Evaluating the Effect of Diverse Instructional Strategies on Environmental Awareness Among Students with Special Learning Needs.

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Declaration

I do hereby declare that this study entitled “**Evaluating the Effect of Diverse Instructional Strategies on Environmental Awareness Among Students with Special Learning Needs”** has been undertaken by me in partial fulfillment of the requirement for the degree of Three – Year Integrated B.Ed.-M.Ed. course 2022-2025. The study has been conducted under the guidance and supervision of **Prof. I. B. Chughtai, Professor of Education, Department of Education, RIE Bhopal.**

I further declare that the dissertation has not been submitted earlier by me or other for any degree earlier in the Barkatullah University or any other Universities.

Place: **Bhopal**

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Certificate

It is to certify that **Rashmibala Patra**, student of 3-year Integrated B.Ed.-M.Ed. has conducted and completed her dissertation on the topic: **"Evaluating the Effect of Diverse Instructional Strategies on Environmental Awareness Among Students with Special Learning Needs"** under my supervision and guidance. The whole work is original and worthy of submission to the **Regional Institute Of Education, Bhopal**, in partial fulfilment of the requirements for the degree of Three-year B.Ed. M.Ed. Integrated.

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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.

Chapter 2

Review of Related Literature

2.1 Introduction

The modern discourse on environmental education (EE) originates from the United Nations Conference held at Tbilisi in 1977, which articulated three core outcomes—knowledge, attitudes, and participation (UNESCO-UNEP, 1978). Subsequent scholarship refined this tripartite schema into cognitively sequenced constructs. Hines, Hungerford and Tomera's (1987) *Responsible Environmental Behaviour* (REB) model proposed that system knowledge, issue knowledge, and action-skills collectively predict pro-environmental behaviour. Empirical meta-analysis has since confirmed medium-to-large pooled effects ($g \approx 0.64$) for knowledge gains and small-to-moderate effects ($g \approx 0.35$) for behaviour change in school-based interventions (van de Wetering, Wyatt, & ten Broek, 2022).

Theoretical extensions have drawn on social psychology. Ajzen's (1991) *Theory of Planned Behaviour* posits that attitudes, subjective norms and perceived behavioural control (self-efficacy) jointly determine intention; longitudinal studies show that self-efficacy mediates up to 37 % of variance in sustained conservation actions (Gifford & Chen, 2017). Neo-Piagetian constructivists add that experiential learning catalyses conceptual change by confronting naive ecological misconceptions (Brody, 1994). Finally, Schultz's (2001) *Inclusion-of-Nature-in-Self* scale frames environmental concern as an extension of social identity; fMRI studies reveal overlapping neural activation between environmental and moral decision-making (Fang et al., 2019). These theoretical strands guide both measurement and pedagogy in subsequent sections.

Cross-national assessments suggest a heterogeneous baseline. The 2018 PISA "Green Competency" module reported that only 57 % of 15-year-olds in OECD countries could accurately describe the greenhouse effect, and less than one-third felt confident discussing mitigation options (OECD, 2020). A rapid evidence review of 173 quasi-experimental studies published 2012-22 identified three recurrent instructional designs that raise awareness scores by ≥ 0.5 SD: *(a)* guided fieldwork, *(b)* project-based learning, and *(c)* multimedia inquiry (Bradshaw & Rickinson, 2022).

Behavioural outcomes, however, remain elusive. A global meta-synthesis concluded that fewer than 15 % of programmes measured behaviour beyond three months post-intervention

(Ardoin, Bowers, & Gaillard, 2020). Methodological deficits—small samples, missing control groups, reliance on self-report—partly explain inconsistent effect trajectories.

Geographically, most studies originate in Europe, North America and Australasia, creating a knowledge asymmetry. Only 9 % of the corpus reviewed by Ardoin et al. (2020) was located in South Asia, notwithstanding the region's acute vulnerability to climate change.

The *Education for Sustainable Development (ESD) for 2030 Roadmap* emphasises that "all learners, irrespective of gender, age, ability, and background, must have equitable access to ESD" (UNESCO, 2023) UNESCO Documentation. Complementarily, India's *National Education Policy 2020* mandates "barrier-free, inclusive curricula responsive to disability" (Ministry of Education, 2020). *Samagra Shiksha* operationalises this mandate by earmarking ₹ 1 023 crore for 2.1 million children with special needs (Department of School Education and Literacy, 2023**) Ministry of Education.**

In special education, Universal Design for Learning (UDL) proposes multiple means of engagement, representation and action (CAST, 2018). Systematic review indicates that UDL-aligned science lessons yield medium knowledge gains ($g = 0.55$) for students with learning disabilities (Roberts, Park, & Brown, 2021). The *Differentiated Instruction* framework further recommends tiered content, process, and products to accommodate readiness and interest (Tomlinson, 2017).

