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Digital Climate Activism as Non-Formal Climate Literacy Education under the Action for Climate Empowerment (ACE) Framework: Evidence from Pakistan

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Abstract: Pakistan faces an urgent climate crisis that disproportionately affects its youth and vulnerable communities. At the same time, the country's rapidly expanding digital connectivity presents new opportunities to advance climate literacy beyond formal classrooms. This paper examines how digital climate activism can function as a form of non-formal sustainability education under the United Nations' Action for Climate Empowerment (ACE) framework in Pakistan. Drawing on academic literature, policy analysis, and a case study of a youth-led initiative (EcoRevival Pakistan), the study conceptualizes digital platforms as educational spaces that support climate learning, public awareness, participation, and youth empowerment. The analysis situates Pakistan's climate vulnerability, youth demographics, and digital landscape within the ACE framework, highlighting how social media, online training, and digital campaigns contribute to climate literacy development. Findings illustrate that youth-led digital initiatives foster experiential learning, systems thinking, and civic engagement while complementing gaps in formal climate education. However, challenges such as digital inequality, uneven access, and limited institutional support constrain broader impact. Building on these insights, the paper proposes a scalable digital climate education and empowerment model tailored to Pakistan's socio-cultural and technological context. A brief comparative perspective draws lessons from international approaches to climate education and youth engagement. The study concludes with practical recommendations for policymakers, educators, and civil society to strengthen non-formal climate education through digital tools. By positioning digital activism as a sustainability education pathway, this research contributes to scholarship on climate literacy, youth engagement, and Action for Climate Empowerment in the Global South.

Keywords: Climate literacy; Action for Climate Empowerment; sustainability education; digital activism; non-formal education; youth engagement; Pakistan

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Introduction

Pakistan faces a severe climate vulnerability burden that is already disrupting lives, livelihoods, infrastructure, and long-term development planning. Although Pakistan contributes only a small share of global greenhouse gas emissions, it remains among the countries most exposed to climate-related risk and loss. These pressures are visible across multiple sectors, including water security, agriculture, public health, urban systems, and disaster preparedness. This reality makes youth engagement especially consequential in Pakistan, where the population remains strikingly young and future climate resilience will depend in large part on the knowledge, capacities, and participation of younger generations (Kemp, 2025). For that reason, climate resilience in Pakistan is not only a technical or governance challenge; it is also an educational and civic one.

Digital communication environments now offer one of the most accessible pathways for reaching, informing, and mobilizing young people at scale. Pakistan's expanding internet and mobile connectivity has widened the reach of online communication, information exchange, and youth networking. At the start of 2025, Pakistan had approximately 116 million internet users and about 66.9 million social media user identities, indicating a substantial digital public that can be reached through online platforms (Kemp, 2025). At the same time, uneven connectivity and persistent urban-rural disparities mean that digital opportunity remains unevenly distributed. Within this landscape, young people are among the most active digital users, making online platforms increasingly important sites for climate communication, peer learning, and civic expression. These conditions create new possibilities not only for awareness raising, but also for non-formal climate learning, public participation, and youth-led environmental advocacy. In this context, digital climate activism can be understood not simply as online advocacy, but as a non-formal educational process through which youth encounter information, interpret climate risks, exchange ideas, and organize collective responses (Abubakar, Maharvi, Sattar, & Rashid Ahmad, 2025).

To be analytically useful and policy relevant, however, this digital engagement must be situated within a broader framework for climate literacy and public empowerment. One such framework is Action for Climate Empowerment (ACE), the UNFCCC agenda that links climate action to education, training, public awareness, public participation, public access to information, and international cooperation (UNFCCC, n.d.). Grounded in Article 6 of the Convention and Article 12 of the Paris Agreement, ACE emphasizes that effective climate response depends not only on policy and technology, but also on informed and engaged publics; ACE outlines six interrelated elements: climate change education, public awareness, training, public participation, public access to information, and international cooperation (UNFCCC, n.d.). For youth-centered contexts such as Pakistan, ACE offers a useful lens for understanding how learning, participation, and access to information can reinforce one another in climate governance. Strengthening climate literacy, the knowledge and skills needed to make informed climate-friendly decisions, is a core objective of ACE and is increasingly seen as "pressing" for shaping an equitable, low-emissions future.

This article argues that digital climate activism can function as a meaningful form of non-formal climate literacy education in Pakistan when examined through the ACE framework. Drawing on literature review, qualitative policy analysis, and an illustrative case study of EcoRevival Pakistan, the article examines how digital platforms can support youth climate learning, civic participation, and public engagement while also revealing important constraints related to access, institutional support, and implementation. It further proposes a more focused Digital Climate Empowerment for Youth model to show how Pakistan might translate dispersed digital activism into a more structured and scalable climate education strategy. In doing so, the article contributes to scholarship on sustainability education, youth engagement, and climate empowerment in the Global South.

