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EXAMINING CURRICULUM AND TEXTBOOK GAPS IN CLIMATE-RESILIENT EDUCATION AND GREEN PEDAGOGIES IN SINDH

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Abstract
Sindh was the climatic disturbed region of Pakistan in which during 2022 floods 19808 schools had been damaged which hardened the learning, created traumatic psyche and gender dropout ratio reached up to 0.5 million students. This study focuses the educational concerns which for see's preparedness towards climatic shocks which are weak or unavailable and pedagogically nonaligned in curriculums and textbooks of Sindh from primary to intermediate level. This qualitative design is used to review the curriculums and textbooks of Directorate of Curriculum and Assessment Research (DCAR) and Sindh Textbook Board (STBB) respectively in terms of climatic resilience and green pedagogies. The study samples are taken curriculums of 2006 to 2023-24 and textbooks of Science, English, Physics and Chemistry from primary to intermediate level and aftereffects of flood reports and policy reports issued by SELD and world Bank. The analysis of these documents disclosed a major gap in curriculum even though some environmental content contains in isolated chapters while disastrous or climatic resilience outcomes are missing at primary and middle levels. Another aspect is also found through this study that current curricula contains only little content instead of practical and indigenous knowledge climatic variation or disaster preparedness especially at secondary and intermediate levels. The study recommends green pedagogic curriculum reforms, teacher professional development and assessment alignment to transform education as frontline mechanism for climatic adaptation. The study recommends two-way strategy as horizontal integration of climate, green pedagogy and environmental concepts across all subjects and vertical strengthening of science curriculum by applied, community oriented and precautionary learning. For next step of research to cross-check classroom implementation and students learning outcomes develops from green pedagogy integration.

Key Words: Green Pedagogies, Climate Resilience, the gap, intermediate level, horizontal, vertical, assessment, environmental, curriculum, textbook, Sindh.

1. INTRODUCTION

Pakistan is ranked fifth among the world's most climate-vulnerable countries, with Sindh bearing a disproportionate share of climate-induced disasters (German watch, 2021). The 2022 floods submerged nearly 1/3rd of the country, causing widespread human displacement and economic losses exceeding USD 40 billion (World Bank, 2022). Within Sindh, the education sector emerged as one of the most severely affected systems, with thousands of schools damaged or destroyed, disrupting access to learning for millions of children (SELD, 2022). The floods laid bare the fragility of Sindh's social infrastructure, particularly its education system, with a staggering 19,808 schools damaged (SELD, 2022).

Not only the physical destruction, but the floods also identified system weaknesses. Teachers and school Headmaster's reported sensitive student trauma, declining attendance, and a shift in household priorities from education to survival. Under these conditions, education cannot return to routine practices. It should support learners in understanding risks, responding to emergencies, and adapting to changing disastrous or environmental conditions. Classrooms were destroyed, more than nineteen thousand schools damaged, 7,500 destroyed (SELD, 2022). But the calamity prolonged

away from infrastructure. As reported by teachers, a deeper, invisible scar was formed: students were left traumatized, with "the slightest thunder sending them trembling in their seats" (Khan, 2025). The disaster triggered a tragic trade-off where survival eclipsed schooling, forcing children into labor and families to prioritize "food and shelter over pencil and paper" (Khan, 2025). These realities raise a critical question: can an education system designed around static content and rote learning respond effectively to recurring climate shocks? The reform in education system refers to the evaluation of an education system to provide accountability in the system to inform the public and to inform policies to improve educational system and process for the betterment of the outcomes (OECD, 2013). Evidently education reforms bring positive changes which coups current social challenges.

Education Sector Plan (SESP) is the first provincial policy document that empowers the Government of Sindh to assume full jurisdiction over the provincial education system with all partners, focusing on key areas of education policy planning, curriculum standards, centers of excellence and Islamic education spirit (SESP 2018).

This research paper argues that education in Sindh must move beyond recovery toward climate resilience. Central to this shift is the adoption of green pedagogies, teaching approaches that integrate environmental literacy, sustainability, disaster risk reduction, and local ecological knowledge into everyday learning. Critically scrutinizing the primary, secondary and intermediate-level curriculums and textbooks, this study highlights the non-alignment between climate realities and curriculum content, books content and points curriculum reform as a need of time for climate adaptation.