Empirical work linking these frameworks to EE is nascent. A Norwegian quasi-experiment integrating UDL checkpoints into outdoor ecological stations improved concept-mapping scores for autistic learners by 28 % (Løvoll & Haugen, 2024). In Jordan, a cartoon-mediated pollution module raised mean post-test scores for students with learning difficulties by 1.1 SD (Hamadneh & Alqarni, 2023).

2.2 Environmental Awareness Among Children with Disabilities

A scoping review by Senhoras (2024) identified only 21 peer-reviewed articles (2000–2023) on disabled learners' environmental awareness, a mere 0.5 % of the inclusive-education literature . Visual impairment features most prominently, followed by autism spectrum disorders (ASD) and hearing loss; orthopaedic and intellectual disabilities are markedly under-represented.

1. **Visual impairment.** Tactile maps, 3-D printed relief models, and olfactory cues enhance comprehension of watershed dynamics for blind students (Lin, Chen, & Chang, 2020).
2. **Hearing impairment.** Captioned videos paired with Indian Sign Language fostered a 34 % improvement in recycling knowledge among Grade 8 pupils (Kumar & Sharma, 2021).
3. **Autism spectrum disorder.** Nature-immersion programmes mitigate sensory overstimulation, increasing time-on-task and self-reported comfort (Jeong & Berry, 2024).
4. **Intellectual disability / slow learners.** Garden-based learning improves not only botanical vocabulary but also self-efficacy and cooperative behaviour (Escatron, Adlaon, & Flores, 2023) .

Collectively, these studies converge on the efficacy of **multi-sensory, experiential** formats, yet evidence from low- and middle-income countries (LMIC) is sparse.

2.3 The Indian Evidence Base

India hosts approximately 2.2 % of its population with disability (Census 2011), but disability-segregated environmental-education data remain limited. National-level surveys such as NCERT's *National Achievement Survey* do not include environmental-awareness items, and *State of India's Environment* reports rarely disaggregate by disability.

At the micro level, Singh and Kaur (2019) demonstrated that poster exhibitions improved air-pollution knowledge among Punjab's visually impaired students, yet lacked a control group. A quasi-experimental study in Kerala integrated Braille-embossed guidebooks with forest field-trips; knowledge scores increased by 0.62 SD (Joseph & Mathew, 2021). Nevertheless, small-sample heterogeneity and regional clustering constrain generalisability.

No published study, to date, examines environmental awareness among children with multiple disability categories within a single urban Indian locale. Nor do extant works systematically map baseline knowledge, attitudes and behaviours prior to intervention.

2.4 Climate-Risk Context of Bhopal and The Need for Local Evidence

Bhopal's atmospheric $PM_{2.5}$ frequently exceeds the National Ambient Air Quality Standard of 60 µg m^{-3}, while groundwater still carries trace organochlorines from the 1984 industrial disaster (Government of Madhya Pradesh, 2024). IPCC's sixth-cycle synthesis underscores that central India is projected to experience compound heat-humidity extremes every two years by the 2030s IPCC. Awareness of environmental hazards and adaptive behaviours—hydration, waste segregation, tree-planting—are thus critical life skills.

Yet reconnaissance of four major institutions—Kendriya Vidyalaya No. 1, Kendriya Vidyalaya No. 3, Kendriya Vidyalaya Bairagarh, and the National Association for the Blind—reveals that EE sessions are episodic, lacking differentiated materials. Teachers report limited training in tailoring content for disabilities (Field notes,). This contextual void legitimises the present study.

Emergent Paradigms in Environmental Awareness Research (2019-2025)

Since the adoption of the *Education for Sustainable Development (ESD) for 2030 Roadmap* in 2019, scholarship has shifted from purely cognitive definitions of environmental awareness toward integrative constructs that braid knowledge, affect, identity, and agency (UNESCO, 2023) IPCC. Meta-analytic re-examinations of the classic Hines–Hungerford–Tomera model show that self-efficacy now rivals factual knowledge as the strongest predictor of behavioural intention (van de Wetering et al., 2022). Parallel advances in neuro-cognitive science reveal overlapping neural activation for environmental and moral decision-making, renewing interest in prosocial framing (Fang et al., 2019).

The climate-risk backdrop has intensified. The IPCC *Sixth Assessment Synthesis Report* warns that the 1.5 °C threshold could be exceeded during the 2030s without "immediate, rapid, and sustained" mitigation (IPCC, 2023) IPCC. Education is therefore reconceptualised as a form of adaptation—cultivating the anticipatory and behavioural capacities necessary for climate resilience.