Literature Context: Climate Literacy, ACE, and Digital Activism

Climate Literacy and ACE in Pakistan

Effective climate action depends on an informed public. Climate literacy, understood as knowledge of climate science, impacts, and response options, is central to adaptation, mitigation, and informed civic participation. Within the Action for Climate Empowerment (ACE) framework, education and public awareness are foundational to building this capacity (UNFCCC, n.d.). Because climate change cuts across ecological, social, and economic systems, climate literacy is not an optional supplement but a core condition for effective climate governance (UNFCCC, n.d.). In Pakistan, this makes climate education especially important for youth, communities, and institutions involved in climate decision-making.

In Pakistan, climate education has historically remained limited, although recent policy steps indicate movement toward integration within formal schooling. UNESCO reports that climate change has been incorporated into Pakistan's national curriculum, but it also emphasizes that curriculum reform must be accompanied by teacher preparation, resilient learning environments, and broader system-level support if it is to translate into effective practice (UNESCO, 2025). This is especially important in a country where climate shocks already affect schooling conditions and learning continuity. A UNDP youth perception report likewise suggests that climate awareness remains uneven and that greater public dissemination of climate knowledge is needed (Jamshaid). Taken together, these sources indicate that climate literacy in Pakistan remains a developing policy and pedagogical agenda rather than a fully established educational reality.

The ACE framework provides a broader lens for evaluating these efforts because it extends beyond formal schooling to public awareness, training, access to information, participation, and international cooperation (UNFCCC, n.d.). Pakistan's climate and youth policy discourse has increasingly acknowledged awareness and youth engagement, but implementation remains uneven. One notable example is the Green Youth Movement, launched under the Prime Minister's Youth Programme, which DAWN reported as linking university students to climate

action, green skills, and youth mobilization through trainings and digital engagement (DAWN, 2022). Read in this way, such initiatives suggest that Pakistan is moving toward ACE-aligned practice, but the available evidence still points to early-stage implementation rather than a mature national system.

At the same time, the literature shows that Pakistan's climate literacy and ACE implementation still face structural constraints. Peer-reviewed work on social media and environmental advocacy suggests that digital platforms can support climate awareness, but their effects are shaped by unequal access, differing levels of digital literacy, and the social context in which youth engage online (Abubakar, Maharvi, Sattar, & Rashid Ahmad, 2025); (Boje Mortensen & Dadhich, 2025); (Sato, 2024). Research on digital participation barriers in Pakistan further indicates that socio-economic pressures, language, and access constraints shape who can participate meaningfully in online climate activism (Hussain & Tahir, 2025). In addition, gender and broader equity concerns remain central to any ACE-aligned strategy, since women and marginalized groups are often less able to access information or participate in environmental initiatives (Rankine, Nikolova, Mortelliti, Zhu, & Cebon, 2024). This literature suggests that any climate empowerment strategy in Pakistan must be both digitally enabled and equity-conscious.

Overall, the literature points to three persistent gaps: limited climate literacy, incomplete policy implementation, and unequal participation. These gaps make digital tools promising not because they replace formal climate education, but because they can extend its reach, create informal learning spaces, and support youth engagement when used alongside institutional reforms (UNFCCC, n.d.); (UNESCO, 2025); (Abubakar, Maharvi, Sattar, & Rashid Ahmad, 2025). The next section therefore examines how digital activism can function as a non-formal pathway to climate literacy in Pakistan.

Digital Climate Activism as a Non-Formal Education Pathway

Digital climate activism has emerged as a significant dimension of contemporary environmental engagement, particularly among youth. It refers to the use of digital platforms, including social

media, online networks, and other information and communication technologies, to disseminate climate-related information, mobilize participation, and advocate for environmental action. In contrast to traditional forms of advocacy, digital environments enable rapid, decentralized communication and create new spaces for interaction, dialogue, and collective expression. In Pakistan, where mobile and internet access has expanded significantly in recent years, these platforms have become increasingly relevant for reaching large youth populations and facilitating engagement at scale (Kemp, 2025). Importantly, recent scholarship suggests that such engagement is not limited to advocacy alone but can function as a form of non-formal learning, where individuals acquire climate-related knowledge, attitudes, and behavioral orientations through ongoing digital interaction (Abubakar, Maharvi, Sattar, & Rashid Ahmad, 2025).

