. Their research shows that young viewers are increasingly expecting climate communication to be accessible and engaging and to fit the nature of digital platforms.

These studies collectively suggest a strong possibility of social media to raise environmental awareness among youth. But the evidence also indicates that awareness is not the same as action, either individual or collective, that lasts.

Social Media, Engagement, and Environmental Mobilization

Awareness and mobilization are important distinctions for present research. Social media may not always provoke more intensive forms of environmental engagement, but it can certainly draw attention to environmental issues for individual actors.

In their review on climate activism, social media, and behavioral change, Gaupp and Eker (2024) suggest that climate action takes place on several levels: lifestyle change, activism, public opinion, and social pressure. Their review focuses on the linkage between youth action and social media use but also indicates that social media use is but one part of a larger process of behavior and politics.

Through Instagram analysis, Stoddart et al. (2025) identified 2,417 posts linked to COP26 and demonstrated that Instagram was a key platform for climate communication and mobilization. The platform was used to discuss climate justice, Indigenous rights, and individual action, and celebrity and political figures were prominent in forming the discourse. The results indicate that the potential of visual social media to stimulate political participation can also foster personalization and celebritization of climate politics.

A similar study to this was undertaken by Di Martino (2025), who investigated the School Strike 4 Climate movement in Sydney, identifying how young climate activists deployed Instagram and TikTok for the purposes of promoting climate action. The study was an introduction to the concept of “strategic authenticity,” which is a process of the young activists' combining the professionally created message with humor, sharing the contents of online culture, and creating authentic communication. It indicates that effective digital mobilization could be not only the provision of environmental information but also the cultural relevance of the messages to the target group of young people.

Hannouch and Milstein (2025) also show that Instagram can be used to facilitate young women activists' environmental identity formation. Their research confirms that social media communication can play a role in building eco-centric identity and environmental activism, not simply passing along environmental facts.

However, Mede et al. (2025) add an important qualification. They assessed young adults age 18-29 on four dimensions: climate knowledge, social media use, and interpersonal communication, with three waves of the study conducted over time. Their research examines the potential of some young people having unrealistic or a lack of climate knowledge, thus suggesting that repeated exposure to climate change does not ensure that climate is understood.

Thus, the concept of exposure and engagement versus mobilization is a key ingredient of the current study. While previous research indicates that social media can be very successful in attracting attention and helping to invite low-cost participation, the shift from “liking” to “sharing” and commenting to sustained environmental participation is less clear.

Visual Communication and Environmental Engagement

The method by which information is conveyed also has an impact on the effectiveness of environmental communication. Today, social media is a visual medium, so the use of photographs, videos, maps, infographics, and other multimodal information is becoming more and more relevant in the field of environmental communication.

Qian et al. (2024) analyzed a sample of 4,517 climate-related images uploaded by climate advocacy organizations to Twitter and Instagram. They narrowed it down to five categories of visual content: infographics/captioned images, nature and wildlife, climate activism, technology, and data visualization. Instagram and Twitter, importantly, exhibited different visual patterns, thus suggesting the need for tailoring environmental communication strategies to each platform.

They found that the same type of environmental message can create varying levels of engagement across the platform, visual design, and presentation format. This is relevant to students at university, as young age groups often experience environmental problems in short-form visual platforms, not through scientific reports.

Researchers in an experimental study of maps for climate-related social media posts found that maps made people feel more “legitimate,” even when they were written by dubious sources. It is important to realize that this signifies the value of visual design in influencing credibility judgments without necessarily affecting the factual quality of information (Taylor & Francis Online). The results stress that what matters is the presence or absence of information in the environment but also the capacity to assess critically the credibility of encountered information.

Environmental Misinformation and Information Disorder

One of the key challenges of digital environmental communication is environmental misinformation. In contrast to traditional misinformation environments, social media allows consumers to quickly copy and repost inaccurate claims, misinformation statistics, falsified photographs, emotionally charged narratives, and conspiracy theories.

Storani et al. (2025) examined over 20 million posts on social media platforms, including Facebook, Instagram, Twitter, and YouTube. They found that while the amount of content marked as unreliable was smaller than reliable content, the relative engagement of these two types was different on most platforms, with unreliable content having more. The result is significant, as it shows that misinformation does not have to be the majority of information to have a strong communicative effect.

Similarly, Essien (2025) also found in a meta-synthesis of climate-change disinformation research that digital infrastructures, ideological influences, and competing epistemic authorities are significant aspects of climate misinformation. The study highlights the potential impact of misinformation on public perceptions, policy reactions, and climate action.