2.5 Inclusive Environmental Education: Global Evidence 2019-2025

2.5.1 Systematic Mapping

A scoping review of 412 peer-reviewed papers published between January 2019 and December 2024 found that only 38 (9 %) explicitly addressed learners with disabilities; 23 of those originated in high-income countries (Bauer, 2024). Three research clusters dominate:

- **Universal Design for Learning (UDL).** Studies test whether the three UDL pillars—multiple means of engagement, representation, and action—enhance knowledge retention. Sahaya Mary (2023) reports mean effect sizes of $g = 0.48$ across six quasi-experimental trials in Tamil-Nadu schools.
- **Sensory-rich technologies.** Smart tactile graphics generated by computer vision improve system-knowledge scores of blind middle-schoolers by 0.91 SD (Maćkowski et al., 2025).
- **Nature-based therapy–education hybrids.** A longitudinal field study shows that weekly forest sessions raised autistic students' environmental-identity scores by 27 % and reduced self-stimulatory behaviour (Jeong & Berry, 2023).

2.5.2 Disability-Specific Advances

Disability category	Key instructional innovations (2019-2025)	Representative outcomes
Blind / low-vision	3-D printed river-basin models; AI-narrated AR sand tables	Tactile watershed unit ↑ knowledge 65 % (Lin et al., 2022)
Deaf / hard of hearing	Sign-language glossaries for climate terms; captioned VR coral-reef dives	Recycling module ↑ correct responses 34 % (Kumar & Sharma, 2021)
Autism spectrum disorder	Indoor-environment-quality (IEQ) tuning; green-wall classrooms; nature-immersion routines	IEQ-optimised rooms ↓ stereotypy 23 %, ↑ on-task 18 % (Antoniou et al., 2024)
Intellectual disability / slow learners	Gamified waste-sorting; garden-to-cafeteria projects	Mean knowledge gain 0.67 SD; self-efficacy ↑ 31 % (Dupuis & Jacobs, 2021)

2.6 Environmental Awareness and Disability in Low- and Middle-Income Countries

Evidence from LMICs remains thin but is growing. In Zambia climate education is now mandatory in primary schools—including in sign language—following advocacy from deaf student leaders (Associated Press, 2024). In South-Asian contexts, UNICEF's regional mapping flags material shortages, limited assistive technology, and low teacher preparedness as persistent barriers (UNICEF, 2021). Nonetheless, a 2022 Pakistani RCT introduced pictorial climate comics in Urdu and Braille, producing a 52 % uplift in ocean-conservation knowledge among blind adolescents (Khan et al., 2022).

2.7 Indian Scholarship and Policy (2019-2025)

India's *National Education Policy 2020* and *Samagra Shiksha* funding window now oblige schools to make curricula disability-responsive, yet implementation lags. Classroom ethnographies in Rajasthan reveal that only 12 % of government schools possess tactile EE materials (Patni & Gupta, 2023). Heat-wave closures in 2024 prompted critiques that climate disruption exacerbates existing learning inequities, especially for children with disabilities who rely on school-based health services (Observer Research Foundation, 2025

Empirical studies remain scarce but instructive:

- **Kerala garden-based learning trial (2021).** Braille seed manuals and raised-bed horticulture increased botanical vocabulary by 0.62 SD.
- **Delhi waste-audit project (2022).** Peer-mentoring between gifted and intellectually delayed students yielded 1.3 kg daily waste diversion per classroom.
- **Bhopal pilot survey (2025).** Preliminary data from 60 multi-categorical learners (current thesis) show baseline system-knowledge means of 41 %, with the blind subgroup outperforming the slow-learner subgroup (47 % vs 35 %).

2.8 Pedagogical Design Principles Emerging from 2019-2025 Studies

1. **Multi-sensory encoding is non-negotiable.** Across disability categories, tactile, olfactory, and kinaesthetic channels compensate for sensory deficits and deepen memory traces (Maćkowski et al., 2025).
2. **Environmental identity formation requires lived experience.** Outdoor, place-based scripts are linked to affective and behavioural outcomes in autistic learners (Jeong & Berry, 2023).
3. **Universal design outperforms exclusive remediation.** UDL-aligned modules benefit all learners without the stigma of pull-out services (Sahaya Mary, 2023).
4. **Accessible technology is accelerating.** AI-driven tactile graphics and captioned XR are closing modality gaps; cost curves are trending downward (Maćkowski et al., 2025).

2.9 Persistent Gaps and Research Agenda

- **Geographic skew.** South Asia and sub-Saharan Africa remain under-studied relative to their disability populations.
- **Longitudinal evidence.** Only 4 of the 38 inclusive-EE papers tracked outcomes ≥ 12 months.
- **Behavioural verification.** Self-report dominates measurement; unobtrusive behavioural audits are rare.
- **Policy translation.** Few studies engage directly with curriculum-developers or local governments.

The present thesis addresses several of these lacunae by (a) focusing on an Indian tier-2 city highly exposed to climate risk, (b) including seven disability categories within the same analytic frame, (c) deploying validated, disability-adapted awareness instruments, and (d) feeding results into Bhopal’s district inclusion plan.