Global youth climate movements provide clear evidence of how digital communication can translate into collective action. The Fridays for Future movement, for instance, demonstrates how online mobilization can scale rapidly across geographic contexts and facilitate both digital and on-ground participation. In Pakistan, participation in global climate strikes has similarly been supported by social media coordination and digital outreach (Ali, 2019). These examples illustrate a broader pattern identified in the literature: digital platforms lower barriers to entry for participation by enabling individuals to engage through sharing information, expressing support, and coordinating action, while also amplifying the visibility and impact of offline initiatives (Boje Mortensen & Dadhich, 2025). Rather than existing as separate domains, digital and physical forms of activism are increasingly interdependent.

Existing research highlights the enabling potential of digital climate activism, particularly in expanding access to participation. Digital platforms allow individuals who may lack financial, geographic, or institutional access to traditional forms of activism to engage in climate discourse and action. Studies of youth activism in Asia suggest that online spaces can broaden participation and create opportunities for new forms of engagement, including storytelling, peer-to-peer learning, and networked advocacy (Boje Mortensen & Dadhich, 2025). These forms of engagement are especially relevant for younger populations, who are often more digitally

connected and more likely to interact with climate-related content through informal, self-directed channels.

At the same time, the literature cautions that digital activism is shaped by structural inequalities and may reproduce existing social divides. Access to digital infrastructure, levels of digital literacy, and socio-economic conditions influence who is able to participate meaningfully in online climate engagement. In South Asian contexts, including Pakistan, these disparities are often reflected in differences between urban and rural populations, as well as along gender and income lines (Sato, 2024); (Hussain & Tahir, 2025). Research further indicates that effective participation in digital spaces frequently requires resources such as stable connectivity, language proficiency, and discretionary time, which are not equally available across populations (Boje Mortensen & Dadhich, 2025). Gendered barriers, including limited access to devices and concerns about online safety, also constrain participation for young women and marginalized groups (Rankine, Nikolova, Mortelliti, Zhu, & Cebon, 2024). These findings suggest that digital climate activism, while expanding opportunities, must be understood within broader patterns of inequality.

Despite these constraints, empirical evidence indicates that digital engagement can contribute meaningfully to climate awareness and pro-environmental attitudes. A study of university students in Pakistan found that exposure to environmental content on social media was associated with higher levels of awareness and a greater willingness to engage in advocacy and sustainable practices (Abubakar, Maharvi, Sattar, & Rashid Ahmad, 2025). Such findings suggest that digital platforms can complement formal education by providing accessible and continuous channels for climate learning. Policy-oriented analyses similarly highlight digital engagement as an emerging avenue for youth climate participation in Pakistan, emphasizing its potential to connect information, awareness, and action in ways that traditional approaches alone may not achieve (Naeem, 2023).

Overall, the literature suggests that digital climate activism holds significant potential as a non-formal pathway for climate literacy and youth engagement. It can facilitate information dissemination, enable participation, and support the development of climate-related awareness and agency. However, its effectiveness depends on addressing structural constraints such as unequal access, socio-economic disparities, and the need to connect online engagement with tangible outcomes. These dynamics underscore the importance of examining digital activism not only as a communication tool, but as part of a broader educational and policy framework, a perspective that informs the conceptual approach of this study.

Methodology and Conceptual Framework

This study adopts a qualitative policy analysis approach to examine the role of digital climate activism as a non-formal pathway for climate literacy in Pakistan. The analysis is based on a structured review of secondary sources, including peer-reviewed literature, policy documents, institutional reports, and publicly available datasets relevant to climate education, youth engagement, and digital activism. Rather than generating primary empirical data, the study synthesizes existing knowledge to identify patterns, gaps, and opportunities within Pakistan's climate literacy landscape.

Sources were selected based on three criteria: relevance to the themes of climate literacy, digital activism, or the Action for Climate Empowerment (ACE) framework; credibility, with preference given to peer-reviewed publications and reports from international organizations such as UNFCCC, UNESCO, and UNDP; and contextual applicability to Pakistan or comparable Global South settings. This approach ensures that the analysis is grounded in both global scholarship and locally relevant evidence while maintaining academic rigor.

The study employs thematic analysis to synthesize findings across sources. Key themes were identified through iterative reading of the literature, including climate literacy gaps, digital engagement practices, barriers to participation, and policy opportunities for youth empowerment. These themes were then organized in relation to the six elements of the ACE framework to

examine how digital tools may support or constrain each dimension of climate empowerment. This analytical approach allows for a structured yet flexible interpretation of diverse sources.

To complement the broader literature, the study incorporates a case study of EcoRevival Pakistan as an illustrative example of youth-led digital climate activism. The case study is not intended to provide statistically generalizable findings but rather to offer grounded insight into how digital engagement operates in practice. Data for the case study are drawn from organizational records, program documentation, and publicly available outputs, including digital campaigns, training activities, and outreach metrics.