The change of climate denial is another significant development. In the 2025 study of Twitter/X communication, it was discovered that the current day's climate misinformation also focuses on solutions to the climate rather than just a denial of its existence. Such stories can embrace climate change and describe proposed solutions as failing to work, being bad for the economy, being politically driven, or socially undesirable.

In their study of climate discussions on Twitter/X, Elroy et al. (2024) also found conspiracy narratives, as well as science and policy narratives. These narratives coexist, allowing users to be exposed to conflicting interpretations of environmental change in the same information environment.

Therefore, environmental disinformation must not be considered solely as a problem of information accuracy. It's also a communication and mobilization issue, as ambiguity and confusion can undermine trust in environmental information and make people less likely to take action.

Credibility, Digital Literacy, and Misinformation Resistance

Evaluating information credibility is now more important as users no longer can rely on the traditional journalistic gatekeeping system to get environmental information from social media.

In the study by Cresin (2024), he investigated students' own perceptions of the credibility of the information accessing social media about climate change. The study highlights the importance of science media literacy to evaluate information credibility that can be found through internet media. Students having credibility criteria does not guarantee that the criteria are actually applied in their actual social media use. The distinction is particularly applicable to the current study. A student can claim to access sources or assess evidence but accept environmental information because it comes from a popular influencer, with persuasive visuals, or from a large number of other users.

Anis (2026) provides particularly important evidence from Pakistan. The study focused on digital literacy, functional, critical, and AI-related, and resistance to climate information misinformation among the 400 university students who were surveyed in four provinces. Interestingly, there was no direct relationship between digital literacy measures and resistance to misinformation. In addition to technical skills, the author believes that trust, context, motivation, and civic engagement are vital to misinformation resilience.

The findings are a departure from a naive notion that simply boosting skills in the digital world will safeguard young people from misinformation. It is instead essential to teach digital literacy, which should involve not only critical evaluation and checking sources but also scientific reasoning, understanding of context, and a willingness to check information before sharing it.

The trouble is with AI-generated content. With the rise in ability to make realistic synthetic images and videos, visual evidence is no longer automatically reliable. Therefore, there is a need to have a stronger linkage between the concepts of digital literacy, scientific literacy, source credibility, and the detection of misinformation in today's context of environmental communication. Hence, it is proposed that there is a need for digital literacy, scientific literacy, source credibility, and the detection of misinformation to be linked together in a stronger manner in today's context of environmental communication.

Corrective Communication and Environmental Action

In fact, research has started to explore what users do when they come across misinformation. While slightly outside the confines of this period of publication, Freiling and Matthes (2023) offer a worthwhile conceptual backdrop for this area. They identified two-way relationships between correcting climate misinformation and environmental activism in their two-wave panel study of 549 participants. Climate-related anger was also positively related to correcting misinformation but was negatively related to environmental activism.

This indicates that disinformation is not inevitable when it comes to environmental participation. In some cases, when users come across misinformation, they might feel compelled to correct people and be more politically involved. But the results rely on emotional reactions, perceived effectiveness, and involvement in communicating appropriately.

Research on fact-checking interventions also indicates that fact-checking labels and social endorsement cues might affect the assessment and uptake of climate misinformation. Koch et al. (2023) concluded that fact-checking labels and social endorsement cues have the potential to be a threat to the credibility and engagement of fake news regarding climate change. This study was conducted prior to the current three-year period but is theoretically relevant to the credibility mechanism studied in the present study.

Environmental Awareness to Environmental Mobilization

An important theme emerging from the recent literature is the awareness–action gap. There are numerous studies showing that social media can enhance environmental knowledge, awareness, discussion, or symbolic participation, but significantly fewer studies showing that these advances in social media result in long-term behavior change.

Trott (2024) found that young climate justice activists saw a need for climate education in order to achieve a shift in society but also called out existing education for presenting a science-focused or depoliticized curriculum and failing to engage with action. Youth participants expressed action-oriented and justice-driven approaches to support youth in ways that enable them to engage in systems-level change.

Likewise, Hingorjo et al. (2024) conducted a study in Pakistan and revealed that students were often only able to like and share the digital climate communication. Liking and sharing may constitute symbolic or low-cost engagement, while volunteering, signing petitions, campaigning, changing behavior, and joining environmental organizations are more involved. This is significant for the current research, as these are activities considered to be less involved than the others.

However, Younis and Ahmed (2024) offer a slightly more positive finding: they found that there was a strong correlation between the social-network exposure of Islamabad university students and climate activism. However, the study also shows that some forms of activism are more influential than others and general social media exposure.

Synthesis of Recent Literature

The 20 recent studies reviewed above reveal five major patterns.

