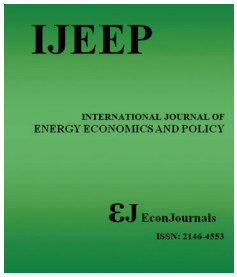

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Fostering a Green Future: The Role of Environmental Education in Community Empowerment

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ABSTRACT

The present research examines how community engagement, community empowerment, and environmental education affect environmental sustainability in the industrial sector of Pakistan particularly among the working employees of the HEIs. A survey research design was adopted and a self-developed structured questionnaire adopted from research conducted in similar studies was used in gathering data from 322 participants in different capacities in HEIs. The participants included clerical workers up to managerial level like deans of the colleges to increase the generalizability of the results. Smart partial least squares structural equation modeling was employed to analyze the data to explore the links between the constructs under investigation as well as their impact on environmental sustainability. The analysis showed that there were positive relations between community engagement and environmental education and environmental sustainability and that community engagement had the strongest relationship. Community empowerment was another variable that was positive with environmental sustainability albeit with a much smaller effect size compared to the others. Community engagement and community empowerment were discovered to have a limited moderating effect which has led to the understanding that their direct contribution to sustainability is greater than their moderation role. Therefore, the results highlight the need to continue encouraging community participation and environ mental awareness in order to encourage sustainable behavior. The findings of this research would be of great interest to policymakers, educators, and industry players interested in bolstering environmental sustainability initiatives within the Pakistani industry.

Keywords: Community Empowerment, Community Engagement, Environmental Education, Environmental Sustainability
JEL Classifications: I25, Q01, Q56, Q59

1. INTRODUCTION

Pakistan, with its diverse landscapes ranging from the towering peaks of the Himalayas to the arid expanses of the Thar Desert, faces a myriad of environmental challenges (Qasim et al., 2024). Rapid urbanization, industrial growth, and agricultural expansion have exerted tremendous pressure on the country's natural resources. Deforestation, water pollution, air quality degradation, and the impacts of climate change are becoming increasingly severe, affecting both rural and urban populations (ud Din and Ahmad, 2023). As these environmental issues escalate, the need for robust and effective environmental education becomes ever more apparent. Historically, environmental education in Pakistan has been limited in scope and reach (Begum et al., 2021). Traditional educational frameworks have often overlooked the importance of incorporating environmental awareness and sustainable practices into curricula (Shah Bukhari et al., 2022). While some efforts have been made to introduce environmental education in schools and universities, these initiatives frequently lack depth and fail to engage the broader community. Furthermore, the existing educational programs often adopt a one-size-fits-all approach, disregarding the unique socio-economic, cultural, and ecological contexts of different regions within the country (Murtaza and Hui, 2021). Community empowerment is a critical yet underutilized component in environmental education. Empowering communities means involving them in decision-making processes, recognizing and utilizing their local knowledge, and providing them with the tools and resources necessary to manage their

environments sustainably (Uzoaru and Ijah, 2021). In Pakistan, many communities possess rich traditional ecological knowledge that has been passed down through generations (Shafi et al., 2021). This knowledge, however, is rarely integrated into formal environmental education programs, resulting in a disconnect between modern environmental practices and traditional wisdom (Shafi et al., 2021).