Given the authors' involvement in the case study initiative, a reflexive approach is adopted to mitigate potential bias. Observational insights are triangulated with external sources, including academic literature, policy reports, and independent documentation, to ensure analytical balance. This combination of insider perspective and external validation strengthens the credibility of the findings while acknowledging the interpretive nature of qualitative research.

While the study provides a comprehensive synthesis of available evidence, it is limited by its reliance on secondary data and the absence of primary field-based data collection. However, this approach is appropriate for the study's objective of developing a conceptual and policy-oriented understanding of digital climate activism within Pakistan's climate literacy landscape.

Conceptual Framework: The conceptual framework guiding this study is grounded in the Action for Climate Empowerment (ACE) framework, with a specific focus on how digital engagement can enhance its six core elements in the context of Pakistan. Within sustainability education discourse, this approach positions digital activism not only as a tool for advocacy, but as an interconnected educational ecosystem that facilitates learning, participation, and knowledge exchange across formal and non-formal settings. By mapping digital tools onto ACE elements, the framework provides a structured lens for analyzing how climate literacy can be expanded through contemporary communication technologies. We conceptualize that digital tools (such as

social media, mobile apps, e-learning platforms, and online forums) can be mapped onto ACE elements as follows:

- **Education:** Digital platforms extend climate education beyond formal institutions by enabling access to learning resources, online courses, and interactive content. In contexts where curricular implementation is uneven, such tools can supplement formal education and reach broader audiences, including out-of-school youth (UNFCCC, n.d.).
- **Public Awareness:** Social and digital media facilitate large-scale dissemination of climate information, shaping public understanding and attitudes. Unlike traditional media, digital platforms enable interactive communication, allowing users to engage with, reinterpret, and share climate-related content, thereby reinforcing awareness through participation (UNFCCC, n.d.).
- **Training:** Digital tools support skills-based learning through webinars, virtual workshops, and instructional content. These formats allow for scalable capacity-building initiatives, particularly in resource-constrained environments where in-person training opportunities may be limited (UNFCCC, n.d.)
- **Public Participation:** Online platforms create accessible channels for civic engagement, enabling individuals to contribute to climate discussions, organize collective action, and interact with policy processes. This expands participation beyond formal institutional settings and aligns with ACE's emphasis on inclusive engagement (UNFCCC, n.d.).
- **Public Access to Information:** Digital environments enhance access to climate-related data, research, and policy information. When designed inclusively, these platforms can reduce information asymmetries and improve transparency between institutions and the public (UNFCCC, n.d.).
- **International Cooperation:** Digital connectivity enables transnational exchange of knowledge, practices, and experiences. Through online networks and collaborative platforms, youth and organizations can engage with global climate initiatives, strengthening local action through international learning (UNFCCC, n.d.).

Using this framework, the study evaluates how digital climate activism in Pakistan interacts with each ACE dimension, identifying both enabling conditions and structural constraints. The framework also informs the development of the proposed Digital Climate Empowerment for Youth (DCEY) model, ensuring that the analysis remains aligned with internationally recognized principles of climate education and public engagement.

Learning, Participation, and Empowerment through Digital Climate Education in Pakistan

Current Landscape of Youth Climate Activism in Pakistan

Youth engagement in climate action has expanded in Pakistan in recent years, reflecting both increasing exposure to climate impacts and the influence of global environmental movements. A growing number of youth-led initiatives, including university-based clubs, grassroots organizations, and national networks, are actively involved in awareness campaigns, community projects, and advocacy efforts. Many of these initiatives rely on digital platforms for coordination, outreach, and knowledge sharing, indicating a shift toward hybrid models of engagement that combine online and offline participation.

At the policy level, youth climate engagement has been incorporated into national programs. The Green Youth Movement (GYM), launched in 2022 under the Prime Minister's Youth Programme, aims to involve university students in climate-related activities such as environmental restoration, awareness campaigns, and green innovation (DAWN, 2022). A notable feature of the program is its integration of digital engagement, including online trainings, virtual events, and digital coordination platforms. Such initiatives reflect a growing recognition that effective youth mobilization requires both institutional support and alignment with the digital practices of young populations.

Beyond government-led efforts, civil society organizations and youth networks have played a significant role in shaping climate activism in Pakistan. Platforms such as Climate Action Pakistan and youth-led networks associated with global movements have used social media to

organize campaigns, coordinate events, and disseminate information (Ali, 2019). These initiatives demonstrate how digital tools enable decentralized organization and facilitate connections between geographically dispersed participants. Rather than functioning as isolated efforts, such networks contribute to an emerging ecosystem of youth-led climate engagement that operates across institutional and informal spaces.