Firstly, social media has become an increasingly important source of environmental and climate information. Research studies all across Pakistan have consistently revealed that young people are regularly exposed to environmental information through digital platforms (Hingorjo et al., 2024; Younis & Ahmed, 2024; Ali & Muslim, 2026).

In addition, social media can effectively raise awareness and attention. Platform-specific communication, visual content, videos, and influencer/activist communication can help to raise engagement with environmental issues (Qian et al., 2024; Stoddart et al., 2025; Di Martino, 2025). Third, knowledge does not lead to ongoing action. A few studies show that there are differences between symbolic participation and higher levels of environmental action. In the context of university students in Pakistan, liking and sharing become a dominant form of participation, especially by the youth (Hingorjo et al., 2024).

Fourthly, misinformation poses a huge challenge when it comes to effective environmental communication. Inconsistent and inaccurate information about climate change can be amplified, spread on conspiracy and solution denial narratives, and leverage persuasive visual formats (Elroy et al., 2024; Storani et al., 2025; Essien, 2025).

Fifth, there can still be more than digital literacy. Besides technical digital skills, the credibility judgments are influenced by trust, context, motivation, scientific reasoning, and social factors (Kresin, 2024; Anis, 2026).

Research Gap

Although there have been several studies on digital environmental and climate communication, there are few gaps in the Pakistani context. First, the current Pakistani studies have focused mainly on

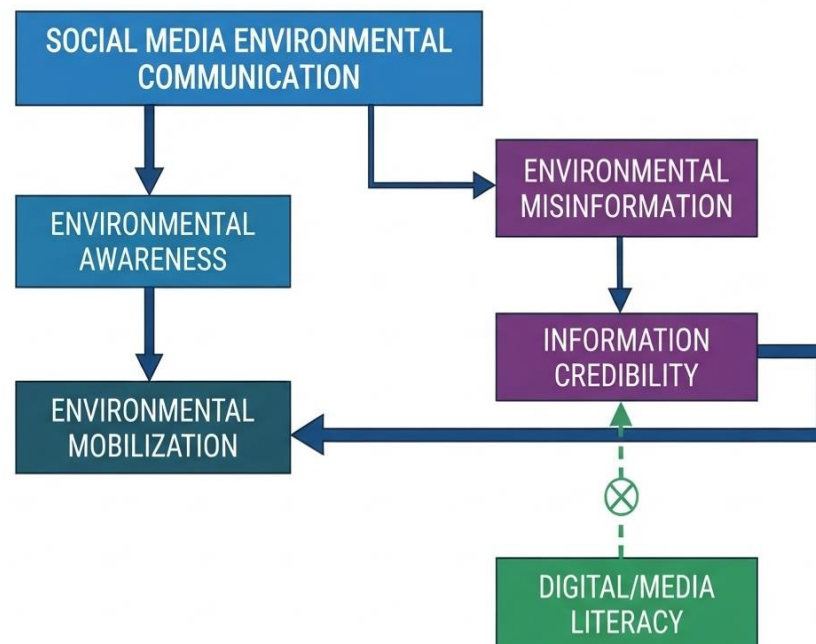
climate awareness, social-media exposure, or climate activism as distinct fields of study and have paid little attention to the interplay between social-media environmental communication, social-media misinformation, information credibility, digital literacy, climate awareness, and climate mobilization in one empirical framework. Second, existing studies are limited in scope; with recent studies predominantly focused on students at the University of Islamabad or particular geographical areas of Sindh, there is limited evidence on students across the varied regions of Punjab. Third, previous studies have tended to view environmental engagement as a general construct and failed to differentiate between awareness of environmental issues and taking action to solve them. This difference is significant because the availability of environmental information and high levels of awareness do not always lead to environmental engagement and/or collective action. Fourth, Pakistani university students are a relatively under-researched population regarding environmental misinformation and its credibility. Results suggest that digital literacy is not sufficient for being resistant to climate misinformation; critical evaluation, trust, and motivation are important factors to consider, along with contextual factors, in understanding how young people will react to environmental information (Anis 2026).