The socio-economic and political barriers that hinder effective community participation in environmental initiatives are another significant challenge. Issues such as poverty, lack of access to education, and political instability can limit the ability of communities to engage in and benefit from environmental programs (Dwivedi et al., 2021; Hajjar et al., 2021). Additionally, gender disparities often mean that women, who are crucial stakeholders in environmental management, are excluded from many of these initiatives (Imran et al., 2021; Lawless et al., 2021; Ross et al., 2022). This approach is beneficial in contributing towards realization of several of the sustainable development goals. By enhancing environmental literacy and awareness, the study supports "SDG 4: Quality Education," to timely implement the sustainable development goal 4, which deal with provision of inclusive and equitable quality education and lifelong learning opportunities in favor of all. The integration of community empowerment within environmental education fosters "SDG 5: Gender Equality," added that the involvement of development programs and projects for the disadvantaged sectors of society such as women in environmental projects will help them play an influential role in environmental related activities. This inclusivity is quite much helpful in minimizing social injustice, and enhancing gender equity. In addressing the sustainable management of water resources and promoting conservation practices, the study aligns with "SDG 6: Available: Clean Water and Sanitation," promoting rational management of water consumption. By fostering a culture of conservation and sustainable practices, it contributes to "SDG 13: Climate Action," improving the ecological literacy of communities in order to increase vulnerability to climate extreme events and natural disasters. The research focuses on involving local communities and using traditional ecological knowledge to make environmental programs relevant and useful for sustainable use of natural resources. Moreover, the study supports "SDG 8: Decent Work and Economic Growth" through encouraging the establishment of climate change friendly employment opportunities and income generating practices such as environmental conservation and responsible tourism, and better farming techniques. It also aligns with "SDG 15: The Sustainable Development Goal 15, Life on Land," support the conservation and sustainable use of terrestrial ecosystems, to reverse the desertification process and to halt the loss of terrestrial animal and plant species (Ashida, 2022; Leite, 2022). Through empirical research, the study provides valuable insights for policymakers, helping them design and implement effective environmental policies and programs. Overall, this study not only addresses Pakistan's environmental challenges but also contributes to broader global efforts to achieve sustainable development, making significant strides towards several SDGs through education, community empowerment, and sustainable practices.

Moreover, there is a notable lack of empirical research examining the long-term impacts of environmental education initiatives on community behavior and environmental health in Pakistan (Akmal and Jamil, 2021; Begum et al., 2021; Habib et al., 2021). While short-term programs may raise awareness and prompt initial actions, their lasting impact on sustainable practices and community resilience remains unclear (Haque, 2022). Addressing these gaps requires a multi-faceted approach that not only enhances environmental education but also actively involves communities in the process. By integrating traditional knowledge with modern environmental practices, and by addressing the socio-economic and political barriers to participation, environmental education can become a powerful tool for sustainable development. This study seeks to explore these dimensions, aiming to provide a comprehensive framework for empowering communities through environmental education in Pakistan. By focusing on localized and context-specific educational strategies, this research aims to develop more effective and sustainable approaches to environmental education. It will also provide valuable insights for policymakers, educators, and community leaders, helping them to foster a deeper sense of environmental stewardship and resilience among the diverse populations of Pakistan. Ultimately, this study aspires to contribute to the broader goals of environmental sustainability and community empowerment, aligning with global efforts to address environmental challenges through education and participation.

1.1. Research Gap

The study presents several critical research gaps. Current studies often adopt generalized approaches to environmental education without adequately considering the diverse cultural, social, and economic contexts within Pakistan. There is a notable absence of research focusing on localized, context-specific educational strategies that resonate with the varied communities across the country (Akmal and Jamil, 2021; Begum et al., 2022; Habib et al., 2021). Moreover, empirical evidence on the direct impact of community engagement on environmental outcomes is limited (Anthony Jr, 2024; Kuang and Lin, 2021). While many initiatives promote community involvement, few studies explore how different levels and forms of engagement tangibly influence conservation and sustainability results (Hajjar et al., 2021; Szetey et al., 2021). Another underexplored area is the integration of traditional ecological knowledge with modern environmental education practices (Sharifian et al., 2022; Tiberio and Du Mérac, 2023). This integration could potentially enhance the effectiveness of educational initiatives and foster deeper community connections to sustainability efforts. Additionally, understanding the socio-economic and political barriers that hinder community participation in environmental programs is critical but not sufficiently addressed in the current literature. Identifying these barriers could inform more inclusive and effective strategies. Addressing these gaps could significantly enhance the effectiveness of environmental education and community engagement strategies in Pakistan.