Digital engagement has also begun to influence youth participation in policy-related processes. Initiatives such as "COP in My City," supported by the Ministry of Climate Change, illustrate how digital tools can be used to broaden participation in climate dialogue. By enabling virtual submissions, mentorship, and coordination, such platforms allow youth from diverse regions to contribute to policy discussions and connect with national and international forums (Rankine, Nikolova, Mortelliti, Zhu, & Cebon, 2024). These developments suggest a gradual opening of institutional spaces for youth input, mediated through digital participation mechanisms.

Despite these developments, several structural challenges continue to constrain the effectiveness and inclusivity of youth climate activism in Pakistan:

- First, although climate change has been introduced into formal curricula, its implementation remains inconsistent, resulting in uneven levels of climate literacy among students. As a result, many young people rely on informal and self-directed learning through digital platforms, which can lead to both knowledge gains and gaps.
- Second, the digital divide remains a significant barrier. While internet penetration has expanded, access to reliable connectivity, digital devices, and digital literacy varies across regions and socio-economic groups, limiting participation for many youth, particularly in rural areas (Kemp, 2025) (Sato, 2024). This uneven access contributes to a concentration of digital activism among urban and relatively privileged populations.
- Third, socio-cultural and economic factors influence participation. Competing priorities such as employment, education, and household responsibilities can limit engagement, while social norms may discourage active participation in public or digital advocacy

spaces. These factors shape not only who participates in climate activism, but also how climate issues are framed and communicated.

- Fourth, the quality of information in digital spaces presents additional challenges. The presence of misinformation and fragmented knowledge can undermine effective climate communication, highlighting the need for credible, accessible, and contextually relevant content.
- Finally, resource constraints affect the sustainability of youth-led initiatives. Many organizations operate with limited funding and rely on volunteer labor, which restricts their ability to scale activities, invest in digital infrastructure, or sustain long-term programs. These constraints point to the need for institutional support, capacity-building mechanisms, and funding pathways to strengthen youth-led climate engagement.

Taken together, these dynamics indicate that youth climate activism in Pakistan is expanding but remains uneven in reach and impact. Digital tools have enabled new forms of engagement, learning, and coordination, yet structural constraints continue to limit their transformative potential. Understanding how these opportunities and limitations interact is essential for designing more effective and inclusive approaches to climate literacy. The following section therefore examines EcoRevival Pakistan as an illustrative case of how youth-led digital engagement can function in practice.

Case Study: Youth-Led Non-Formal Climate Education through Digital Platforms

One illustrative example of youth-led digital climate activism in Pakistan is EcoRevival Pakistan (ERP), a grassroots environmental initiative founded in 2023 by university students. The organization positions environmental action as a pathway to broader social and economic well-being, with a focus on youth engagement, climate literacy, and community-based interventions. While relatively small in scale, ERP provides a useful case for examining how digital tools can support non-formal climate education and youth participation in practice.

EcoRevival Pakistan's activities between 2023 and 2026 provide an illustrative example of youth-led digital climate engagement at scale. The organization has conducted over 100 webinars, engaged more than 2,000 participants through its WhatsApp community, and delivered multiple structured learning programs, including two month-long fellowships and two virtual educational courses. Its digital outreach includes approximately 1,300 Instagram followers, 4,000 LinkedIn followers, and 3,300 Facebook followers. In addition to digital engagement, the initiative has organized over ten on-ground plantation and clean-up drives across cities including Faisalabad, Gilgit, Quetta, Karachi, Swat, and Islamabad, as well as five in-person seminars. These activities demonstrate the integration of digital and physical modes of engagement in youth-led climate action.

ERP's programming combines digital coordination with localized action. Its Student Ambassador model, for example, uses digital recruitment and onboarding processes to build a distributed network of volunteers across educational institutions. Participants are engaged through online orientations, communication platforms, and collaborative tools, enabling coordination across geographically dispersed contexts at relatively low cost. This structure illustrates how digital connectivity can facilitate decentralized organization while maintaining program coherence.

Digital Campaigns: ERP's digital campaigns further demonstrate how online platforms can function as spaces for climate learning and engagement. Campaigns addressing issues such as climate-related disruptions to education and urban flooding have used infographics, short-form videos, and bilingual content to communicate complex issues in accessible formats. By linking climate change to everyday experiences, such campaigns contribute to contextualized climate literacy and encourage audience interaction through comments, sharing, and discussion. This form of engagement reflects a shift from one-way information dissemination toward participatory learning environments.

ERP also integrates digital outreach with field-based activities. Community initiatives, such as workshops on sustainable practices, are documented and shared through digital platforms,

extending their reach beyond local participants. This hybrid approach allows localized interventions to generate broader visibility and potential replication. It also demonstrates how digital tools can amplify the educational value of field-based experiences by transforming them into shareable learning resources.

