Chapter 1

Introduction

1.1 Global Imperatives for Environmental Literacy

The environment constitutes the life-support system for humanity, delivering oxygenated air, potable water, nutrient cycles, and the regulating services that underpin health and economic vitality. Anthropogenic pressures—deforestation, greenhouse-gas emissions, synthetic pollutants—have driven the Earth system beyond several safe operating spaces, thereby jeopardising the stability of socio-ecological networks (IPCC, 2023). The Sixth Assessment Synthesis Report warns that global mean temperature has already risen 1.1 °C above pre-industrial levels, and that a 1.5 °C overshoot could materialise during the 2030s without "deep, rapid, and sustained" mitigation and adaptation (IPCC, 2023). Concomitant intensification of heatwaves, altered monsoon dynamics, and escalating particulate matter loads render environmental vigilance an existential necessity rather than an ethical luxury.

The twenty-first century has been characterised by accelerating ecological disruption. Annual mean temperature has already climbed 1.1 °C above the pre-industrial baseline; the Intergovernmental Panel on Climate Change now projects a serious probability of overshooting the 1.5 °C guard-rail during the early 2030s in the absence of "deep, rapid, and sustained" mitigation (IPCC, 2023). The physical symptoms are manifest: glaciers in the Hindu Kush-Himalaya region exhibit mean mass losses of 0.28 m, the Indian Ocean is warming at almost 0.12 °C decade^{-1}—faster than the global average—and extreme precipitation events over central India have tripled since the 1950s (Krishnan et al., 2020). These climatic perturbations cascade through food, water, and health systems; the World Bank (2021) estimates that, without a corrective shift, South Asia could witness the displacement of 40 million people by 2050 as a direct consequence of intensifying heat stress and sea-level rise.

The 2030 Agenda treats environmental sustainability and social justice as mutually constitutive goals. Education—explicitly codified in SDG 4, Target 4.7—is assigned a transformational mandate: to cultivate learners who possess the knowledge, competencies, values, and agency required to safeguard Earth-system integrity while promoting human well-being (UNESCO, 2023).

1.2 Environmental Awareness: Concept and Components

Environmental awareness encompasses a range of knowledge, attitudes, and behavioural intentions that collectively foster responsible interaction with the environment. It is a multidimensional construct that integrates: (a) System knowledge—an understanding of ecological processes such as the water cycle, energy flow, and biodiversity; (b) Issue knowledge—recognition of environmental stressors like climate change, plastic pollution, and habitat destruction; and (c) Action knowledge—comprehension of strategies for mitigating environmental harm through behaviour such as recycling, conservation, and advocacy.

Social-psychological models such as Ajze n's Theory of Planned Behaviour and Schultz's Inclusion-of-Nature-in-Self index underscore that awareness is not merely cognitive but also affective and conative in nature (Ajzen, 1991; Schultz, 2001). Neuroscientific research further supports the integration of emotion in environmental decision-making, highlighting that affective responses such as awe or concern can significantly motivate behavioural change (Fang et al., 2019).

1.2.1 Environmental Awareness as an Adaptive Capacity

Environmental awareness is not a monolithic construct; it is an amalgam of cognitive, affective, and conative elements (Hines, Hungerford, & Tomera, 1987). System knowledge denotes understanding of ecological processes—energy flow, nutrient cycling, and climate regulation. Issue knowledge refers to awareness of anthropogenic pressures such as greenhouse-gas emissions or plastic pollution. Action knowledge—often conflated with behavioural intention—captures the procedural know-how necessary to adopt pro-environmental practices (Kollmuss & Agyeman, 2002).

Awareness embodies a composite of (a) system knowledge—understanding ecological processes, (b) issue knowledge—recognising anthropogenic stressors, and (c) action knowledge—evaluating and enacting protective behaviours. Meta-analyses encompassing more than 320 effect sizes confirm that well-designed environmental-education programmes produce medium to large gains in knowledge ($g \approx 0.64$) and small to moderate gains in pro-

environmental behaviour ($g \approx 0.35$) among the general student population (van de Wetering et al., 2022). A complementary synthesis of 73 quasi-experimental studies reports parallel improvements in intention and attitude, thereby positioning awareness as a pivotal precursor of collective climate action (Bradshaw & Rickinson, 2022).