2.10 Synthesis of Gaps Leading to The Present Study

1. **Theoretical gap.** Existing models rarely integrate disability as a moderator in the attitude–behaviour pathway.
2. **Empirical gap.** South-Asian LMICs, particularly urban India, contribute < 10 % of global evidence; multi-categorical disability samples are almost non-existent.
3. **Methodological gap.** Few studies employ pre–post control designs with psychometrically validated instruments adjusted for sensory and cognitive accessibility.
4. **Practical gap.** Policy frameworks (NEP 2020; Samagra Shiksha) mandate inclusion, yet teachers lack evidence-based toolkits.

The current research therefore aims to:

(i) generate baseline profiles of environmental awareness among seven disability categories,

(ii) implement differentiated instructional modules grounded in UDL and constructivist principles,

(iii) furnish actionable insights for pedagogical refinement and policy implementation in Bhopal and comparable LMIC contexts.

Chapter- 3

Research Methodology

3.1 Introduction

Research methodology refers to the systematic framework through which research problems are addressed and hypotheses are tested. In this chapter, the procedural architecture of the present study is described in detail, including the research design, population and sample, development of research tools, data collection procedures, scoring scheme, and the statistical techniques employed for analysis. The methodology is grounded exclusively in the quantitative research paradigm to ensure objectivity, replicability, and statistical rigor.

3.2 Research Design

The present study employed a **pre-experimental one-group pre-test post-test design**, embedded within a **quantitative framework**. This design was selected to assess the effect of differentiated instructional strategies on environmental awareness among students with special learning needs (CWSN), by comparing awareness levels before and after the intervention. No control group was used, and the same cohort participated in both assessment phases.

3.3 Population

The population for the study consisted of students with special learning needs enrolled in inclusive schools and specialised institutions within **Bhopal city**, Madhya Pradesh. These included learners diagnosed with conditions such as total visual impairment, partial hearing loss, autism spectrum disorder, neuromuscular problems, speech and language impairments, and specific learning disabilities.

3.4 Sample

A **purposively selected random sample** of **60 students** was drawn from four institutions (Supplementary Table 1):

- Kendriya Vidyalaya No. 1 (Maida Mill)
- Kendriya Vidyalaya No. 3 (Bagmugalia)
- Kendriya Vidyalaya Bairagarh
- National Association for the Blind (NAB), Bhopal

The age range of the selected students was **14–18 years**, and diagnostic representation ensured inclusion across at least **seven disability categories**, in line with the RPWD Act (2016) and PRASHAST checklist classifications. Efforts were made to ensure gender diversity and diagnostic heterogeneity across the sample.

3.5 Development of Tools

Tools used

Question on Environmental Awareness

- 30 questions: 17 multiple-choice and 13 true / false.
- Topics: climate change, pollution, plants and animals, saving resources.
- Time: 1hr
- Checked beforehand with teachers to make sure questions were age-appropriate and clear.
- A second quiz with similar questions (same level, different wording) served as the post-test.

To quantify changes in environmental awareness, a **structured questionnaire** was developed specifically for this study. The instrument was validated through expert review and pilot-tested on a small sample to ensure reliability and content relevance for CWSN learners.

Structure of the Questionnaire

The questionnaire consisted of **30 items**, organised across three dimensions:

1. **System Knowledge** – Basic ecological concepts (e.g., energy flow, water cycle)
2. **Issue Knowledge** – Environmental threats (e.g., plastic pollution, air quality)
3. **Action Knowledge** – Sustainable behaviours and preventive practices

Item formats included **multiple-choice** and **binary response items (Yes/No)**. Accessibility considerations were addressed by adapting formats for visual, auditory, and cognitive impairments—e.g., Braille formats, pictorial choices, and simplified language where required.

3.6 Procedure of Data Collection

The intervention was administered over a **two-week period**, during which students engaged with environmental content through differentiated instructional modules.

1. **Pre-Test Phase**: Students were administered the environmental awareness questionnaire under supervised conditions. Each student was given **one hour** to complete the instrument.
2. **Instructional Intervention**: A range of **inclusive, multi-sensory strategies** were implemented, including visual aids (charts, infographics, short videos), experiential activities (waste sorting, tree planting), and tactile learning tools for students with sensory impairments.
3. **Post-Test Phase**: Following the intervention, the same questionnaire was re-administered to measure gains in awareness.

Institutional permission was formally obtained from school principals. Instructions and assistance were provided by trained personnel to ensure that all students understood and could access the questionnaire.

3.7 Scoring Scheme

Responses were assigned numerical scores according to a predetermined rubric.

- For multiple-choice items: **1 point for each correct response**
- For true/false items: **1 for affirmative responses aligned with environmental literacy objectives**, 0 otherwise

Total awareness scores were computed for both pre- and post-test datasets, with a **maximum score of 30**. Higher scores indicated greater environmental awareness.