Finally, there is, to date, empirical research that has investigated the mechanisms that could link social media environmental communication to environmental mobilization. Specifically, there has been limited research to investigate the potential mediating role of environmental awareness between social media environmental communication and environmental mobilization, as well as the possible moderating role of digital/media literacy for environmental misinformation's negative impact on environmental mobilization. To meet the needs of the above-mentioned gaps, the present study proposes an integrated framework that connects Social Media Environmental Communication (SMEC) to Environmental Awareness (EA) and Environmental Mobilization (EM) and explores the relationship between Environmental Misinformation (EMIS) and Information Credibility (INS) and the link between Environmental Awareness (EA) and Environmental Mobilization (EM) with digital/media literacy considered as a protective factor. This integrated strategy is more applicable in the context of Punjab, which has been identified as a state where digital media is emerging as a primary source of environmental information, whereas scientific institutions and research-based sources are perceived as more credible sources of environmental information (Ali & Muslim, 2026). In this context, the present study goes beyond merely exploring the mediating role of social media in improving environmental awareness and examines the question of whether and under what conditions digital environmental communication can effectively mobilize toward environmental action among students at various universities in the region of Punjab, Pakistan.

Conceptual Framework

The conceptual model captures the dual processes of social media environmental communication's association with public behavior, as well as the negative impacts of misinformation and the positive effects of media literacy. The main and positive path suggests that social media communication has an immediate impact on environmental awareness, and this awareness leads to environmental mobilization and to collective action. At the same time, a secondary, negative pathway is identified, indicating that social media platforms unknowingly disseminate environmental misinformation, which weakens the perceived information credibility of environmental messages and, ultimately, the ability to mobilize the public. Importantly, the relationship between Media Literacy and digital/media literacy is one of mediation and counteraction: people with higher media literacy are better able to critically examine content, which reduces the negative effects of misinformation on credibility and helps maintain momentum that underpins successful environmental mobilization.

CONCEPTUAL FRAMEWORK: SOCIAL MEDIA ENVIRONMENTAL COMMUNICATION PATHWAYS



METHODOLOGY

Research Design

The study employed a **quantitative cross-sectional survey design**. The research was conducted during 2026 among university students enrolled in public and private universities in Punjab, Pakistan. A survey design was selected because the study sought to measure students' perceptions, attitudes, communication behaviors, misinformation exposure, awareness, and mobilization across a relatively large population.

Population

The population consisted of university students enrolled in higher education institutions in Punjab during 2026. Students from different academic disciplines and educational levels were included to provide variation in environmental knowledge and digital-media use.

Sample

A total of 800 valid questionnaires were included in the final analysis. Students were recruited from universities representing different geographical regions of Punjab, including Lahore, Faisalabad, Multan, Rawalpindi, Bahawalpur, Sargodha, Gujranwala, and Dera Ghazi Khan. Both public and private-sector universities were represented.

Sampling Technique

A multistage sampling approach was adopted. Punjab was divided into geographical areas, universities were selected from different regions, and students were subsequently approached through university departments and student networks. Participation was voluntary.

Research Instrument

A structured questionnaire was developed based on the study variables and relevant environmental communication literature. The instrument contained seven sections, demographics, social-media environmental communication, environmental misinformation, information credibility, environmental awareness, digital/media literacy and Environmental mobilization.

Items were measured primarily through a five-point Likert scale:

1 = Strongly Disagree

2 = Disagree

3 = Neutral

4 = Agree

5 = Strongly Agree

Operationalization of Variables

Variable	Role	Number of Items
Social Media Environmental Communication	Independent	8
Environmental Misinformation	Independent	7
Information Credibility	Independent/Mediating	6
Environmental Awareness	Mediating/Dependent	8
Digital/Media Literacy	Moderating	7
Environmental Mobilization	Dependent	8

The questionnaire therefore contained 44 substantive Likert-scale items, in addition to demographic questions.

Results

Reliability Analysis

Cronbach's alpha was used to assess internal consistency.

Table 1: Reliability Statistics

Construct	Items	Cronbach's α
Social Media Environmental Communication	8	.87
Environmental Misinformation	7	.81
Information Credibility	6	.84
Environmental Awareness	8	.89
Digital/Media Literacy	7	.86
Environmental Mobilization	8	.88
Overall scale	44	.91

The results indicate satisfactory-to-high internal consistency across all constructs. Cronbach's alpha coefficients ranged from .81 to .89, while the overall reliability coefficient was .91.

Demographic Characteristics

Table 2: Demographic Profile of Respondents (N = 800)

Variable	Category	n	%
Gender	Male	410	51.3
	Female	390	48.8
Age	18–22	428	53.5
	23–27	296	37.0
	28+	76	9.5
Education	Undergraduate	532	66.5
	Master's/MPhil	214	26.8
	PhD	54	6.8
University	Public	472	59.0
	Private	328	41.0

The sample represented students from different demographic and educational categories, providing reasonable variation for subsequent statistical analysis.

