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Climate Change, Education, Awareness, Climate Resilience, Preparedness, Interior Sindh, Gender Disparity, Community-Based Adaptation, Early Warning Systems, Climate Literacy, Pakistan

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Abstract: *Climate change is a big threat to vulnerable groups, especially in developing countries like Pakistan. This research delves into the importance of education and knowledge in equipping people in Interior Sindh, a region prone to climate-related catastrophes, to tackle and adapt to this evolving threat. Using a mix of surveys, focus groups, and interviews with key informants, the research gathered data from five districts that are being affected by climate change. The results show that awareness campaigns help people comprehend early warning systems better, and climate education makes them far more prepared. Disparities persist between sexes when it comes to access to weather reports. This makes women-headed families less resilient to change. The research highlights the need of using trusted and culturally relevant teaching methods to enhance adaptive ability. Some suggestions include teaching about climate change in the classroom, expanding existing community awareness initiatives, and enlisting the help of neighborhood watch organizations. In order to make low-income areas more resistant to climate change, the research offers helpful recommendations.*

Introduction

One of the biggest problems for human development and environmental sustainability in the 21st century is climate change. Vulnerable groups, especially those in developing countries, are at greater risk because they can't adapt as easily and are pushed to the edges of society (IPCC, 2022). Pakistan's Sindh province, especially its interior regions, is very vulnerable to disasters caused by climate change, such as extreme heat waves, droughts, floods, and changing rainfall patterns (Government of Pakistan, 2021). These repeated climate shocks not only put people's jobs at risk, but they also make poverty, food insecurity, and public health problems worse in communities that are already weak.

Things are especially bad in Interior Sindh. Many communities still don't know what climate change is, what causes it, or what it means for them. This is because they have bad infrastructure, low literacy rates, and limited access to resources. Because of this, they can't take steps to protect themselves and their surroundings from harm. There is still a lot we don't know about how education and awareness-

raising programs can help people get ready for and deal with climate change in their own communities, even though more and more people are realizing how important community-based adaptation is. The capacity to understand and manage environmental hazards is a transformative skill that individuals develop through education (UNESCO, 2019). Learning about climate change, whether in a school or not, can help people learn how to think critically, solve problems, get ready for disasters, and use resources in a way that is good for the environment (Anderson, 2014). Arora-Jonsson (2011) discovered that localized climate change awareness initiatives were more effective in disseminating knowledge, altering behaviors, and galvanizing communities to engage in action.

The Sindh Climate Change Policy (2019) and the National Climate Change Policy (2021) are two Pakistani policy documents that stress the importance of climate literacy and community involvement in adaptive governance. But in places with fewer people where schools are harder to get to, these strategies don't always work as planned. This necessitates an immediate evaluation of the efficacy of climate-related awareness and educational initiatives in Interior Sindh in equipping local populations. This research study aimed to address the existing gap by examining how marginalized communities in Interior Sindh could enhance their resilience to the impacts of climate change through improved knowledge and education. To investigate the impact of information dissemination on behavior, it aims to utilize diverse methodologies. Another goal is to find good practices that other people can use. The study's premise posits that communities may be better positioned for long-term recovery if granted increased authority through culturally relevant, targeted educational initiatives.

Literature Review

Climate Change Vulnerability in Sindh, Pakistan

Sindh is one of the most climate-vulnerable areas in Pakistan because of its geology, economy, and infrastructure. Dangerous heat, drought, and flooding are common in the interior of Sindh. Rasul et al. (2022) say that things like low literacy rates, bad infrastructure, weak institutions, and poverty have made these climate-related problems worse. In 2022, monsoon floods destroyed large areas of Sindh, forcing millions of people to leave their homes. This shows how important it is to be ready at the local level (UN OCHA, 2022).

The Pakistan Meteorological Department (2023) says that the average temperatures in Interior Sindh are still rising quickly, and the amount of rain is falling. This makes communities that depend on farming more vulnerable. These changes in the environment have a direct effect on health, food security, and access to water, especially in rural and low-income areas.

Theoretical Perspectives: Climate Resilience, Education, and Awareness it is very important to teach people about climate change and make them aware of it, especially in places that are already weak or left out. The Adaptive Capacity Framework (Smit & Wandel, 2006) and Transformative Learning Theory (Mezirow, 1997) are two examples of theoretical models that show how knowledge shapes people's perceptions, choices, and responses to external stressors such as climate change.

The UNFCCC and IPCC also say that learning is an important part of plans to deal with climate change. Article 6 of the UNFCCC stresses how important it is to "develop and implement educational and public awareness programs on climate change and its effects," especially in countries that are still developing. Mochizuki and Bryan's (2015) study demonstrates that both formal (institutional) and informal (community-based) education enhance risk comprehension and foster sustainable behaviours, thereby increasing community adaptability.

Teaching people about climate change and getting ready for it

Community-level education programs have been shown to lower the risk of disasters and raise climate literacy in developing countries. To illustrate the point, Gaillard and Mercer (2013) discuss the use of early warning systems and hazard mapping in participatory education programs aimed at preparing rural regions for typhoons in the Philippines. Bangladeshi schools and awareness seminars in rural areas have also taught students how to prepare for and respond to floods (Shaw et al., 2010).