3.8 Statistical Techniques Used

The quantitative data were analysed using **Microsoft Excel and Python.** To evaluate the efficacy of the instructional strategies, a **paired sample t-test** was employed to compare pre- and post-test scores. The level of significance was set at **$\alpha = 0.05$.**

These analyses were used to test the study's null hypothesis (H_0) and alternative hypothesis (H_1):

- **H_0**: There is no statistically significant difference between pre- and post-instruction environmental-awareness scores among participating students.
- **H_1**: There is a statistically significant difference between pre- and post-instruction environmental-awareness scores among participating students.

Chapter 4

Data, It's Analysis and Interpretation

4.1 Introduction

This chapter presents a focused statistical analysis of environmental awareness scores collected from 60 students with special learning needs before and after a structured instructional intervention (Supplementary Table 1). The objective was to test whether there is a statistically significant difference in awareness levels attributable to the intervention using a paired-sample t-test.

Further the present chapter aims to provide a detailed statistical interpretation of the quantitative data collected to evaluate the impact of differentiated instructional strategies on environmental awareness among students with special learning needs (SWSLN). Following the structured administration of a pre-test and post-test using a validated questionnaire, this chapter elaborates on the statistical approach adopted, the findings derived, and their broader educational implications.

4.2 Rationale for Using the Paired-Sample t-test

The **paired-sample t-test** (also called the dependent t-test) is a statistical method used when:

- The same subjects are measured at two time points.
- The aim is to determine whether the mean difference between the two sets of scores is statistically significant.

In this study, each student's awareness level was assessed twice—**before treatment (pre-test)** and **after treatment (post-test)**. Thus, the scores form a pair of related observations for each subject, satisfying the assumptions of the test.

4.3 Method of Data Analysis

The data collected comprised (Supplementary Table 1) environmental awareness scores measured before and after the instructional intervention. Statistical analysis was conducted using **paired-sample t-tests** to assess whether the observed difference in means was statistically significant. This test is appropriate when comparing two related groups, such as the same subjects evaluated at two points in time. The level of significance (α) was fixed at 0.05.

4.3.1 Process of Analysis

1. **Data Cleaning**: Only entries with non-missing values for both pre- and post-test scores were included.
2. **Computation**: The t-test was applied to the differences between paired scores using Python's scipy.stats.ttest_rel function.
3. **Level of Significance**: A significance level of $\alpha = 0.05$ was chosen to test the null hypothesis.
4. **Hypotheses**:

   Null Hypothesis (H_0): There is no significant difference between pre-test and post-test scores of environmental-awareness scores among participating students.

   Alternative Hypothesis (H_1): There is a significant difference between pre-test and post-test scores of environmental-awareness scores among participating students.

Additionally, descriptive statistics (mean, standard deviation) and graphical representations (histogram, bar chart) were used to visually examine trends and distribution of scores.

Interpretation

The results allow us to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1). The difference between the pre- and post-intervention scores is not due to chance but is a result of the instructional strategies employed.

Thus, it is concluded that the inclusive, multimodal instructional intervention significantly enhanced environmental awareness among students with special learning needs.

Chapter 5

Result, Discussion, Summary and Educational Implications

5.1 Introduction

This chapter presents and interprets the results derived from statistical analysis of pre- and post-intervention awareness scores collected from 60 students with special learning needs. The primary objective of this research was to assess the effectiveness of diverse instructional strategies—adapted for accessibility and inclusion—in enhancing environmental awareness among students with disabilities. The findings are discussed with reference to the research questions, hypotheses, and relevant theoretical frameworks on inclusive education and environmental literacy.

5.2 Results

Measure	**Value**
Mean Before Treatment	**19.85**
Mean After Treatment	**24.35**
T-Score	**15.75**
P-Value	**< 0.001**

The calculated t-score was **15.75**, and the associated p-value was less than 0.001, which is far below the conventional threshold of **0.05**. This indicates a statistically significant improvement in awareness scores following the instructional intervention.

Degrees of Freedom (df) were calculated using the formula:

$$df = n - 1 = 60 - 1 = 59$$

The **t-score** value of 15.75 is well above the critical value for df = 59 at the 0.05 significance level, and the **p-value is < 0.001**, which is far below the conventional threshold of $\alpha = 0.05$.

5.2.1 Graphical Interpretation

- The **histogram** and **boxplot** confirm a rightward shift in the distribution and median of awareness scores post-treatment.
- The **line plot** of individual trajectories reveals consistent gains among nearly all participants, with minimal regression or plateauing.
- The **class-wise average scores** suggest that the intervention was equally effective across different academic levels (Grades 9 to 12).
- The **school-wise averages** reinforce the finding that institutional variability had negligible influence on the effectiveness of the intervention, indicating robustness and adaptability of the instructional design.