2. LITERATURE REVIEW

International evidence suggests that curriculum reform plays a decisive role in preparing learners for complex global challenges, including climate change (OECD, 2019; UNESCO, 2021). Education linked to climate variation helps students understand how ecological systems function and how different environmental factors are interconnected. It builds awareness about biodiversity, the pressures faced by various species, and the broader consequences of environmental imbalance (Swami Nath 2016). Such education also familiarizes learners with both natural and human induced disasters, including floods, earthquakes, landslides, and cyclones, while highlighting practical ways to reduce their impact (Buriro, 2023). Apart from environmental awareness, green education plays a wider role in shaping responsible citizens and supporting sustainable development by encouraging the protection and balanced functioning of ecosystems.

According to Encyclopedia Britannica, education is the field that examines the processes of teaching and learning, particularly within formal institutions such as schools. It focuses on structured systems of instruction, in contrast to informal or non-formal modes of acquiring knowledge (Pervaiz, 2024). These educational reforms carry “top-down” perspective, where the “success” of the implementation was measured by the “fidelity” and “adherence” to the reformed curriculum by implementers, such as teachers and school principal (Castro et el, 2015; Weddell & Grassick, 2017). This approach not only gives autonomy to the teachers but it supports decentralized curriculum enactment. This way teachers equally curriculum mediators play central role in the curriculum development and implementation process, both as enactors and mediators of the policy, makes obsolete the concept of reliability itself (Snyder et el, 1992; Braun et el, 2010). Also the role of teacher during teaching can be promoting green pedagogies and prepare students to face and safeguard themselves, fellows and their family

Green pedagogies move beyond traditional environmental education by emphasizing experiential, inquiry-based learning that fosters critical thinking, agency, and a connection to local ecosystems (Bengtsson et al., 2018). In recent years, many OECD countries have engaged in curriculum reform as a way to equip children with the knowledge, skills and competences needed for tomorrow. Education systems in Finland, Estonia, Japan, and Wales have embedded sustainability and climate literacy as climatic resilient themes rather than isolated content areas as in STBB textbooks in some chapters. Green pedagogy is grounded in constructivist and transformative learning theories. Experiential learning emphasizes, community engagement, and the application of indigenous knowledge to local environmental challenges (Sterling, 2016). Studies in developing contexts show that when environmental education is disconnected from lived realities, its impact remains limited (Naseem & Arshad, 2019).

In Pakistan, curriculum reform has generally focused on textbook revision rather than pedagogical transformation. As highlighted by Hussain et al. (2022), curriculum implementation remains weak due to limited teacher ownership, insufficient professional development, and misaligned assessment systems. This study adopts framework that links curriculum content, textbooks content, pedagogical practice, and assessment alignment as codependent components necessary for effective climate resilience education.

3.PROBLEM STATEMENT

Sindh is climate vulnerable region suffering recurrent floods, heatwaves, and environmental degradation that leads towards disruption of education systems and student learning. Floods in 2022 exposed not only the physical destruction of school infrastructure but also deeper systemic weaknesses that how education prepared learners to understand, respond to, and adapt to climate related risks. Along with these facts, the curriculums and textbooks of Sindh, secondary and intermediate level remains mostly content driven, examination oriented, and detached from students lived environmental and climatic disaster experiences. 18th constitutional amendment enables provinces to undertake educational reforms to transform pedagogy and develop textbooks as per needs of the climatic resilience and promote green pedagogies with local environmental context. Concepts related to climate change, sustainability, disaster risk reduction, and environmental ethics are either weakly embedded or confined to isolated units within science subjects. There is limited evidence of curricular integration, applied learning, or alignment between curriculum objectives and assessment practices that would support the development of resilience, critical thinking, and problem-solving skills. The central problem, therefore, is the absence of a coherent, integrated, and pedagogically grounded framework for embedding green pedagogy and climate resilience within the intermediate level curriculum of Sindh.

4.OBJECTIVES OF THE STUDY:

The objectives of this study are to:

RO1. To examine what extent curriculum at higher secondary schools in Sindh reflect concept of climate change, and disaster resilience with specific reference to green pedagogy.

RO2. To identify gaps in the integration of green pedagogical approaches across science, humanities, and commerce subjects at the intermediate level.

RO3. To assess the alignment of curriculum content at local context, including indigenous and community-based climate adaptation practices at the intermediate level

5. RESEARCH QUESTIONS OF THE STUDY:

RQ1. What do the curriculums in higher secondary schools in Sindh incorporate concepts of climate change, and disaster resilience with specific reference to green pedagogy?

RQ2. What curriculum-level gaps and misalignments can be identified that hinder the integration of green pedagogy in intermediate education in Sindh?