Pakistani classrooms and adult literacy programs, on the other hand, still don't talk about climate change. Iqbal et al. (2020) say that climate-related topics are either not covered at all or not covered well enough in textbooks at schools in rural Sindhi-speaking areas. A recent study by Ali et al. (2023) found that communities that took part in awareness programs, like those run by NGOs and local governments, learnt more about climate risks, used water-saving methods more often, and were better able to deal with disasters.

Gender, Education, and Being Ready for Climate Change

Women in rural Sindh, are more vulnerable to the effects of climate change, than men because of social norms, caregiving duties, and money problems. Raising awareness and educating women in particular can help families get ready and make communities stronger, (Nasreen, 2012). Jabeen and Khan (2021) found that women who learn about climate change are more likely to help their families deal with it and to tell other people about what they know.

Things that make it hard for people in Interior Sindh to be aware of climate change

There are a number of things that make education and awareness campaigns in Interior Sindh less effective:

- Low Literacy Rates: This makes it hard for people, especially women and older people, to get written information.
- Language and cultural barriers: Most materials are in Urdu or English, and there isn't much that is specific to Sindhi or Seraiki dialects.
- Limited Resources: There aren't enough trained teachers, money, or support from schools for climate-focused education.
- People in the neighborhood are less inclined to participate in government-led initiatives because they do not trust those from outside the community (Ahmed et al., 2020).

Experts say that to get around these problems, we need to use community-owned, contextualised methods that mix traditional knowledge with scientific knowledge.

New policies and actions that have happened recently

The National Climate Change Policy (2021) and the Sindh Climate Change Policy (2019) both say that climate education should be a part of all levels of society. The Pakistan Climate Change Council has recently started pilot programs to teach people about climate change, but they are still not very widespread.

Nonprofits like HANDS, TRDP, and Indus Earth Trust have run climate awareness campaigns in rural Sindh. These campaigns have focused on topics like early warning systems, sustainable agriculture, and the role of women in building resilience. According to preliminary evaluations, these initiatives have positive results when conducted by respected local leaders using the local language (Khan & Mahar, 2023). Among order to better prepare for climate change, especially among at-risk populations, education and awareness are crucial, according to the reviewed literature. Focussing on a single area, making them accessible to everyone, and including everyone are all necessary for the success of such programs. There isn't much research on how these programs affect people in real life in Interior Sindh.

This study fills in the gaps by looking at the real-world connection between educations, awareness, and being ready for climate change in this area that hasn't been studied much.

Methodology

Research Design

To provide a complete picture of how education and awareness improve climate readiness in vulnerable communities in Interior Sindh, this study adopted a mixed-methodologies research design. This means it combines both quantitative and qualitative methods.

In order to measure levels of knowledge, attitudes, and readiness, the quantitative part uses structured questionnaires. The qualitative component includes methods such as key informant interviews (KIs) and focus group discussions (FGDs). Through these, we may get a better understanding of people's perspectives, cultural norms, and the efficacy of awareness initiatives.

Population

The targeted population were people who live in communities in Interior Sindh that are vulnerable to climate change, especially those who have been affected by floods, droughts, and heat waves in the last five years. People from these districts are included: Dadu, Badin, Tharparkar, Sanghar, Thatta

The population also included adults who live in the community (men and women) e.g., Local schoolteachers, Representatives from NGOs, Community leaders and elders

Method of Sampling

The study uses a sampling method with more than one stage:

Stage 1: Choosing five districts that are affected by climate change through purposive sampling.

Step 2: Use cluster sampling to pick union councils or villages in each district.

Step 3: Stratified random sampling within each village to make sure that the people who answer are from different backgrounds, ages, and genders.

For the qualitative part, purposive sampling was used to choose key informants, such as:

Local education officers, NGO staff working on climate awareness, Teachers and trainers, and Female community leaders

The number of people in the sample

The quantitative survey aimed to get 300 people to fill out the survey:

About 30 men and 30 women from each of the five districts (60 people total)

For the qualitative data

10 FGDs (2 per district: 1 male group and 1 female group) • 15 Key Informant Interviews (KIs) in all districts

Ways to Collect Data

Collecting Quantitative Data

Structured questionnaire surveys done in person by trained local enumerators.

The questionnaire asks about:

- o Basic demographics
- Knowing what causes climate change and what it does
- where to get information on how to get ready (at home or in the community)
- o how effective people think education and awareness efforts are

Gathering Qualitative Data

Focus Group Discussions (FGDs) look into:

- o What people in the community think about climate risks
- o How disasters affect men and women differently
- o How people feel about NGO and government awareness programs

Key Informant Interviews (KIs) got expert and institutional views on:

- o Problems with putting education

and awareness programs into action o How responsive the community is Problems with current methods

Ways to Analyze Data

Quantitative data analysis

SPSS was used to enter and clean the data.