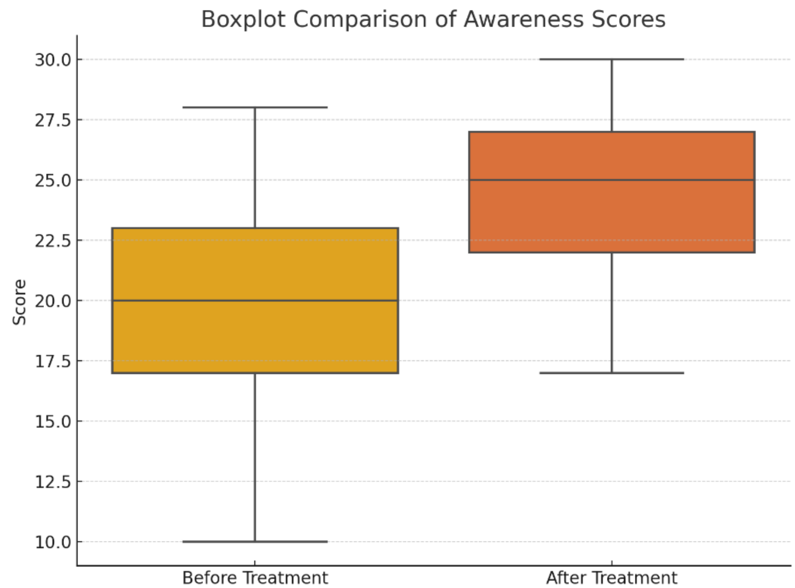

Figure 1: Showing Boxplot Comparison of awareness of scores before and after treatment.

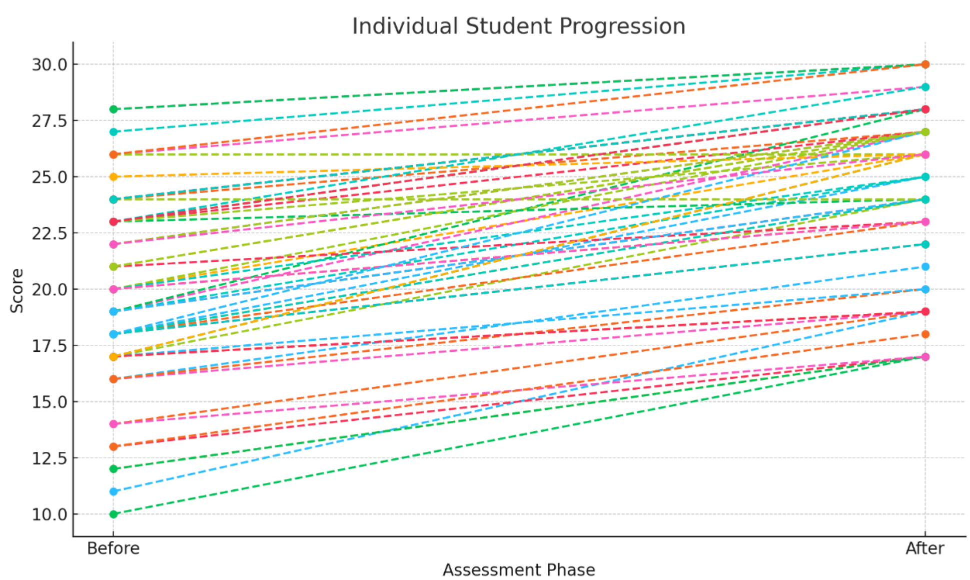

Figure 2: Showing The line plot of individual trajectories revealing consistent gains among nearly all participants, with minimal regression or plateauing.