1.2. Problem Statement

Despite the critical importance of environmental education in fostering sustainable development, there is a significant gap in research focusing on the integration of community empowerment

within these educational initiatives in Pakistan (Habib et al., 2021; Hinduja et al., 2023). Existing studies often adopt a generalized approach to environmental education, neglecting the diverse cultural, social, and economic contexts of various communities across the country. This lack of localized strategies limits the effectiveness of educational programs in engaging different regions (Alam, 2023; Seikkula-Leino et al., 2021). Moreover, there is a paucity of empirical evidence on how varying levels and forms of community engagement directly impact environmental conservation and sustainability outcomes (Anthony Jr., 2024; Kuang and Lin, 2021). While community involvement is frequently promoted, few studies investigate its tangible effects on environmental results. The integration of traditional ecological knowledge with modern educational practices remains underexplored, despite its potential to enhance the relevance and impact of these initiatives (Sharifian et al., 2022; Tiberio and Du Mérac, 2023). Additionally, understanding the socio-economic and political barriers that hinder effective community participation in environmental programs is crucial but insufficiently addressed in current literature. Addressing these gaps is essential for developing more effective and sustainable environmental education and community engagement strategies in Pakistan.

Research questions

1. To what extent do environmental education programs in Pakistan address the diverse cultural, social, and economic contexts of communities?
2. What is the relationship between community empowerment, levels of engagement, and environmental conservation outcomes in various regions of Pakistan?
3. What is the impact of integrating traditional ecological knowledge with modern educational practices on the effectiveness of localized environmental education initiatives?

1.3. Research Objectives

- To evaluate the extent to which environmental education programs in Pakistan address the diverse cultural, social, and economic contexts of communities.
- To analyze the relationship between community empowerment, levels of engagement, and environmental conservation outcomes in different regions of Pakistan.
- To assess the impact of integrating traditional ecological knowledge with modern educational practices on the effectiveness of localized environmental education initiatives.

2. LITERATURE REVIEW

2.1. Community Empowerment and Environmental Sustainability

Community empowerment is a multifaceted concept that includes enhancing the capacity, autonomy, and self-determination of communities, enabling them to influence outcomes that matter to them (Kruahong et al., 2023). In the context of environmental sustainability, community empowerment has been recognized as a crucial element (Salam, 2024). When communities are empowered, they are more likely to participate in decision-making processes, advocate for sustainable practices, and manage local resources effectively (Coy et al., 2021). Studies indicate that empowered communities are better equipped to undertake conservation activities, implement sustainable resource management practices, and adapt to environmental changes (Mia et al., 2022; Surya et al., 2021; Tabish et al., 2024). For instance, in rural areas of developing countries, community-based forest management has been shown to improve both environmental and socio-economic outcomes. This aligns with the idea that when local communities have control over their natural resources, they can balance the need for conservation with their livelihood requirements.

2.2. Community Engagement and Environmental Sustainability

Community engagement refers to the process of involving community members in the planning, decision-making, and implementation of projects and initiatives (Anthony Jr., 2024). High levels of community engagement are correlated with improved environmental sustainability outcomes. Engaged communities tend to have higher levels of awareness and commitment to environmental issues, leading to more sustainable behaviors and practices (Zhang et al., 2022). Research has shown that various forms of community engagement, such as participatory planning, public consultations, and collaborative management, can lead to better environmental outcomes. Engaged communities are more likely to support and adhere to conservation measures, reduce pollution, and participate in sustainable land-use practices (Bouman et al., 2021; Ge et al., 2021). Moreover, community engagement can enhance the social capital of a community, fostering a sense of ownership and responsibility towards the environment (Grilli and Curtis, 2021; Mahmood et al., 2024).

2.3. The Role of Environmental Education

Environmental education plays a critical role as a moderator between community empowerment, community engagement, and environmental sustainability. It provides the knowledge, skills, and attitudes necessary for individuals and communities to make informed decisions and take responsible actions for the environment (Dillon and Herman, 2023; Uralovich et al., 2023). Environmental education can enhance community empowerment by increasing awareness and understanding of environmental issues, which can lead to greater involvement in sustainable practices. Incorporating environmental education into community engagement efforts can significantly enhance the effectiveness of these initiatives (Yadav et al., 2022). Educational programs that combine traditional ecological knowledge with modern environmental science can create a more holistic understanding of sustainability, bridging the gap between indigenous practices and contemporary conservation strategies (Debrah et al., 2021; Luna-Krauletz et al., 2021).