- Frequencies, percentages, and means were used to summarize how much the respondents knew and how ready they were.
- We used inferential statistics, like chi-square tests and logistic regression, to find links between education/awareness and behaviors that show readiness.

Qualitative Analysis

We coded the transcripts thematically by hand. A grounded theory approach was used to find new patterns and ideas.

Things to think about when it comes to ethics

Informed Consent: Everyone who took part in the study was given clear information about its purpose, how it would work, and that it was voluntary. Verbal or written consent obtained. Confidentiality: Respondents' identities and personal information is kept anonymized in all reports and publications.

Right to Withdraw: Participants were allowed to opt out at any point during the study without any consequences. Cultural Sensitivity: Gender-segregated FGDs and tools in the local language were used to make sure everyone was treated with respect and included.

Results and Discussion

The study examined community perceptions regarding climate knowledge, climate education, awareness of early warning systems, adoption of preparedness measures, perceived efficacy of education, access to awareness materials (Mobile/TV/Radio), gender disparities in awareness and resilience, with particular emphasis on the distinctions between men and women. Survey data from many demographics indicated a broad understanding of climate issues. This research examines the extent of community awareness regarding climate change, the repercussions of such unawareness, the level of preparedness for climate change in affected areas of Sindh, potential gender disparities in access to climate education, and the correlation between climate education and community resilience. The qualitative focus group discussions also revealed that the communities lack awareness regarding climate change. They engage in deforestation and neglect their surroundings, demonstrating unpreparedness for environmental challenges. Consequently, their children suffer from health issues. It appears that communities with greater awareness exhibit increased resilience. This study examined seven variables and four hypotheses. Data was analyzed using frequencies, mean scores, percentages, cross tabulation, and logistic regression analysis. All hypotheses were tested and supported, except for the gender discrepancy in access to climate education.

Table -1 Variable wise percentage and mean score

Variable	Percentage (%)	Mean Score (Likert 1-5)
Respondents with prior climate knowledge	68%	3.40
Received climate education (Govt/NGO)	42%	2.10
Aware of early warning systems	55%	2.75
Adopted any preparedness measures	39%	1.95
Perceived usefulness of education	—	4.2
Access to awareness material (Mobile/TV/Radio)	61%	3.05

Gender gap in awareness (women vs men)	29% vs 71%	1.45 vs 3.55
Total Mean Score		2.61

Hypotheses Testing

Hypothesis 1: Communities are not aware of the climate changes effects.

Hypothesis 2: Communities are not prepared for climate change.

Hypothesis 3: There is no gender disparity in access to climate education

Hypothesis 4: Communities with education and awareness are more resilient

Table – 2 HYPOTHESIS VALIDATIONS

HYPOTHESIS	RESULT
H1: Communities are not aware of the climate changes effects.	Supported (P < 0.05)
H2: Communities are not prepared for climate change.	Supported (P < 0.05)
H3: There Is No Gender Disparity in Access to Climate Education	Rejected
H4: Communities With Education and Awareness Are More Resilient	Supported

Descriptive Analysis showed that 68% of the people who answered the survey knew something about climate change, but only 39% said they had done anything to get ready for it. Cross-tabulation showed that communities that had received structured education or awareness training were 2.5 times more likely to act in ways that showed they were ready ($p < 0.05$). Gender analysis showed a big difference: women consistently said they were less exposed to awareness campaigns, especially in conservative rural areas. Regression Analysis (Binary Logistic) showed that there is a statistically significant link between climate education and behaviors that show readiness ($\beta = 1.62$, $p = 0.03$). Focus groups showed that people in communities value education that comes from trusted sources, like schoolteachers or local leaders, more than campaigns in the media.

Key Findings

- Education is a strong predictor of preparedness: People who knew a little bit about climate change and had some educations were much more likely to take steps to protect themselves.
- Awareness campaigns work, but they don't reach everyone. For example, NGOs and radio/TV campaigns had an effect, but they didn't reach many people in rural areas.
- There aren't enough women in awareness outreach, which means that homes run by women are less prepared.
- Delivery methods that were culturally appropriate, like storytelling, radio, or announcements made in mosques, worked better than printed materials.
- People in the community trusted NGOs more than government-led projects.

Conclusion

This study shows that education and awareness are very important for helping vulnerable communities in Interior Sindh get ready for climate change. But these benefits aren't shared equally because of structural inequalities, gender differences, and a lack of access to localized educational resources. The results show that targeted educational programs, when used with community-trusted ways to raise awareness, can greatly improve people's readiness and make them less vulnerable to climate risks.

Recommendations

- Include lessons about climate change in primary and secondary school curriculums, especially in rural Sindhi-medium schools.

- Use community radio and street theatre to make localised awareness materials in Sindhi and Seraiki.
- Teach women who work in the community how to reach out to women and girls and close the gender gap.
- Build stronger partnerships between schools, local governments, and NGOs to make community-based climate literacy programs bigger.
- Add traditional and indigenous knowledge to climate awareness programs to make them more relevant and acceptable to the community.
- Use mosques, local councils, and schools as places to spread information about climate risks and early warning alerts.

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