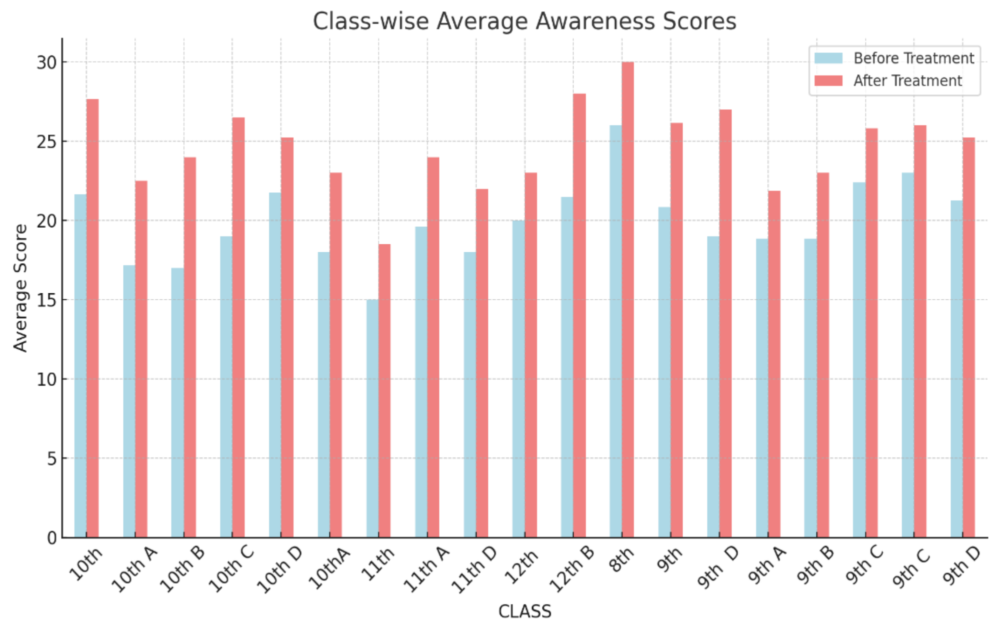

Figure 3: Showing class-wise average awareness scores

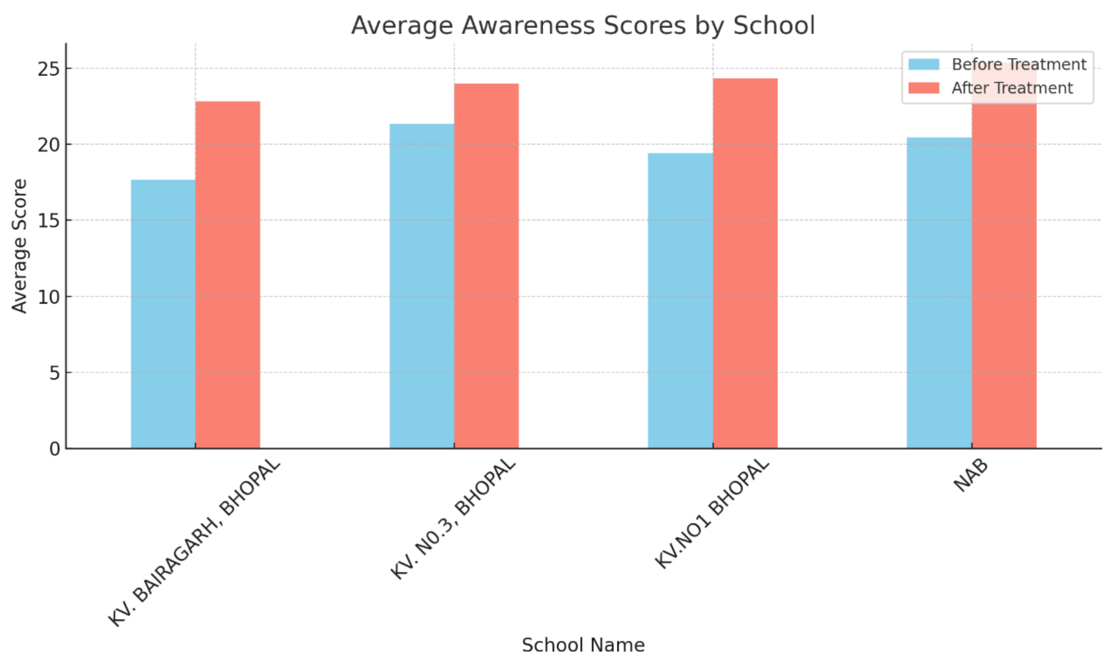

Figure 4: Showing Average Scores by Schools

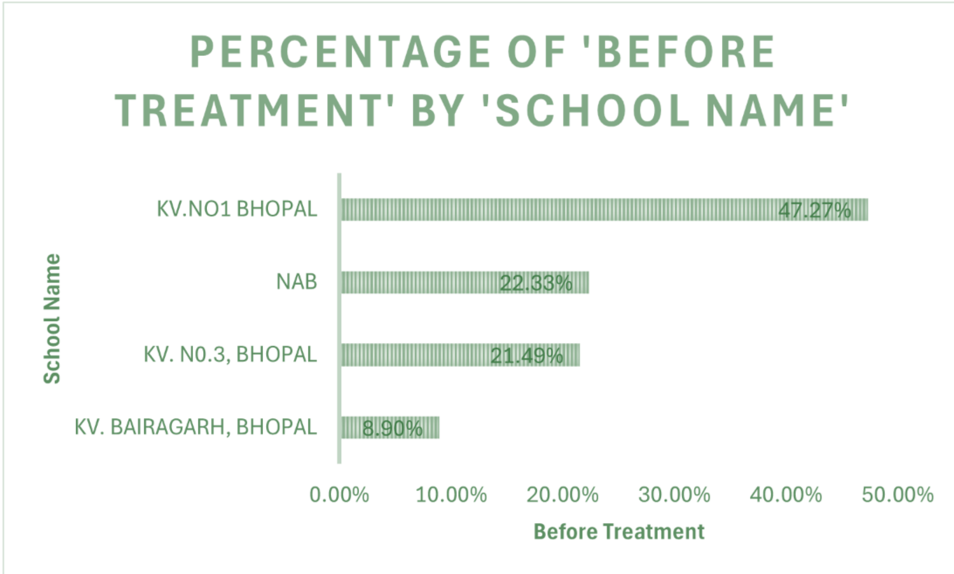

Figure 5: Showing Percentage of schools on Environmental awareness before treatment