Field Projects and Digital Integration: The organization has also engaged with institutional and policy spaces through its association with youth-focused initiatives and participation in national and international forums. Such engagements suggest that youth-led digital initiatives can serve as intermediaries between grassroots actors and formal governance processes. While these linkages remain limited in scale, they highlight the potential for digitally enabled youth networks to contribute to broader climate dialogue.

Challenges and Reflections: At the same time, the EcoRevival case reflects structural challenges common to youth-led initiatives in Pakistan. Limited financial resources, reliance on volunteer labor, and constrained organizational capacity affect the scalability and sustainability of activities. In addition, while digital outreach enables broader engagement, audience reach remains relatively modest compared to mainstream platforms, indicating that youth-led climate initiatives often operate within niche networks. These constraints underscore the importance of institutional support, funding mechanisms, and capacity-building frameworks for scaling such efforts.

Beyond advocacy outcomes, ERP's activities function as non-formal learning environments. Through webinars, fellowships, ambassador programs, and digital campaigns, participants engage in experiential learning processes that develop climate knowledge, communication skills, and leadership capacity. These activities align with multiple elements of the ACE framework, including education, public awareness, and participation, demonstrating how digital engagement can support climate literacy outside formal institutional settings.

Impact: The impact of ERP is best understood in terms of its role in facilitating engagement and capacity-building rather than large-scale transformation. Program participants have been involved in initiating local environmental activities, contributing to awareness efforts, and participating in broader climate conversations. While systematic impact evaluation remains limited, available evidence suggests that such initiatives can contribute to incremental changes in awareness, engagement, and youth participation.

Overall, EcoRevival Pakistan illustrates how youth-led digital initiatives can integrate online engagement with community-based action to support climate literacy and participation. While constrained by scale and resources, the case demonstrates the potential of digital platforms to function as non-formal educational spaces within the ACE framework. These insights inform the development of the proposed Digital Climate Empowerment for Youth (DCEY) model, particularly in relation to scalability, inclusivity, and the integration of digital and field-based approaches.

A Digital Climate Education & Empowerment Model for Youth

Building on the preceding analysis, this section proposes a Digital Climate Empowerment for Youth (DCEY) model as a structured approach to integrating digital tools into climate literacy and youth engagement in Pakistan. Rather than functioning as a collection of isolated initiatives, the model conceptualizes digital climate activism as a coordinated system aligned with the Action for Climate Empowerment (ACE) framework. It is designed to be scalable, context-sensitive, and adaptable to Pakistan's socio-economic and technological realities, including uneven digital access, strong youth demographics, and emerging institutional support for climate engagement.

The DCEY model is organized into three sequential phases to ensure feasibility, gradual scaling, and effective resource allocation.

Phase 1: Foundation (Short-Term: 1–2 Years)

The initial phase focuses on establishing core digital infrastructure and accessible entry points for climate learning. Key priorities include the development of a national digital climate education platform that provides localized learning resources, including short courses, interactive modules, and simplified climate data in Urdu and regional languages. This platform should also serve as a repository for teaching materials and peer-learning forums, enabling both students and educators to engage with climate content.

In parallel, a national digital youth climate network can be established to connect student groups, youth organizations, and emerging climate leaders. This network would facilitate webinars, collaborative campaigns, and peer-to-peer learning, creating an initial ecosystem of digitally connected climate actors. Efforts in this phase should also prioritize accessibility, including partnerships with telecommunications providers to reduce data costs and the integration of alternative communication channels such as community radio to reach underserved populations.

Phase 2: Expansion (Medium-Term: 3–5 Years)

The second phase focuses on scaling participation, strengthening capacity, and expanding engagement across sectors. This includes the introduction of structured youth-led programs such as media and advocacy incubators, which train young individuals in climate communication, digital storytelling, and public engagement. These programs aim to increase the quality and reach of climate-related content while also creating pathways for green skills and employment.

Additionally, mechanisms for digital participation in policymaking should be introduced. These may include a national Youth Climate Council, online consultation platforms, and annual digital climate dialogues that connect young people with policymakers. Such mechanisms align with ACE principles by expanding public participation and ensuring youth perspectives are incorporated into decision-making processes. To address persistent inequalities, this phase should also include targeted digital literacy initiatives, particularly for rural populations and young women, ensuring that expanded digital opportunities translate into inclusive participation.

Phase 3: Institutionalization (Long-Term: 5+ Years)

The final phase focuses on embedding digital climate empowerment within national policy and institutional frameworks. At this stage, the digital platform and youth networks should be formally integrated into government structures, such as the Ministry of Climate Change, Ministry of Education, and Higher Education Commission. Long-term funding mechanisms, including public-private partnerships and international climate financing, should be established to ensure sustainability.

