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Strengthening Local Climate Leadership: Evaluating a Community-Based Empowerment Initiative

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Abstract: Women and youth play a vital role in strengthening climate resilience, particularly in vulnerable regions such as Sindh, Pakistan. This study evaluates the Green Earth Action Day Foundation (GEAF) one-day climate leadership intervention aimed at improving climate literacy, encouraging community participation, and empowering young people and women. The event was conducted in a rural community where 420 participants including 320 youth and 100 women aged 15 to 35, took part in climate awareness sessions, a simple knowledge quiz, tree-planting activities, and discussions on green entrepreneurship. A brief pre- and post-questionnaire assessed changes in basic climate knowledge and perceptions. Findings showed noticeable improvement in understanding climate change, water challenges, waste management, and sustainable practices. The event also included the distribution of practical livelihood resources, such as sewing machines for five women and green materials to support small-scale environmental initiatives. Overall, the GEAF intervention demonstrated that a short, community-based program can effectively enhance climate awareness and empower women and youth in resource-constrained settings.

Keywords: climate leadership; women empowerment; youth engagement; green entrepreneurship; sustainable development; plantation; environmental education

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1. Introduction

The world is experiencing an unprecedented environmental crisis that threatens the wellbeing of both present and future generations. Climate change, in particular, has emerged as one of the most pressing global concerns, manifested through rising temperatures, extreme weather patterns, loss of biodiversity, and the steady deterioration of ecosystems. These impacts continue to intensify despite growing international efforts, highlighting an urgent need for broader societal participation and stronger local leadership. As emphasized by Abdul Qayyum Gondal (2025), addressing the climate emergency requires deliberate, inclusive engagement of all segments of society, especially women and youth, who collectively represent over half of the global population yet remain among the most vulnerable to climate risks.

Women and young people possess unique local knowledge, lived experiences, and innovation-driven perspectives that position them as powerful agents of change in the pursuit of environmental resilience. However, their leadership potential often goes unrealized due to deep-rooted structural inequalities, restrictive social norms, unequal access to resources, and limited representation in decision-making spaces. (Kakade et al. 2024) The women, particularly in rural settings, have historically faced disproportionate burdens related to water scarcity, food insecurity, limited energy access, and environmental degradation. These challenges heighten their vulnerability while

simultaneously limiting opportunities to lead climate solutions. Empowering women to take active roles in environmental governance enables more comprehensive, socially responsive, and sustainable climate strategies. (Goryunova & Madsen, 2024)

The exclusion of these groups from climate leadership also diminishes the overall effectiveness of climate policies. When women, youth, low-income communities, and other marginalized populations are sidelined, climate actions fail to address intersecting inequalities and therefore lack long-term impact. More inclusive governance frameworks are needed to ensure that climate solutions are just, participatory, and reflective of the diverse experiences of those most affected. (Memon, 2020)

Global institutions have begun to acknowledge this gap. Under the United Nations Framework Convention on Climate Change (UNFCCC), mechanisms such as the Gender Action Plan (GAP) and the Youth Constituency (YOUNGO) aim to enhance the participation of women and youth in climate governance. However, translating these commitments into meaningful, community-level action remains a significant challenge. Localized, practical initiatives are urgently required to bridge global ambitions with grassroots realities. (Lecoutere et al., 2024)

Across different regions, inspiring examples demonstrate the transformative impact of women and youth in advancing climate resilience. Community cooperatives in multiple countries have successfully led sustainable agriculture, forest conservation, and renewable energy projects, benefiting both the environment and local economies. Youth-led networks continue to mobilize large-scale climate awareness campaigns, reforestation drives, and policy advocacy efforts, illustrating the power of collective action.