2.4. Impact of Integrating Traditional Ecological Knowledge

Integrating traditional ecological knowledge (TEK) with modern educational practices can enhance the effectiveness of environmental education initiatives (Carr, 2021; Debrah et al., 2021). TEK, which encompasses the wisdom, practices, and beliefs of indigenous and local communities regarding their natural environment, offers valuable insights for sustainable resource management (Casi et al., 2021). By combining TEK with modern

scientific knowledge, environmental education programs can provide a more comprehensive understanding of environmental issues and sustainable practices (Albuquerque et al., 2021; Molnár and Babai, 2021). Research has demonstrated that incorporating TEK into environmental education can improve conservation outcomes by fostering a deeper connection to the environment and enhancing the relevance of educational content to local contexts (Billiot et al., 2022; Jessen et al., 2022). This integration can also promote cultural preservation and respect for indigenous practices, contributing to more culturally sensitive and effective education programs (McKinley et al., 2023).

2.5. The Role of Higher Educational Institutions in Pakistan

Higher educational institutions in Pakistan have a pivotal role in advancing environmental sustainability through education, research, and community engagement (Habib et al., 2021). These institutions are uniquely positioned to contribute to environmental education and sustainability efforts in several ways:

2.5.1. Curriculum development and delivery

Higher educational institutions can develop and deliver comprehensive environmental education programs that incorporate both modern scientific knowledge and traditional ecological wisdom (Dillon and Herman, 2023). By offering specialized courses and degree programs in environmental science, sustainable development, and natural resource management, these institutions can equip students with the necessary knowledge and skills to address environmental challenges (Žalėnienė and Pereira, 2021).

2.5.2. Research and innovation

Universities and colleges in Pakistan can contribute to environmental sustainability through cutting-edge research and innovation (Shabir et al., 2023). By conducting research on local environmental issues, developing sustainable technologies, and promoting best practices, higher educational institutions can generate valuable knowledge and solutions that can be applied to real-world problems (Bukhari et al., 2023; Tanveer, 2024). Hence, collaborative research projects with local communities and international partners can further enhance the impact of these efforts.

2.5.3. Community outreach and engagement

Higher educational institutions can play a vital role in community outreach and engagement by organizing workshops, seminars, and training programs on environmental sustainability. These activities can raise awareness, build capacity, and foster community involvement in environmental conservation efforts (Post et al., 2023). By partnering with local communities, non-governmental organizations, and government agencies, higher educational institutions can facilitate the dissemination of environmental knowledge and practices (Berchin et al., 2021).

2.5.4. Policy advocacy and leadership

As thought leaders and knowledge hubs, higher educational institutions can advocate for policies and practices that promote environmental sustainability (Bautista-Puig and Sanz-Casado, 2021). By engaging in policy dialogues, providing expert advice, and contributing to the development of environmental regulations and standards, these institutions can influence decision-making processes at local, national, and international levels (Kohl et al., 2022).

2.5.5. Campus sustainability initiatives

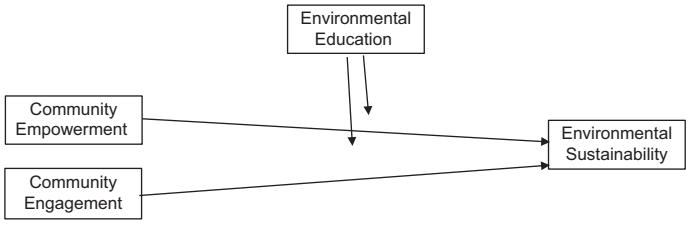
Higher educational institutions can lead by example by implementing sustainable practices on their campuses. This includes reducing energy consumption, managing waste, promoting biodiversity, and encouraging sustainable transportation (Žalėnienė and Pereira, 2021). By creating green campuses, these institutions can demonstrate the feasibility and benefits of sustainability practices, inspiring students and staff to adopt similar behaviors in their personal and professional lives (Fissi et al., 2021).