Innovation and collaboration can be further strengthened through national climate innovation challenges, hackathons, and partnerships with the private sector, enabling youth to develop and scale climate solutions. This phase also includes the development of standardized monitoring and evaluation systems to assess program impact, including indicators related to climate literacy, participation rates, and behavioral change outcomes.

The DCEY model is distinct in its integration of digital tools, youth engagement, and policy alignment within a single framework. Rather than introducing entirely new structures, it connects and scales existing initiatives, including youth programs, digital platforms, and educational efforts. By positioning youth as active contributors rather than passive recipients, the model emphasizes co-creation, participation, and localized knowledge production.

By structuring digital climate engagement through phased implementation and institutional integration, the DCEY model provides a practical pathway for operationalizing the ACE framework in Pakistan. It demonstrates how digital tools can extend climate literacy beyond formal education systems while enabling broader participation and collaboration. While implementation will depend on political will, institutional coordination, and resource availability, the model offers a structured foundation for advancing youth-centered climate empowerment in the digital age.

Comparative Perspectives: ACE and Digital Activism in Other Countries

To contextualize Pakistan's approach, selected international experiences illustrate how climate literacy and digital engagement have been operationalized under different policy and socio-economic conditions. Rather than serving as direct templates, these cases highlight transferable lessons related to institutional commitment, youth participation, and the strategic use of digital tools within the Action for Climate Empowerment (ACE) framework.

Italy, Mandatory Climate Education: One key lesson from international practice is the importance of formalizing climate education within national systems. Countries such as Italy have introduced mandatory climate-related content in school curricula, supported by dedicated instructional time and institutional backing. This approach demonstrates that climate literacy can be systematically embedded when supported by policy mandates, teacher training, and resource allocation. For Pakistan, where climate education is present but unevenly implemented (UNESCO, 2025), the implication is that policy inclusion alone is insufficient without mechanisms for delivery, accountability, and pedagogical support.

Finland and Mexico, Curriculum and Legal Reforms: A second insight concerns the integration of digital tools into education and governance frameworks. In several contexts, digital platforms are used to support interdisciplinary learning, provide open-access educational resources, and facilitate teacher training. Policy reforms that combine curriculum integration with digital resource development have proven particularly effective in extending climate literacy beyond traditional classrooms. For Pakistan, this reinforces the importance of developing centralized digital learning infrastructure, as proposed in the DCEY model, to address gaps in resource availability and educational delivery.

United Kingdom, Youth Activism and Digital Campaigns: A third lesson emerges from youth-led climate movements in contexts such as the United Kingdom, where digital activism has been closely linked to policy engagement. Organized online campaigns, digital advocacy tools, and coordinated communication strategies have enabled youth to influence public discourse and contribute to policy debates. This demonstrates that digital participation mechanisms can

translate awareness into civic engagement when supported by institutional openness and strategic coordination. For Pakistan, this highlights the importance of creating structured channels for youth participation, such as digital consultations and youth councils, to ensure that online engagement leads to meaningful policy input.

Bangladesh, Youth Engagement Amid Constraints: Experiences from countries with similar socio-economic constraints, such as Bangladesh, underscore the importance of context-appropriate technology. In these settings, digital engagement extends beyond social media to include tools such as community radio, SMS-based communication, and localized information systems. Such approaches expand access for populations with limited internet connectivity and demonstrate that effective climate communication does not depend solely on high-bandwidth platforms (Hossain, 2025). For Pakistan, this reinforces the need for a hybrid approach that combines advanced digital platforms with accessible communication channels to ensure inclusivity.

Small Island Developing States (SIDS), International Digital Cooperation: Finally, experiences from climate-vulnerable regions, including Small Island Developing States, highlight the role of digital platforms in enabling international cooperation and visibility. Youth in these contexts have used digital storytelling and online networks to communicate climate impacts to global audiences, shaping broader climate narratives and attracting international attention. This illustrates the potential of digital engagement not only for local education and participation, but also for transnational collaboration. For Pakistan, similar strategies could enhance global engagement and support knowledge exchange within international climate networks.

Taken together, these comparative insights point to three consistent factors underlying effective climate empowerment: strong institutional support for climate education, structured mechanisms for youth participation, and the strategic use of digital tools adapted to local contexts. Rather than replicating any single model, Pakistan's approach can benefit from integrating these

elements within its own socio-economic and technological landscape. The proposed DCEY model reflects this synthesis by combining policy alignment, digital infrastructure, and youth-centered engagement into a cohesive framework.

Recommendations

Drawing on the analysis and the proposed Digital Climate Empowerment for Youth (DCEY) model, this section outlines a set of targeted policy and programmatic recommendations to strengthen climate literacy and youth engagement in Pakistan. Rather than introducing new components, these recommendations translate the model into actionable priorities for policymakers, educational institutions, and supporting stakeholders.