RQ3. How to assess the alignment of curriculum content at local context, including indigenous and community-based climate adaptation practices at the intermediate level.

6. RESEARCH METHODOLOGY

This study adopts a qualitative research design; content analysis method was used for this research and analyzing written content of curriculums and textbooks. The choice of this design was aligned with the nature of the research problem, which seeks to examine the alignment, coherence, and adequacy of curriculums and textbooks content rather than to measure variables or test hypotheses. The population of the study were curriculums and textbooks of English, Science, Physics and Chemistry from grades five to twelve. Criterion sampling and curriculums and textbooks for grades five to twelve had been used as sample size for this research. Content analysis of curriculums and textbooks which were available at DCAR and STBB Jamshoro, Sindh. The data was collected through documents i.e. curriculums analysis and qualitative content analysis of textbooks. A sample technique was employed to select documents that directly relate to curriculum intent, implementation, and climate resilience. These documents were chosen because they represent authoritative and policy-relevant perspectives shaping primary, secondary and higher secondary education in Sindh

Qualitative content analysis was chosen for this study as it allows a detailed examination of textual data, capturing patterns, themes, and meanings green pedagogies within curriculums and textbooks. This method provides insight into how concepts are presented, interpreted, and prioritized, and enables the researcher to explore complex educational content, highlight underrepresented perspectives, and develop a deeper understanding of the curriculum's approach to learning objectives (Sofaer, 1999). Qualitative document analysis is particularly suitable when policy texts, curriculum frameworks, and official reports are the primary sources of evidence, as it allows for systematic interpretation of meaning, intent, and omissions within official narratives. In this study, the data were examined using thematic analysis. From the collected raw data, key themes and sub-themes were identified through a process of organizing and breaking down the information. As Braun and Clarke (2006) explain, thematic analysis involves identifying patterns or themes within qualitative data to interpret the underlying meanings. At the initial stage, all data were carefully examined to determine the presence or absence of climate resilience concepts. This classification was done manually. Using a

matrix method, the researchers were able to organize the content systematically and make informed judgments at each level (Charmaz, 2008). Thematic analysis was then applied to identify key themes, topics, patterns, and points related to climate resilience and green pedagogies within the curriculums and textbooks.

6.1 Data Sources

The primary data sources include:

1. Sindh Curriculum documents (2006 and 2023–24) developed by DCAR
2. Textbooks published by STBB for General Science (Grades IV–VIII), English (Grades V–VIII), Physics (Grades XI–XII), and Chemistry (Grades X–XII)
3. Selected post-2022 flood impact and policy documents published by SELD, World Bank, UNDP, and UNESCO

6.2 Research Instrument

A structured curriculum review matrix was developed as a research instrument. The matrix consisted of indicators related to climate literacy, sustainability, disaster risk reduction, green pedagogical orientation, and assessment alignment. This instrument enabled a systematic and replicable review of curriculum and textbooks content across subjects.

6.3 Curriculum Review Matrix

To operate the qualitative document analysis, a curriculum review matrix was developed and applied to all reviewed materials. The matrix translates abstract concepts such as green pedagogy and climate resilience into observable curriculum indicators, ensuring transparency and analytical rigor.

Analytical Dimension	Review Indicators	Key Questions Guiding Review	Evidence Identified in Reviewed Curriculum
Curriculum Intent and Vision	Policy alignment, stated learning outcomes	Does the curriculum explicitly acknowledge climate change, sustainability, or resilience as learning goals?	Climate-related intent is implicit and fragmented; no explicit cross-curricular vision at intermediate level
Content Coverage	Topics on environment, climate, disasters	Are climate and environmental issues addressed systematically across subjects?	Limited to selective units in science subjects; absent in humanities and commerce
Pedagogical Orientation	Experiential learning, problem-based tasks	Does the curriculum promote applied, inquiry-based, or community-linked learning?	Predominantly theoretical and content-heavy; minimal applied or field-based activities
Green Pedagogy Integration	Sustainability, indigenous knowledge, ethics	Are local ecological knowledge and sustainability practices integrated?	Marginal references; indigenous and local context largely missing
Disaster Risk Reduction	Preparedness, mitigation, adaptation	Are students prepared for floods, heatwaves, or climate emergencies?	No structured DRR learning outcomes or skill-based preparedness components
Teacher Mediation	Guidance notes, flexibility	Does the curriculum support teacher autonomy and instructional guidance?	Limited instructional support; curriculum treated mainly as textbook-driven
Assessment Alignment	Skill-based assessment, competencies	Do assessment expectations align with applied and competency-based learning?	Recall examination prone assessment

7. DATA ANALYSIS:

Data was analyzed using a content analysis approach. Curriculums and textbooks were reviewed through a review matrix to identify environmental themes, climate change references, practical activities, and SLO's of green pedagogy. Findings from curriculum and textbooks analysis were compared with post-disaster education data to understand gaps between curriculums and textbooks content and ground realities. The matrix crux represents limited availability, theoretical content, missing applications, precautions and missing local context to cope with environmental and climatic disasters situations.