Hence, the interplay between community empowerment, community engagement, and environmental sustainability is crucial for achieving positive environmental outcomes. Environmental education serves as a vital moderator, enhancing the effectiveness of empowerment and engagement initiatives. Higher educational institutions in Pakistan have a significant role to play in this context by providing education, conducting research, engaging with communities, advocating for sustainable policies, and leading by example. By fulfilling these roles, higher educational institutions can contribute significantly to the promotion of environmental sustainability in Pakistan. Research framework of the study is presented in Figure 1.

3. METHODOLOGY

This study examined the impact of community engagement, community empowerment, and environmental education on environmental sustainability in Pakistan's industrial sector, focusing on employees from higher educational institutes. A quantitative research approach was used, with data collected through a structured questionnaire adapted from previous studies to ensure reliability and relevance (Dillon and Herman, 2023; Kruahong et al., 2023; ud Din and Ahmad, 2023). The target population comprised employees from various roles in higher education institutions, ranging from office assistants to senior administrators like deans, to capture diverse perspectives on sustainability practices, community involvement, and environmental education. To achieve a robust sample size, 470 questionnaires were distributed across universities in Pakistan, with 322 usable responses collected after excluding incomplete or inaccurately marked questionnaires. This final sample size aligns with statistical guidelines for quantitative research, ensuring the data's reliability and generalizability. The questionnaires

Figure 1: Research framework



were distributed both in paper and electronic formats, based on respondents' accessibility and preferences. University administrative staff assisted in distributing the questionnaires broadly across departments, and participants were briefed on the study's purpose and assured of their anonymity to encourage honest responses. The data collection process spanned 3 months, allowing ample time for follow-up, which contributed to a high response rate of approximately 68.5%. The questionnaire included sections to measure community engagement, community empowerment, environmental education, and environmental sustainability, using a Likert scale for responses. These constructs were developed based on a comprehensive review of existing literature and adapted to align with the study's objectives.

Data analysis was performed using smart partial least squares structural equation modeling (PLS) software, which is well-suited for assessing complex relationships between latent variables and is commonly used in social sciences research. Factor analysis was conducted within Smart PLS to confirm the validity of each construct, ensuring that questionnaire items accurately reflected the intended dimensions of community engagement, community empowerment, and environmental education. Reliability was also confirmed with Cronbach's Alpha values for each construct exceeding the acceptable threshold of 0.7, indicating high internal consistency. Path analysis was then performed to examine the relationships among community engagement, community empowerment, environmental education, and environmental sustainability, as well as to assess the moderating effects of community engagement and empowerment. This analysis provided insights into the direct and indirect effects of these variables on sustainability outcomes within the context of Pakistan's industrial sector. Strict ethical standards were followed throughout the study. Informed consent was obtained from each participant, and confidentiality was maintained by anonymizing responses and securely storing data. Participants were informed that their participation was voluntary, with the option to withdraw at any time. The study adhered to the ethical guidelines of the participating universities. Overall, this methodology provides a comprehensive and rigorous approach to exploring factors influencing environmental sustainability, with data collection, sample size, and analysis methods ensuring the validity, reliability, and relevance of the findings for the industrial sector in Pakistan.