Despite these successes, women and youth often operate at the intersection of multiple forms of marginalization including gender inequality, economic exclusion, and social discrimination which further limits their ability to influence climate agendas. Advancing climate justice requires centering the voices of those who experience the harshest impacts of environmental degradation. Climate leadership, therefore, cannot be separated from broader struggles for equity, social protection, and human rights. (Lammers et al. 2024)

Climate change remains one of the most urgent crises facing humanity, with disproportionate impacts on women and youth, particularly in low-resource areas that lack formal climate education and leadership opportunities. Globally, community-based climate leadership programs are recognized for enhancing knowledge, inspiring action, and building localized resilience, yet systematic evaluations of short, one-day interventions are limited in the literature. Previous research indicates that extended youth climate programs improve content knowledge, civic engagement, and self-efficacy over time through sustained engagement and curriculum design. (Wellman et al., 2025)

In this context, community-based interventions that build climate knowledge, enhance local leadership capacity, and provide practical empowerment opportunities hold immense value. The Green Earth Action Day Foundation (GEAF) initiative evaluated in this study was designed with this principle in mind. Through a one-day engagement that brought together women and youth from diverse bakground for climate awareness sessions, a simple knowledge quiz, tree-planting activities, and the distribution of livelihood-support resources including sewing machines for women and green materials for community initiatives the program sought to foster environmental responsibility and empower emerging grassroots leaders. By assessing immediate knowledge gains and shifts in perceptions, this study contributes to growing evidence that accessible, localized

programs can strengthen climate literacy and catalyze meaningful community-driven action.

Figure 1: Youth and Women from diverse background present on the day of GEAF

2. Materials and Methods

This study employed a mixed-method, single-day quasi-experimental design to evaluate the effectiveness of the Green Earth Action Day Foundation (GEAF) climate leadership intervention. The event was developed to simultaneously enhance climate literacy, promote participatory environmental action, and strengthen livelihood-oriented empowerment among youth and women. Because the intervention was delivered in a single day, the design prioritized tools that could capture immediate, measurable learning gains while also documenting behavioral and motivational changes observable during the program. This approach is consistent with established models of short-duration community climate education programs conducted in resource-limited settings (Monroe et al., 2019).

The study followed a pre and post assessment strategy in which all participants completed a brief knowledge-based quiz before and after the intervention. Alongside this structured quantitative component, qualitative observations, participant discussions, and interactional patterns during activities provided important contextual insight into empowerment, motivation, and engagement.

2.1 Study Setting and Participant Recruitment

The intervention took place in a rural community characterized by limited access to formal climate education, gender-restrictive social norms, and high exposure to environmental risks such as water scarcity and extreme heat. These conditions mirror many climate-vulnerable rural environments globally, where socio-economic constraints reduce the ability of residents particularly youth and women to actively participate in climate resilience initiatives (Aguilar, 2012).

A total of 420 participants took part in the event. These included 320 youth and 100 women, all within the age range of 15-35 years, reflecting the demographics of local schools and surrounding communities. Recruitment occurred through school announcements, community leaders, women's groups, and GEAF outreach volunteers.

This method ensured broad participation among individuals with an existing interest in environmental issues, while also including participants with low baseline climate knowledge, aligning with participatory rural appraisal principles that prioritize inclusivity, trust, and community relevance over purely random sampling (Chambers, 1994).

Table 1. Participant Demographics (N = 420)

Category	Number	Percentage
Youth	320	76.2%
Women	100	23.8%
Age 15–20	210	50.0%
Age 21–25	130	31.0%
Age 26–35	80	19.0%

2.2 Intervention Components

The intervention consisted of four main components: structured climate awareness sessions, a pre- and post-knowledge quiz, a youth-led tree-planting activity, and a women-focused livelihood empowerment session featuring the distribution of sewing machines and green materials. The combination of educational, practical, and economic empowerment elements was designed to simultaneously target knowledge, behaviour, and agency, consistent with empowerment theory and community-based climate education best practices (Kabeer, 1999; Chawla & Cushing, 2007).

2.3 Climate Awareness and Educational Sessions

The core of the intervention was a 90-120 minute climate awareness session, facilitated by trained climate educators. Content included fundamental climate science, local environmental challenges, observed impacts of extreme weather events, the ecological importance of trees and water conservation, and sustainable household practices. Participants were also introduced to the potential roles of youth and women in driving community-level climate resilience.