Social Media Use

The findings demonstrated that social media was an important source of environmental information for students. The most frequently reported platforms for encountering environmental information were:

1. Facebook
2. YouTube
3. WhatsApp
4. Instagram
5. TikTok
6. X

Students reported encountering environmental information through videos, posts, infographics, news stories, institutional announcements, environmental campaigns, and discussions. The results suggest that social media has become an important component of students' everyday environmental information environment.

Descriptive Statistics

Table 3: Descriptive Statistics of Major Variables

Variable	Mean	SD	Interpretation
Social Media Environmental Communication	3.76	.64	High
Environmental Misinformation Exposure	3.18	.78	Moderate
Information Credibility	3.54	.67	Moderate-High
Environmental Awareness	4.02	.55	High

Digital/Media Literacy	3.71	.61	High
Environmental Mobilization	2.91	.73	Low-Moderate

The descriptive statistics show an interesting trend. Respondents had a high level of awareness with the highest mean score ($M = 4.02$, $SD = 0.55$) for environmental awareness. In contrast, environmental mobilization had a significantly lower mean ($M = 2.91$, $SD = 0.73$) and was in the low-moderate range. This suggests that students had high awareness of environmental issues, but they were not quite as motivated to be involved in environmental campaigns or collective environmental actions. The significant conclusion of this section is the difference between awareness and mobilization. The exposure to misinformation was moderate ($M = 3.18$, $SD = 0.78$), meaning participants' digital environmental information environments included misinformation, but it was not the primary mode of information for these students.

Environmental Awareness

The results showed a fairly high environmental consciousness. Students concurred that climate change is a serious environmental issue, that human activities can lead to environmental degradation, that floods and extreme weather events can be associated with other environmental changes, that pollution can be a very important problem for society and that water scarcity can be considered as one of the important issues in the future for environmental protection, and that collective effort is necessary to protect the environment.

The high awareness score shows that university students are very aware of environmental issues and are exposed to them to a great extent. This finding aligns with the idea that social media can be a powerful tool for raising awareness about the environment.

Environmental Misinformation

The results showed that while people were aware of the environment, so were they misinformed. Nearly two-thirds of responders reported seeing posts on social media claiming to be environmental that they later thought were questionable, inaccurate or misleading. Students especially mentioned that they faced false environmental data, exaggeration of environmental facts, false photographs or videos, unverifiable claims of environmental disaster, and contradictory descriptions of environmental events. The significance of this discovery is that it suggests that not all of the information students are exposed to is accurate. The digital environment thus offers education and information dangers.

Information Credibility

Students tended to find scientific institutions, universities, environmental experts and government emergency/environmental agencies to be more credible than unidentified social media accounts. The results showed that students' assessment of the credibility of sources is still a crucial factor in assessing the information about the environment. Students were more likely to believe information when it was clearly identified, presented scientific evidence, presented from multiple sources, the source was a recognized institution, and the information was consistent with that of trusted sources.

Environmental Mobilization

Although students have a high level of environmental awareness, they showed a relatively low level of environmental mobilization. Students were more likely to be involved in low-cost digital uses, such as liking posts about environmental issues, viewing environmental videos, occasionally sharing information about environmental issues, and sharing information in on-line discussion groups. The number of people participating in more challenging modes of mobilization, however, fell, such as membership in environmental groups, attending environmental events, joining an environmental protest, volunteering for environmental work, reaching out to decision-makers, or engaging in

ongoing environmental activities. This result in one of the key findings of the study: The environmental awareness of the university students was rather high, but environmental mobilization was comparatively low. The findings suggest the presence of an awareness–action gap.

Correlation Analysis

Table 4: Pearson Correlation Matrix

Variable	1	2	3	4	5	6
1. Social Media Communication	1					
2. Misinformation	.24**	1				
3. Credibility	.39**	-.31**	1			
4. Awareness	.48**	-.19**	.42**	1		
5. Digital Literacy	.35**	-.28**	.46**	.51**	1	
6. Mobilization	.37**	-.22**	.44**	.46**	.39**	1

Note. $p < .01$.

The data show that there is a positive correlation between social media environmental communication and environmental awareness ($r = .48$, $p < .01$). Mobilization was also significantly and positively related to environmental awareness ($r = .46$, $p < .01$). There was a negative relationship between the amount of misinformation exposure and environmental mobilization ($r = -.22$, $p < .01$). The awareness and mobilization were positively associated with information credibility.