4. DATA ANALYSIS

The following Table 1 shows reliability and validity results. The reliability and validity of the latent constructs in the structural model were evaluated using factor loadings, Cronbach's Alpha, average variance extracted (AVE), and composite reliability (CR). Each indicator's factor loading represents its contribution to the respective latent variable. All factor loadings exceeded the commonly accepted threshold of 0.6, indicating that each indicator reliably measures its associated construct. Community Empowerment was measured by four indicators (CE1-CE4), with factor loadings ranging from 0.747 to 0.908. The Cronbach's Alpha for this construct was 0.85, which exceeds the acceptable threshold of 0.7, suggesting high internal consistency. The AVE value of 0.65 and CR of 0.87 for Community Empowerment indicate adequate convergent validity and composite reliability. Community Engagement included four indicators (CEg1-CEg4), with factor loadings ranging from 0.754 to 0.868. This construct demonstrated high internal consistency, with a Cronbach's Alpha of 0.88. The AVE of 0.70 and CR of 0.89 confirm that the construct has satisfactory convergent validity and reliability. Environmental education was measured by six indicators (EE1-EE6), with factor loadings from 0.693 to 0.825. The Cronbach's Alpha was 0.81, indicating reliable internal consistency for this construct. The AVE value of 0.60 and CR of 0.83 further confirm that Environmental Education meets the required standards for convergent validity and composite reliability. Environmental Sustainability, the primary outcome variable, was assessed with 17 indicators (ES1-ES17), displaying factor loadings from 0.660 to 0.813. The Cronbach's Alpha of 0.90 demonstrates strong internal consistency among the indicators. The AVE for Environmental Sustainability was 0.67, while the CR was 0.91, both of which meet the acceptable thresholds, establishing the construct's validity and reliability. In addition, the P-values associated with each path coefficient were ≤ 0.05, indicating that all observed relationships are statistically significant. Collectively, these reliability and validity indicators affirm that the constructs in the model are well-defined and suitable for further analysis in the context of environmental sustainability.

The following Table 2 and Figure 2 presents path analysis. The path analysis results presented in Table 2 reveal the direct and moderating effects of community empowerment, community engagement, and environmental education on environmental sustainability. The path from community empowerment to environmental sustainability shows a path coefficient of 0.028. This indicates a positive but modest direct effect of Community Empowerment on Environmental Sustainability, suggesting that while Community Empowerment contributes to Environmental Sustainability, its impact is relatively small. Community engagement demonstrates a stronger influence on environmental sustainability, with a path coefficient of 0.331. This finding suggests that Community Engagement is a significant driver of Environmental Sustainability, implying that efforts to involve communities actively may lead to greater improvements in environmental outcomes.

The path from environmental education to environmental sustainability has a path coefficient of 0.275, indicating a positive impact of environmental education on environmental sustainability. This suggests that enhancing environmental education can significantly contribute to achieving sustainable environmental outcomes, likely by increasing awareness and fostering environmentally responsible behaviors among individuals and communities. The results of this study are in line with the past studies (Diemer and Khushik, 2020; Mumtaz, 2021; Zeewaqar, 2024).

Additionally, the moderating effects of community engagement and community empowerment were analyzed, with path coefficients of 0.086 and 0.024, respectively. While these coefficients are positive, they indicate relatively weaker moderating effects compared to the direct effects of community engagement and environmental education. This suggests that, although both community