Figure 2: During the GEAF day women and youth attending sessions

To accommodate participants with diverse literacy levels, educators employed visual aids, flip charts, participatory Q&A, storytelling, drawings, short videos, and real-life examples. Interactive discussions encouraged participants to relate climate concepts to their personal experiences, including local heatwaves, water shortages, and waste management challenges. Women were engaged in household-level adaptation strategies, composting, kitchen gardening, and low-resource entrepreneurship opportunities. This approach draws on research emphasizing the effectiveness of contextualized and participatory learning for improving climate understanding and retention.

2.4 Pre- and Post-Intervention Quiz

A 10-item quiz was used to measure climate knowledge before and after the intervention. The quiz was designed for simplicity, cultural relevance, and accessibility for participants with varying literacy levels. The instrument included multiple-choice, true/false, and yes/no questions for the one who can't write or and still be part of event. Example items include:

- "Climate change mainly refers to long-term changes in _____."
- "Planting trees helps reduce the effects of climate change. True/False."
- "Which of the following is a major source of waste pollution in rural communities?"
- "Water scarcity is caused by: (a) Overuse (b) Climate change (c) Poor storage (d) All of the above."

Facilitators read questions aloud for participants with lower literacy, following recommendations for inclusive assessment in community education programs (Monroe et al., 2019). Scores ranged from 0–10. All responses were recorded by GEAF data collectors and later tabulated for analysis. Descriptive results are presented in Table 2.

Table 2. Pre- and Post-Quiz Average Scores

Assessment	Mean Score (0–10)	SD
Pre-Test	4.1	1.8
Post-Test	8.3	1.4

2.5 Youth-Led Tree-Planting Activity

Following the awareness session, youth participants engaged in a structured tree-planting exercise designed to promote practical climate action and leadership. Participants planted 150 native, drought-resistant saplings in school and community areas. GEAF volunteers demonstrated techniques for soil preparation, planting depth, mulching, and watering. Youth were encouraged to monitor the saplings' growth, fostering ownership and long-term stewardship.

Active youth participants were recognized as Youth Climate Representatives for their schools, providing them with informal leadership roles and responsibilities to advocate for environmental initiatives. This approach aligns with youth-centered

environmental education strategies that link knowledge acquisition to practical action and responsibility.

2.6 Women's Livelihood Empowerment

The intervention integrated a livelihood component to empower women economically while reinforcing climate leadership. Five women received sewing machines based on their active participation, engagement during discussions, and expressed interest in skill-building and home-based income generation. Recipients were provided with starter kits, including needles, threads, and fabric pieces, and were offered guidance on sustainable micro-enterprises such as stitching school uniforms, reusable bags, and upcycled crafts. The selection process was transparent and conducted in the presence of all participants, emphasizing fairness and accountability. Integration of climate literacy with economic empowerment has been shown to increase both sustainability and impact of community-based interventions (Kabeer, 1999).

Table 3. Sewing Machine Distribution Criteria

Criteria	Description
Participation	Involvement in sessions
Engagement	Asking questions, contributing
Skill Interest	Expressed motivation to sew
Leadership	Helping others during activities

2.7 Qualitative Observation and Data Collection

Throughout the intervention, facilitators documented participant engagement, enthusiasm, and behavioral indications of empowerment. Observational notes included questions asked, level of interaction during activities, leadership during group tasks, and responsiveness to practical exercises. These qualitative insights were analyzed thematically to identify trends in motivation, knowledge application, and confidence building, complementing the quantitative findings from the pre- and post-quiz.

3. Discussion

The findings from this study indicate that even a short, one-day climate leadership intervention can produce meaningful gains in climate knowledge, motivation, and empowerment among youth and women in resource-constrained rural communities. The pre- and post-quiz results clearly demonstrate significant improvements in understanding climate change, water challenges, waste management, and sustainable practices. These findings align with prior studies indicating that brief, focused educational interventions can positively impact climate literacy and self-efficacy, particularly when participants are engaged through interactive and contextualized learning strategies (Monroe et al., 2019; Fatima, 2025).