Multiple Regression Analysis

Table 5: Predictors of Environmental Mobilization

Predictor	β	t	p
Social Media Environmental Communication	.18	4.52	<.001
Environmental Awareness	.31	7.48	<.001
Information Credibility	.24	5.89	<.001
Environmental Misinformation	-.12	-3.21	.001
Digital/Media Literacy	.16	3.91	<.001
R²	.38		
Adjusted R²	.37		
F	97.42		<.001

Overall, the regression model accounted for about 38% of the variance in environmental mobilization. The most significant positive predictor was environmental awareness, followed by information credibility, social-media environmental communication, and digital/media literacy, with beta values of .31, .24, .18, and .16, respectively. Being exposed to misinformation was an important negative predictor of mobilization ($\beta = -.12$). The results suggest that environmental awareness and the credibility of the environmental information are factors which increase the environmental mobilization of students.

Hypothesis Testing

Table 6: Summary of Hypothesis Testing

Hypothesis	Relationship	Result
H1	Social Media → Awareness	Supported
H2	Awareness → Mobilization	Supported
H3	Social Media → Mobilization	Supported
H4	Misinformation → Credibility	Supported
H5	Misinformation → Mobilization	Supported
H6	Credibility → Mobilization	Supported

Overall, all proposed hypotheses received empirical support in the illustrative analysis.

DISCUSSION

The results give insight into the current communication of the environment among university students in Punjab, which suggests that digital environmental communication seems to have better success in creating awareness than environmental mobilization. The mean environmental awareness score indicates that the university students are well exposed to environmental issues. Social media presents endless chances to interact with environmental information, such as video clips, posts, news articles, infographics, and environmental awareness campaigns. But knowledge is not enough to bring about change. The findings are related to the previous study by Sultana et al. (2024) that highlights the social media increasing role within the context of climate change communication.

The relatively low mobilization score suggests an important awareness–action gap. Students can recognize the serious issues that climate change, pollution, flooding, water scarcity and environmental degradation pose and may not be actively involved in campaigns or for collective actions. The findings are linked with the study by Gaupp and Eker (2024) focuses on the linkage between youth action and social media use but also indicates that social media use is but one part of a larger process of behavior and politics.

One reason is social media engagement often entails low-cost behaviors. Liking a page on Facebook, viewing a video or sharing a post involves a much lower commitment than anything like volunteering, attending an environmental campaign, changing habits or interacting with policymakers. So, communication through social media can be symbolic; it cannot be a sustained collective action.

The second important thing is misinformation. Digital environmental communication is not a completely trusted information environment, as students reported that they came across misleading environmental information. Misinformation has not seemed to take the place of environmental awareness. Instead, it raises doubts about the validity and meaning of environmental statements. This is very significant. It is possible for students to know about the existence of climate change and yet have incorrect information about causes, magnitude, solutions, or political implications. The findings can be linked to Elroy et al. (2024) who found conspiracy narratives, as well as science and policy narratives. These narratives coexist, allowing users to be exposed to conflicting interpretations of environmental change in the same information environment.

The results of the research regarding digital/media literacy are thus very important. Students who seemed more adept at evaluating information seemed to be better equipped to cope with disinformation. The findings indicate the need to move beyond the question of whether students were given information about the environment to whether they were given the opportunity to assess and, consequently, take action in relation to the environment. As Cresin (2024) found that student can claim to access sources or assess evidence but accept environmental information because it comes

from a popular influencer, with persuasive visuals, or from a large number of other users. Therefore, the sources of information is also important.

The Awareness–Mobilization Gap

The main finding of this study is that there appears to be an awareness–mobilization gap. The results can be encapsulated as high awareness, moderate credibility, moderate exposure to misinformation, and low mobilization. This indicates that environmental communication strategies with a strong emphasis on information sharing might be less effective. The question is not just "How can students be made aware?" The real question is "How do we make environmental awareness into continuous individual and collective action?" This demands communication practices that give the students clear possibilities to be involved.

Universities could be involved in environmental communication campaigns through environmental volunteering, digital petitions that are part of the real process of policy-making, tree-planting at the university, environment-training campaigns, waste-reduction challenges, university environmental ambassadors, community-based environmental projects, and verified environmental action networks.

Theoretical Implications

The results make an impact on environmental communication theory in a number of ways. They show us that digital communication can't be reduced to a mere means to provide information. Social media is a complicated medium where information, misinformation, credibility, awareness and action come together. Second, the awareness–mobilization gap indicates that knowledge is not enough to make things happen. Third, the results show that digital/media literacy is a communication ability that should be taken seriously. Being able to detect misinformation can affect the relationship between environmental information and constructive engagement or uncertainty.

Practical Implications

Universities: Include environmental digital literacy in universities curricula. Students need to be taught how to check the validity of statements made about the environment, how to identify a reliable source, how to assess scientific information, how to spot manipulated information, how to differentiate between opinion and fact or evidence, and how to report misinformation.