Figure 2: Analysis results

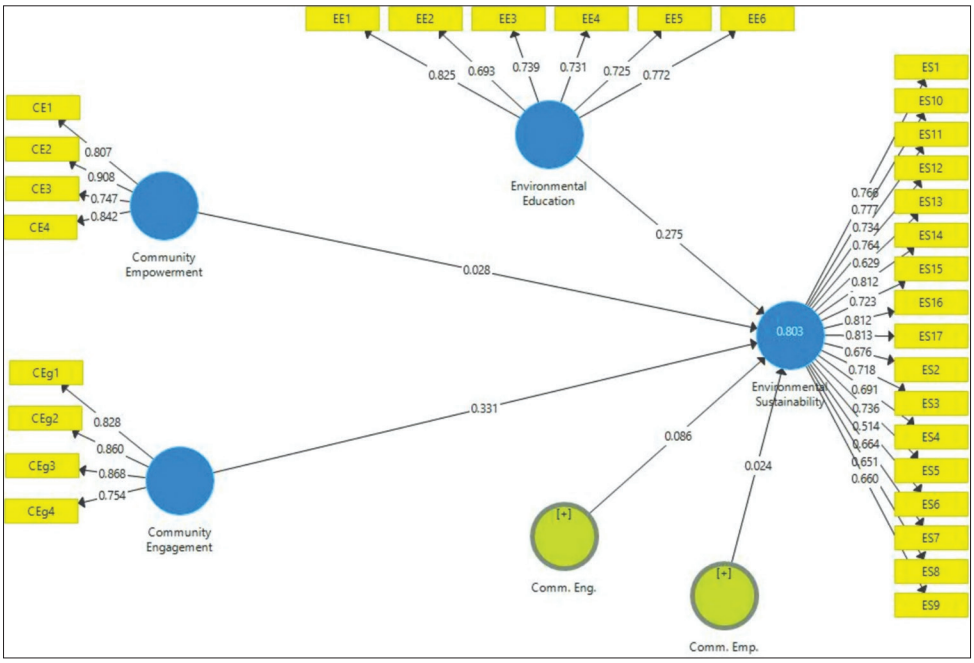


Table 1: Factor loadings

Latent variable	Indicator	Factor loading	Cronbach's alpha (≥ 0.7)	P-value (≤0.05)	AVE (≥0.5)	CR (≥0.7)
Community empowerment	CE1	0.807	0.85	0.01	0.65	0.87
	CE2	0.908				
	CE3	0.747				
	CE4	0.842				
Community engagement	CEg1	0.828	0.88	0.01	0.70	0.89
	CEg2	0.860				
	CEg3	0.868				
	CEg4	0.754				
Environmental education	EE1	0.825	0.81	0.01	0.60	0.83
	EE2	0.693				
	EE3	0.739				
	EE4	0.731				
	EE5	0.725				
	EE6	0.772				
Environmental sustainability	ES1	0.676	0.90	0.01	0.67	0.91
	ES2	0.812				
	ES3	0.718				
	ES4	0.723				
	ES5	0.664				
	ES6	0.660				
	ES7	0.718				
	ES8	0.691				
	ES9	0.676				
	ES10	0.737				
	ES11	0.766				
	ES12	0.777				
	ES13	0.734				
	ES14	0.753				
	ES15	0.813				
	ES16	0.723				
	ES17	0.802				

engagement and community empowerment can slightly enhance the relationship between environmental efforts and sustainability outcomes, their moderating roles are limited. Overall, these findings highlight the importance of direct engagement and education in fostering environmental sustainability. community engagement emerged as the most influential factor, followed by environmental education, while community empowerment had a smaller yet positive effect. The limited moderating impact of

Table 2: Path analysis

Path	Path coefficient
Community empowerment→Environmental sustainability	0.028
Community engagement→Environmental sustainability	0.331
Environmental education→Environmental sustainability	0.275
Moderating variable (Comm. Eng.)	0.086
Moderating variable (Comm. Emp.)	0.024

community engagement and community empowerment suggests that their direct effects on environmental sustainability are more impactful than their roles as moderators.

5. CONCLUSION

Based on the results, this study concludes that community engagement and environmental education are critical factors in promoting environmental sustainability. Community engagement emerged as the strongest predictor, indicating that actively involving communities in environmental initiatives significantly contributes to sustainable outcomes. Environmental education also plays a substantial role, suggesting that enhancing awareness and knowledge around environmental issues can lead to more sustainable behaviors and practices within communities. Community empowerment, while positively related to environmental sustainability, showed a relatively smaller impact, implying that while empowering communities is beneficial, it may not independently drive sustainability as strongly as engagement and education do. The analysis of moderating effects revealed that both Community Engagement and Community Empowerment have limited moderation roles, underscoring the importance of their direct contributions rather than their interaction effects in the sustainability model. Hence, for effective environmental sustainability strategies, stakeholders should prioritize both community engagement and environmental education efforts. This focus will likely lead to stronger, more sustained environmental outcomes, whereas empowerment efforts may need to be integrated with active engagement and education to maximize impact.