The curriculums and textbooks reviewed revealed a critical misalignment. The General Science and English curriculum and textbooks for grades V-VIII contains introductory environmental pollution but no meaningful content on climate change awareness, local agricultural adaptations, or practical precautionary measures for disasters. This signifies a total missed opportunity to build foundational resilience at the most formative stage.
On the contrary, the Physics curriculum 2023-24 for grades XI-XII includes a "Climate Physics" section covering hurricanes, wildfires, floods, and heatwaves. It's commendable but this approach is challenging as:

1. Conservation of Water by using climate education as an abstract, high-level scientific concept.
2. Excludes the majority of students especially not enrolled in science studies.
3. Lacks practical aspects precautionary measures, local impacts, or community involving strategies, focusing just on the "science of" phenomena.
4. English grade VIII curriculum and textbook contain lessons about Pollution and Climatic Regions of World lacks practical orientation to act accordingly.
5. Chemistry curriculum and textbook for grade 9 contains environmental chemistry with atmosphere and water-cycle.
6. Chemistry XII curriculum 2023-24 of Sindh contains environmental chemistry which covers pollution, acid rain, greenhouse gases and sustainable practices like fossil fuels, renewable energy and industrial impacts but still green pedagogies are not aligned in local context.
7.

8. FINDINGS

1. The study finding of review express that General Science and English curricula at primary and middle levels include limited references to pollution and environmental issues. But there is not organized focus on green pedagogies and climate change, disaster preparedness, or local adaptation strategies. This represents a gap to build awareness and resilience at early youngsters.
2. The study finding indicates that at the intermediate level, Physics curriculum and textbook contains a unit on climate related phenomena such as floods and heatwaves. This content is highly theoretical and accessible only to science students. Practical guidance on precautionary measures, community response, or local case studies is largely absent. Also the students enrolled other than science miss this opportunity of climate learning.
3. The finding also reveal that the Chemistry curricula and textbooks of secondary and higher secondary contain environmental chemistry topics such as pollution, greenhouse gases, and energy resources. However, these topics are not linked to Green Pedagogies, project-based learning, or local environmental challenges.
4. The study findings also reveals that Students continue to study in unsafe or temporary spaces, while many experience anxieties related to weather variations. These conditions directly affect learning outcomes and highlight the need for curricula and textbooks that address both academic and psychosocial needs.

10. RECOMMENDATIONS

1. It is recommended to integrate Green Pedagogy SLOs into General Science and English curricula from primary to middle levels. Revise Physics and Chemistry curricula to include local case studies, disaster preparedness, and sustainability projects.
2. It is recommended to ensure textbooks aligned with the 2023–24 curriculum reflect climate resilience themes and introduce professional development on Green Pedagogies and trauma-informed teaching.
3. It is strongly recommended to support teachers through CPD focused on activity-based and project-based learning (PBL) resources should be adopted. Establish eco-clubs and climate awareness activities in schools and colleges.
4. It is also recommended that the regular sessions on precautionary measures during climate emergencies. Promote climate-resilient school reconstruction. Include assessment items that test problem-solving and application of climate knowledge rather than rote recall.

11. CONCLUSION

In world climatic scenario changes which are also affecting the regional areas are damaging physically and academically. The students at rural as well as urban level face starving situations during such seasonal hardships. The government's roles should be redefined to re-track the education in terms of coping with such climatic situation according to their age. Shouldering the responsibilities may ease life at local level learning. The government acts to revise their curriculums and textbooks to transform future generations to act productively and positively. This way we have climatic resilient communities and develop green pedagogical curriculums and textbooks. This involves

empowering a generation of students who are not passive victims of a changing climate but informed, skilled, and resilient agents of change to apply the lessons of both textbooks and tradition to secure their future. The time for incremental change has passed; systemic, courageous curriculum transformation is now an urgent necessity.

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