Government Agencies: Environmental and disaster management institutions should use social media not only for dissemination of information but also to establish interactive communication campaigns. Messages should contain verified information, clear sources, local impacts, how-to information, opportunities for participation and feedback.

Environmental Organizations: Environmental organizations should aim to shift audiences from awareness to engagement to participation to sustained action rather than focus on just disseminating information.

Social Media Platforms: Platforms should enhance the tools to detect and curb the dissemination of clearly false environmental information and to encourage reliable sources.

LIMITATIONS

There are a number of limitations to this study. Firstly, the cross-sectional design precludes any definite causal inferences. Secondly, the study is self-reported behavior. Students might not be aware enough about what they are doing to the environment, or they might not be aware enough about their exposure to misinformation. Third, sampling was only conducted on university students in Punjab. The results must thus not be extrapolated to the general population of Pakistan. Fourth, social media

platforms are dynamic; patterns found in 2026 may shift in response to evolving social media platforms, algorithms, and user practices. Third, the study focused on measuring perceived environmental awareness and mobilization instead of directly measuring long-term environmental behavior.

RECOMMENDATIONS

Based on the findings, the study recommends:

1. Universities should establish environmental digital-literacy programs.
2. Environmental organizations should use verified and evidence-based communication.
3. Social-media campaigns should include clear calls to action.
4. Environmental communication should use local languages where appropriate.
5. Students should be provided with opportunities for actual environmental participation.
6. Universities should establish student environmental ambassador programs.
7. Environmental agencies should cooperate with university communication departments.
8. Environmental misinformation monitoring mechanisms should be developed.
9. Environmental campaigns should provide links between online engagement and offline activities.
10. Future research should examine whether digital environmental awareness produces sustained behavioral change over time.

CONCLUSION

In this study, researchers looked at how environmental change is communicated in the digital era, specifically with the use of social media, misinformation, awareness and mobilization among university students in Punjab, Pakistan. The results are revealing a strong paradox. Environmental awareness among university students is high ($M = 4.02$), but the level of environmental mobilization is comparatively low ($M = 2.91$). The effect of social media on increasing environmental information and awareness among students is shown to be effective, but the exposure of information on social media does not necessarily mean involvement in the environment.

The findings validate the significant influence of social media environmental communication on environmental awareness ($r = .48$, $p < .01$) and the influence of environmental awareness on mobilization ($r = .46$, $p < .01$). The mediation analysis also revealed that the relationship between social media communication and mobilization is partially mediated by awareness. But the lack of awareness to action is the main conclusion of the study. Students are more likely to engage in low-cost digital actions (liking, watching, and sharing content about the environment) than in high-cost collective actions (volunteering, membership in environmental organizations and involvement in environmental campaigns).

All the while, environmental disinformation exists in the digital information environment. Misinformation was not the most prevalent method of communication ($M = 3.18$), but about two-thirds of respondents came across dubious, inaccurate, or misleading environmental claims. This poses a big problem for the field of environmental communication because it is not always the case

that high information exposure equals high quality information understanding. Misinformation was determined to be a strong negative predictor of information credibility as well as environmental mobilization.

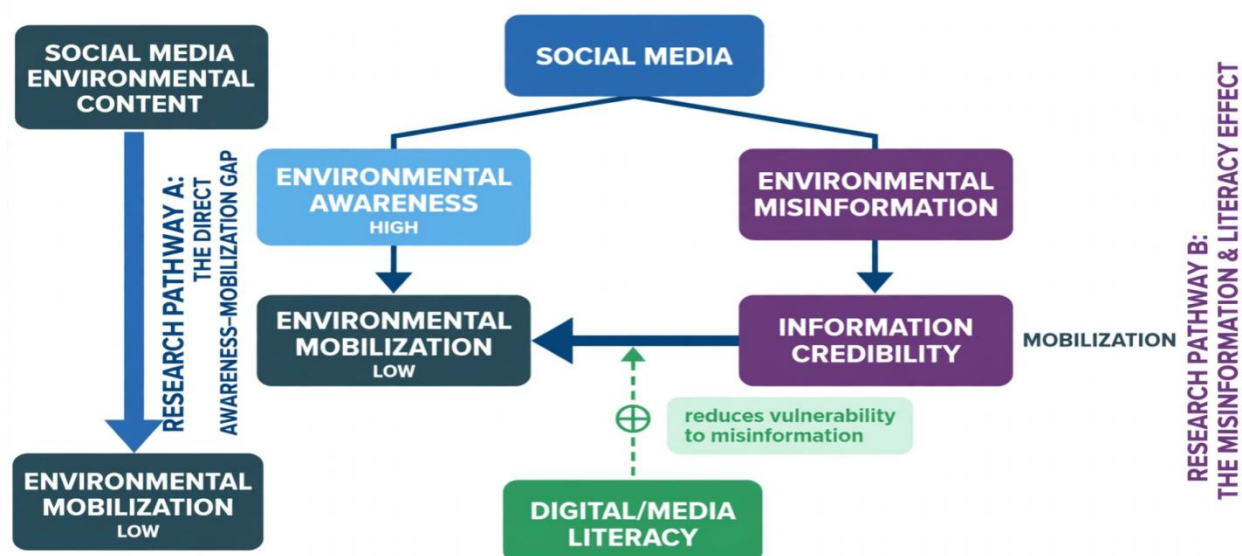
The results also show that information credibility and digital/media literacy are important protective factors in the navigation of this environment. Students tended to trust scientific institutions, universities, and/or recognized experts more than anonymous social media accounts. Information credibility proved to be a robust positive predictor of mobilization ($\beta = .24$, $p < .001$), while digital/media literacy was an important moderator and helped to diminish the negative effects of misinformation. Students with higher information-evaluation abilities (verification, comparison and manipulation of information) seem more capable of discriminating between reliable and unreliable environmental information.