While the cognitive dimension of awareness has attracted disproportionate attention, affect cannot be sidelined. Neuroscientific work demonstrates that moral and environmental decision-making share overlapping neural substrates in the pre-frontal cortex (Fang et al., 2019). Emotions such as awe, hope, and even constructive anger can precipitate environmental action, whereas unmitigated eco-anxiety can paralyse agency (Clayton et al., 2021). Consequently, contemporary environmental-education (EE) programmes strive to orchestrate a trilogy—knowledge, emotional engagement, and participatory skill-building—to close the intention–behaviour gap.

To operationalise this insight, the United Nations has embedded Education for Sustainable Development (ESD) within SDG 4 Target 4.7, calling on nations to "ensure that all learners acquire the knowledge, skills, values, and attitudes needed to build sustainable societies" (UNESCO, 2023).

1.3 Need for Spreading Environmental Awareness Among Children

Children and adolescents are at a formative stage of cognitive and moral development, making them highly receptive to environmental messages and values. Early exposure to environmental education can foster a lifelong sense of stewardship and ecological responsibility. Additionally, environmental degradation disproportionately affects children, particularly those in urban and low-income settings. For example, children are more susceptible to the health impacts of air and water pollution due to their developing physiological systems.

Schools serve as powerful venues for promoting environmental awareness because they offer a structured, consistent, and inclusive space for learning. Research indicates that well-designed environmental-education programmes produce medium to large gains in knowledge ($g \approx 0.64$) and moderate improvements in behaviour ($g \approx 0.35$) among students (van de Wetering et al., 2022). These programmes can include classroom instruction, experiential learning activities such as nature walks or school gardening, and project-based learning focused on sustainability.

1.4 Inclusive Education and Students With Special Needs

Inclusive education is grounded in the principle that all learners, regardless of their physical, sensory, cognitive, or emotional differences, should be provided with equitable access to quality education. The Rights of Persons with Disabilities (RPWD) Act, 2016 mandates that schools adopt inclusive practices, including infrastructural adjustments, curriculum modifications, and teacher training to accommodate diverse learner needs.

India's National Education Policy (NEP) 2020 echoes this commitment by positioning inclusion and equity as non-negotiable pillars of educational transformation. The policy advocates universal design, differentiated instruction, and the integration of assistive technologies to make learning accessible to all. The Samagra Shiksha scheme operationalizes these goals by funding resource rooms, individualized education plans (IEPs), and teacher professional development in inclusive pedagogy.

1.4.1 Inclusive Environmental Education: a Policy Expectation and an Empirical Void

Despite rhetorical commitments to *education for all*, marginalized groups - especially learners with disabilities - remain peripheral to most environmental-education initiatives. The Indian *National Education Policy 2020* specifies that “all curricula and pedagogy must be disability-responsive and inclusive” (Ministry of Education, 2020). *Samagra Shiksha* directives further mandate universal accessibility and periodic screening for 21 disability categories through the PRASHAST checklist, emphasising the creation of supportive

learning ecologies (Department of School Education and Literacy, 2023). Nevertheless, empirical audits show that less than 8 % of published environmental-education studies between 2014 and 2024 include participants with special learning needs, and only 2 % disaggregate outcomes by disability type (Senhoras, 2024).

Inclusive education reframes disability as a consequence of environmental barriers rather than individual deficits. India's *National Education Policy 2020* positions inclusion and equity as "non-negotiable" principles, calling for universal access to adaptive pedagogy, assistive technologies, and flexible curricula. The centrally sponsored *Samagra Shiksha* scheme operationalises these aspirations by funding resource rooms, individualised education plans (IEPs), and in-service teacher training. Nevertheless, qualitative investigations from Indian classrooms report persistent challenges: limited instructional materials, insufficient specialist staff, and low teacher self-efficacy (Singh, 2023; Akmal, 2023) .