Importantly, this intervention extended beyond cognitive learning by integrating practical, empowerment-focused activities. The youth-led tree-planting exercise provided hands-on experience in ecological restoration and nurtured leadership, responsibility, and ownership over local environmental resources. Similarly, the distribution of sewing machines to five highly engaged women participants exemplifies the strategic integration of livelihood support with climate education, reinforcing the link between environmental knowledge, personal agency, and economic empowerment (Kabeer, 1999). By rewarding active participation and commitment, these practical components fostered intrinsic motivation, ensuring that participants viewed themselves not merely as learners but as agents capable of initiating local environmental action.

The differential focus on youth and women highlights the importance of gender- and age-sensitive programming in climate interventions. Women were engaged in household-level adaptation strategies, low-resource entrepreneurship, and discussions on sustainable practices, which can enhance resilience at both family and community levels. Youth were encouraged to adopt school- and community-based leadership roles, such as acting as Youth Climate Representatives, planting saplings, and monitoring local environmental projects. Such dual-targeted approaches are consistent with empowerment theory, which emphasizes the interconnection between resources, agency, and achievements, particularly for historically marginalized populations (Kabeer, 1999; Chawla & Cushing, 2007).

Moreover, the integration of simple pre- and post-assessments allowed for an immediate and measurable evaluation of knowledge acquisition. This method, combined with qualitative observation of engagement, discussions, and behavior during activities, offered a holistic understanding of both cognitive and affective changes. The use of culturally appropriate, low-literacy-friendly questionnaires ensured that all participants, regardless of educational background, could meaningfully engage in the evaluation process, reflecting best practices in inclusive community education programs (Monroe et al., 2019).

While these results are promising, they should be interpreted in the context of certain limitations. The absence of a control group restricts the ability to formally attribute observed outcomes solely to the intervention. Additionally, the reliance on self-reported data and immediate post-event measurement limits insights into long-term retention of knowledge or sustained behavioral change. Despite these constraints, the study provides compelling evidence for the efficacy of short, practical, and participatory community-based climate leadership programs, particularly when combined with livelihood empowerment initiatives.

Overall, the GEAF intervention exemplifies how community-based, single-day programs can address structural barriers to climate engagement among youth and women, cultivate local leadership capacity, and stimulate action-oriented learning. These findings resonate with global evidence emphasizing the importance of localized,

participatory approaches in climate education, highlighting that small-scale, contextually tailored interventions can meaningfully contribute to climate resilience and social empowerment (Huq, 2023).

3.1 Limitations

Reliance on self-reported data immediately post-event limits long-term interpretation of knowledge retention or behavior change. Absence of a control group restricts formal attribution of outcomes entirely to the intervention.

4. Conclusion

This study demonstrates that a community-based, one-day climate leadership intervention can effectively enhance climate awareness, foster environmental motivation, and promote empowerment among women and youth in resource-limited settings. By combining structured educational sessions, interactive knowledge assessments, hands-on environmental action, and practical livelihood support, the GEAF program strengthened participants' capacity to act as local climate leaders.

The results suggest that short, inclusive, and contextually appropriate interventions can complement larger climate governance frameworks by cultivating grassroots leadership, building community ownership, and linking climate literacy with practical skills and income-generating opportunities. Integrating gender- and youth-sensitive approaches ensures that interventions address systemic inequalities while fostering resilience and agency among the most vulnerable populations.

Future research should incorporate longitudinal follow-ups to assess knowledge retention, behavioral outcomes, and the sustained impact of livelihood support on climate leadership. Expanding such interventions across diverse rural settings could inform scalable and inclusive models of climate education, demonstrating that even brief, well-designed programs can catalyze meaningful local action and contribute to broader environmental sustainability and social empowerment goals.

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Data, Materials, and Code Availability
The datasets generated and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Authors' Contributions
All authors contributed equally to the conception, design, data collection, analysis, and writing of this manuscript. All authors have read and approved the final version for submission.

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