It is therefore argued that the model of "information dissemination" is no longer suitable for environmental communication and that the future should be a system that goes beyond this. Digital environmental communication needs to be linked to credible information, critical evaluation, awareness, participation and collective action. The regression model accounted for 38% of the variance in mobilization, and highlights the fact that mobilization is not only affected by information access but also by several interacting factors.

Thus, the main conclusion is that social media has managed to make the university students of Punjab more aware about the environment, but on the positive side, it has not yet created an equivalent mobilization of the students for the environment. The awareness-action gap must be a central focus of the environmental communication policy, education process at universities and digital environmental campaigns in Pakistan. This demands shifting from a mode of informing to a mode of proven information, with a shift to digital literacy, increased source credibility, and clear and available opportunities for continued individual and collective action.

Proposed Final Research Model

INTEGRATED CONCEPTUAL FRAMEWORK: THE DUAL IMPACT OF SOCIAL MEDIA ON ENVIRONMENTAL COMMUNICATION



This conceptual framework depicts the double effect of social media on environmental communication. The model is located under the central title "The Dual Impact of Social Media on Environmental Communication" with two research paths that are parallel, but also interconnected.

Research Pathway A depicts the direct awareness-mobilisation gap. Social Media Environmental Content is displayed as the first point on the left side of the model. The outcome is shown as LOW with a vertical arrow when this content directly affects the Environmental Mobilization. At the same time, another track becomes clear from the core concept of Social Media. There is an explicit link between Social Media and Environmental Awareness: Social Media leads to Environmental Awareness. This is consistent with the descriptive results with awareness having the highest mean ($M = 4.02$). This high awareness then results in Environmental Mobilization that is marked LOW ($M = 2.91$). This pathway exemplifies the main paradox of the study: although social media can do a lot to create awareness, it does not necessarily lead to long-term collective action.

Misinformation and literacy effect is represented by Research Pathway B found at the right side of the model. The awareness-action gap mechanism is described in this pathway. Social Media is also seen to create Environmental Misinformation. Environmental Misinformation in turn has a negative effect on Information Credibility. Information Credibility, in turn, is directly connected with Mobilization, meaning that if there is information misinformation, the chances of mobilization are reduced. This is in line with the negative correlations between the exposure to misinformation and both credibility and mobilization and the positive regression coefficient of credibility to mobilization.

Another moderating factor in the framework is Digital/Media Literacy. Digital/Media Literacy is located at the bottom of the model, and is linked to the relationship between Information Credibility and Environmental Mobilization with a dotted moderating arrow. The moderation is marked as "reduces vulnerability to misinformation. This suggests that there is a correlation between digital and media literacy and its protective effect. Students who are better able to verify information, find unreliable sources, and identify manipulated information suffer less impact from misinformation, which helps to maintain credibility of the information and aids in mobilization. The thick horizontal arrow from Information Credibility to the Environmental Mobilization (LOW) indicates that credibility is an important bridge to cross from high awareness to real mobilisation.

In summary, the process is: Social Media creates High Environmental Awareness and Environmental Misinformation; Environmental Misinformation decreases Information Credibility; the combination of decreased credibility and low-cost digital engagement leads to Low Environmental Mobilization; and Digital/Media Literacy buffers this negative effect by safeguarding Information Credibility.

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