This study is pivotal in advancing the understanding and effectiveness of environmental education in Pakistan through the lens of community empowerment and offers numerous benefits to Pakistan, addressing both immediate and long-term environmental and socio-economic challenges. By focusing on the integration of community empowerment with environmental education, the study aims to develop a model that is both culturally relevant and practically effective for the diverse regions of Pakistan. One significant benefit is the enhancement of environmental awareness and literacy among the population. Increased awareness can lead to more informed and responsible behaviors towards the environment, which is crucial for mitigating issues such as deforestation, pollution, and water scarcity. Educating communities about sustainable practices can foster a culture of conservation and stewardship, promoting actions that protect and restore natural resources. This, in turn, can lead to improved environmental health and resilience against climate change impacts. Another major benefit is the potential for socio-economic development through community empowerment. By involving communities in environmental education and decision-making processes, the study promotes inclusive development. Empowered communities are better equipped to manage their resources sustainably, which can lead to economic benefits such as improved agricultural productivity, sustainable tourism, and the creation of green jobs. This approach can also address social inequalities, providing marginalized groups, including women and rural populations, with opportunities to participate in and benefit from environmental initiatives. Additionally, incorporating traditional ecological knowledge into educational programs can enhance their relevance and effectiveness, as this knowledge often includes time-tested practices that are well-suited to local environmental conditions.

The study also aims to identify and address socio-economic and political barriers to effective community participation in environmental programs. By understanding and mitigating these barriers, the study can help create more inclusive and supportive environments for community engagement. This is particularly important in regions where poverty, lack of education, and political instability hinder active participation. By addressing these issues, the study can contribute to more equitable and effective environmental governance. Furthermore, the study's emphasis on empirical research and evaluation of educational initiatives can provide valuable data and insights. This information is crucial for policymakers and practitioners to design, implement, and refine environmental education programs that are both impactful and sustainable. Long-term monitoring can reveal how educational interventions influence community behaviors and environmental health over time, ensuring that programs are continually improved based on evidence and feedback. On a broader scale, the study aligns with Pakistan's national and international commitments to sustainable development and environmental protection. It supports the goals outlined in Pakistan's National Climate Change Policy and its commitments under the Paris Agreement. By promoting environmental education and community empowerment, the study contributes to the achievement of several Sustainable Development Goals (SDGs), including those related to quality education (SDG 4), gender equality (SDG 5), clean water and sanitation (SDG 6), and climate action (SDG 13). These contributions can enhance Pakistan's reputation and standing in the global community as a proactive and responsible participant in addressing environmental challenges. Finally, the study provides a replicable model that can be adapted and applied in other developing countries facing similar environmental and socio-economic challenges. By sharing the findings and best practices from Pakistan's experience, the study can contribute to a global body of knowledge on environmental education and community empowerment. This can foster international collaboration and support, further amplifying the positive impacts of the study. In summary, this study offers a comprehensive approach to addressing Pakistan's environmental challenges through education and empowerment, promising significant benefits for environmental sustainability, socio-economic development, and global cooperation.

6. LIMITATIONS AND FUTURE DIRECTIONS

This study, focused on Pakistan's educational sector, provides valuable insights but has certain limitations that should guide future research. Its findings may not be generalizable beyond the industrial context in Pakistan, as environmental sustainability drivers can vary across sectors and regions. The cross-sectional design limits causal inference, and the reliance on self-reported measures introduces the potential for response bias. Additionally, while Community Engagement and Empowerment were examined as moderators, other factors like government policies or economic incentives could better explain sustainability outcomes. Future studies could address these limitations by expanding to other sectors and regions, adopting longitudinal and mixed-methods approaches, and exploring additional moderators and mediators. Comparative research, especially across different countries and industries, as well as studies investigating the influence of policy and corporate social responsibility initiatives, would deepen our understanding of sustainability practices and help develop more tailored, effective strategies for environmental sustainability in developing contexts like Pakistan.

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