The normative architecture of inclusive education received formal international endorsement with the Salamanca Statement in 1994. Subsequent treaties, including the UN Convention on the Rights of Persons with Disabilities (CRPD, 2006), expanded the remit from physical access to curricular and pedagogical accessibility. India's National Education Policy 2020 internalises these commitments, stipulating that "curricula and pedagogy must be transformed to be fully equitable and inclusive" (Ministry of Education, 2020, p. 6). Complementary funding via the *Samagra Shiksha* programme earmarks resources for assistive technology, Braille presses, and teacher professional development. However, legislative intent has yet to translate into systemic practice. The 2023 Unified District Information System for Education (UDISE+) indicates that only 18 % of government schools possess resource rooms equipped for children with disabilities; fewer than 10 % of teachers report confidence in adapting environmental-science content for divergent sensory or cognitive profiles (MHRD, 2024).

This shortfall is ethically troubling and pedagogically counter-productive. Learners with disabilities constitute approximately 2.2 % of India's school-age population (Census, 2011), yet evidence suggests they are disproportionately exposed to environmental risks. For instance, inaccessible public transport may force wheelchair-using children to traverse

polluted roads; visually impaired students may rely on tactile navigation that becomes hazardous under extreme heat scenarios. Their exclusion from environmental-awareness initiatives is therefore not merely an equity concern but a direct threat to personal health and community resilience.

1.5 Why Environmental Education for Children with Special Learning Needs?

Children with special learning needs are often excluded from mainstream environmental-education initiatives due to systemic barriers such as inaccessible content, insufficient teacher training, and a lack of adaptive materials. This exclusion not only violates principles of equity but also poses direct risks to the well-being of these children. For example, children with respiratory disorders may be more affected by air pollution, while those with mobility issues may face greater challenges during natural disasters.

Moreover, students with disabilities are fully capable of engaging in environmental topics when instructional strategies are aligned with their abilities. Visual aids, tactile learning tools, audio supports, and peer-assisted learning can bridge comprehension gaps and promote active participation. Inclusive environmental education affirms the rights of CWSN to be informed, engaged, and empowered in the face of global ecological crises.

Students with special learning needs—including students with visual impairment, partial hearing loss, autism, neuromuscular problem, specific learning disabilities/ slow learners—often struggle with abstract verbal explanations common in traditional environmental education. Universal Design for Learning (UDL) offers a compelling framework by advocating multiple means of engagement, representation, and action (CAST, 2018). Empirical studies demonstrate that UDL-aligned outdoor lessons significantly uplift environmental knowledge and self-efficacy among diverse primary cohorts (Løvoll & Haugen, 2024), while nature-based experiences structured with UDL checkpoints enhance sensory integration for children with autism (Jeong & Berry, 2024)

Early explorations reveal pedagogical promise: Hamadneh and Alqarni (2023) demonstrated that cartoon-mediated instruction significantly elevated pollution-prevention scores among Jordanian students with learning disabilities, while Escatron et al. (2023) linked hands-on coastal clean-up activities to improved stewardship behaviours in Filipino senior-high students, including a sub-sample with sensory impairments . Yet generalisability remains constrained by small samples, heterogeneous instruments, and the absence of Indian urban contexts.

1.5.1 Instructional Strategies for Environmental Awareness

Five clusters of evidence-based strategies emerge from the literature and guide the present study.

1. **Visual supports.** Infographics, pictorial schedules, and video modelling reduce cognitive load and scaffolding comprehension for learners with weak auditory processing (Mahoney et al., 2021).
2. **Hands-on inquiry.** Gardening, waste-sorting games, and citizen-science water testing have produced large gains in pro-environmental attitudes among students with intellectual disabilities (Escatron et al., 2023) .
3. **Technology-assisted multimodality.** Tablets running interactive storytelling apps and low-cost virtual-reality field trips promote agency by allowing repeated, self-paced exploration (Bañados et al., 2024) .
4. **Multisensory nature immersion.** Texture-based activities and soundscapes during guided walks reinforce ecological concepts through kinaesthetic and auditory channels (Løvoll & Haugen, 2024).
5. **Peer-assisted learning.** Structured cooperative tasks mitigate social isolation and model environmentally responsible norms (Melnyk & Podorozhnyi, 2023).