- **Institutionalize a National ACE Strategy with Youth Focus:** A national Action for Climate Empowerment (ACE) strategy should be formalized to provide policy direction and coordination across sectors. This strategy should prioritize climate literacy, youth engagement, and digital participation, with clearly defined roles for the Ministry of Climate Change, Ministry of Education, and affiliated institutions. Embedding ACE within national policy frameworks would ensure continuity, resource allocation, and alignment with international commitments.
- **Strengthen Climate Education through Digital Integration:** Climate education should be reinforced across formal and non-formal systems through the integration of digital learning tools. This includes expanding access to localized digital content, supporting teacher training in climate education and digital pedagogy, and linking school-based learning with online platforms. Such integration would address gaps in curriculum implementation while extending learning opportunities beyond the classroom.
- **Develop and Scale National Digital Climate Platforms:** The establishment of a centralized digital climate education platform should be prioritized to provide accessible, structured, and scalable learning resources. This platform can serve as a hub for educational content, youth engagement opportunities, and climate-related information, while also supporting peer learning and collaboration. Integration with existing national youth and digital initiatives would enhance reach and sustainability.

- **Expand Structured Mechanisms for Youth Participation:** Formal channels for youth engagement in climate governance should be strengthened through digital participation mechanisms. This includes the creation of youth advisory bodies, online consultation platforms, and regular digital dialogues between policymakers and young stakeholders. Such mechanisms would ensure that youth engagement moves beyond awareness toward meaningful participation in decision-making processes.
- **Address Digital Inequality and Ensure Inclusive Access:** Efforts to expand digital climate engagement must be accompanied by measures to reduce inequalities in access. This includes improving connectivity in underserved areas, promoting digital literacy, and utilizing alternative communication channels such as radio and SMS-based systems. Ensuring inclusivity is essential for aligning climate empowerment efforts with broader equity goals.
- **Strengthen Partnerships and Innovation Ecosystems:** Collaboration between government, educational institutions, civil society, and the private sector is critical for scaling climate empowerment initiatives. Partnerships can support the development of digital tools, fund youth-led innovation, and create pathways for skills development and green employment. Encouraging innovation through challenges, incubators, and collaborative platforms can further strengthen youth engagement in climate solutions.
- **Establish Monitoring and Evaluation Frameworks:** Robust monitoring and evaluation mechanisms should be integrated into all climate literacy and youth engagement initiatives. Indicators such as participation rates, learning outcomes, geographic reach, and policy engagement can be used to assess effectiveness and guide program refinement. Continuous evaluation will ensure that initiatives remain responsive to changing technological and social conditions.

Collectively, these recommendations emphasize the need for a coordinated, inclusive, and digitally enabled approach to climate empowerment. By aligning policy, education, and youth engagement within a structured framework, Pakistan can strengthen climate literacy while enabling young people to contribute meaningfully to climate action. These priorities reinforce the

broader objective of translating digital engagement into sustained learning, participation, and impact.

Conclusion

Pakistan faces a complex climate challenge that requires not only technical and policy responses, but also a significant expansion of climate literacy and public engagement. This study has argued that digital climate activism can function as a meaningful form of non-formal climate education when situated within the Action for Climate Empowerment (ACE) framework. By examining existing literature, national developments, and a case study of EcoRevival Pakistan, the analysis demonstrates that digital platforms can support climate learning, participation, and youth engagement, while also highlighting structural constraints related to access, capacity, and institutional coordination.

The findings suggest that while youth climate activism in Pakistan is expanding, it remains fragmented and uneven in reach. Digital tools have created new opportunities for awareness, collaboration, and engagement, but their effectiveness depends on how they are integrated into broader educational and policy systems. The proposed Digital Climate Empowerment for Youth (DCEY) model addresses this gap by offering a structured, phased approach to aligning digital engagement with climate literacy and governance objectives.

A key implication of this study is that youth should be recognized not only as recipients of climate education but as active participants in knowledge production, communication, and policy engagement. Strengthening climate literacy in Pakistan therefore requires a shift toward more participatory, inclusive, and digitally enabled approaches that connect formal education, non-formal learning, and civic engagement.

At the same time, translating this potential into sustained impact will depend on institutional support, cross-sector collaboration, and long-term investment in digital infrastructure and

capacity-building. Without such support, youth-led initiatives are likely to remain limited in scale and sustainability.

Overall, this study contributes to emerging scholarship on climate literacy and sustainability education in the Global South by demonstrating how digital activism can extend the reach of climate education and create new pathways for engagement. By aligning digital tools with the ACE framework, Pakistan has the opportunity to develop a more coordinated and inclusive approach to climate empowerment that leverages the strengths of its youth population while addressing existing structural constraints.

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