Despite these promising findings, comparative efficacy across strategy types remains under-examined, especially in Indian urban settings.

1.6 The Bhopal Context and Research Stimulus

Bhopal—historically scarred by the 1984 gas tragedy—continues to grapple with legacy contamination, episodic PM exceedances, and burgeoning solid-waste streams (Government of Madhya Pradesh, 2024). Schools therefore represent frontline venues for cultivating environmental resilience. Preliminary reconnaissance revealed that disability-inclusive environmental programming in the city is sporadic, often relegated to annual "Green Week" events devoid of differentiated instruction. Recognising this lacuna, the present investigation targets four institutions with heterogeneous learner profiles: **Kendriya Vidyalaya No. 1 (Maida Mill), Kendriya Vidyalaya No. 3 (Bagmugalia), Kendriya Vidyalaya Bairagarh,** and the **National Association for the Blind, Bhopal**.

A purposive cohort of **60 students** (aged 14–18 years) was drawn, encompassing the following diagnostic categories:

- total visual impairment (n = 20),
- partial hearing loss (n = 8),
- speech and language impairment— "dumb" in colloquial registers (n = 6),
- autism spectrum disorder (n = 7),
- Neuro muscular Problems (n = 9),
- specific learning disability / "slow learners" (n = 10),

This taxonomy mirrors the Rights of Persons with Disabilities Act 2016 and aligns with PRASHAST screening definitions, thereby assuring regulatory consonance.

Conceptual Framework

Guided by **Universal Design for Learning** (multiple means of engagement, representation, action) and **Constructivist** epistemology, the study posits that environmental concepts must be accessible through multi-sensory channels—visual-tactile models for learners with blindness, captioned videos for those with hearing loss, and gamified simulations for autistic students. The *knowledge–affect–behaviour* triad (Hines et al., 1987 model, updated by van de Wetering et al., 2022) underpins the logic of change: increased knowledge fosters affective connection, which in turn catalyses responsible behaviour.

1.7 Statement of the Problem

Although inclusive education is enshrined in national policy, its application in the context of environmental education remains underdeveloped. Most existing environmental awareness programmes do not consider the diverse needs of learners with disabilities. There is a dearth of empirical studies evaluating differentiated instructional strategies that could bridge this gap. This study seeks to address this deficiency by assessing the impact of tailored instructional interventions on environmental awareness among students with special learning needs.

Objectives

1. **Design and implement** differentiated instructional modules that cultivate environmental awareness among students with special learning needs in the selected schools of Bhopal city.
2. **Measure baseline awareness** across cognitive (facts), affective (concern), and conative (self-reported practice) domains, disaggregated by learners with special learning needs.
3. **Evaluate post-instruction gains** to determine the efficacy of each module and identify moderators such as impairment type and pre-test score.
4. **Generate evidence-informed recommendations** for school leaders, curriculum developers, and municipal policy makers to mainstream inclusive environmental education.

Hypotheses

H_0: There is no statistically significant difference between pre- and post-instruction environmental-awareness scores among participating students.

H_1: There is statistically significant difference between pre- and post-instruction environmental-awareness scores among participating students.

1.8 Definition of Key Terms

Environmental Awareness: Knowledge, attitudes, and behaviours related to ecological systems and sustainability. Inclusive Education: An approach where students of all abilities learn together in common educational settings. Universal Design for Learning (UDL): A pedagogical framework that provides multiple means of engagement, representation, and action. Students with Special Learning Needs: Learners with sensory, cognitive, neurological, or behavioural challenges that require adapted instruction.