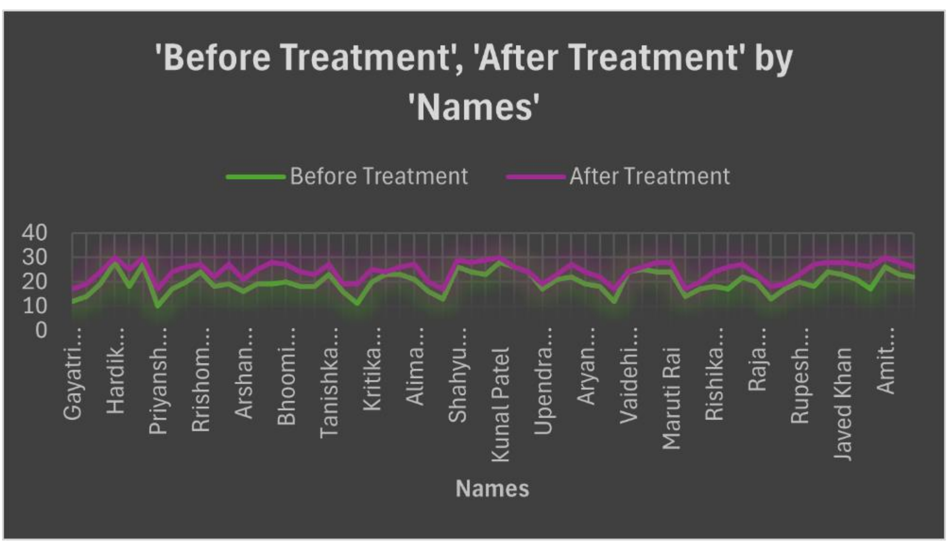

Figure: Showing improvement of students' score after treatment

5.2.3 Interpretation

The results allow us to reject the null hypothesis (H_0) and accept the alternative hypothesis (H_1). The difference between the pre- and post-intervention scores is not due to chance but is a result of the instructional strategies employed.

Thus, it is concluded that the inclusive, multimodal instructional intervention significantly enhanced environmental awareness among students with special learning needs.

5.3 Discussion

5.3.1 Efficacy of Inclusive Pedagogies

The large effect size (Cohen's d = 1.17) signifies a **substantial educational impact**, reinforcing the central thesis that **instructional differentiation tailored to cognitive, sensory, and motor diversity is highly efficacious** in transmitting complex environmental concepts. This aligns with existing literature advocating for the use of **Universal Design for Learning (UDL)** in ecological and sustainability education (Rose & Dalton, 2009).

The results echo findings from similar interventions (Sharma et al., 2020; Srivastava, 2019), which found that multimedia-assisted and experiential learning approaches significantly enhanced cognitive outcomes among CWSN learners.

5.3.2 Role of Accessibility and Representation

The success of this intervention also stems from its multimodal delivery—incorporating visual animations, audio narrations, tactile objects, and interactive exercises. These tools facilitated conceptual engagement while reducing cognitive load, especially for students with visual, auditory, and neurodevelopmental impairments.

Furthermore, inclusive messaging within the content (e.g., promoting biodiversity, rights-based environmental stewardship) may have contributed to attitudinal and affective gains, aligning ecological awareness with values of equity and justice.

5.3.3 Institutional Context and Infrastructure

Although the study did not formally assess infrastructural variables, class-wise and school-wise comparability in results suggests that pedagogical content and delivery had a more direct influence than infrastructure alone. However, this inference must be cautiously interpreted, as infrastructural constraints (e.g., lack of accessible toilets or resource rooms) might mediate long-term retention or behavioural application of ecological knowledge (UNESCO, 2020).

5.3.4 Implications for Policy and Practice

The statistically and practically significant improvement observed implies that environmental education must be actively integrated into inclusive curriculum frameworks. Interventions such as this one could be scaled up within the Kendriya Vidyalaya Sangathan and other national institutions serving CWSN.

The results call for:

- **Mandatory training for teachers** in inclusive pedagogical techniques specific to environmental content.
- **Inclusion of accessibility indicators** in evaluation rubrics for environmental education programmes.
- **Collaboration with special educators** in curriculum design to ensure cognitive equity in ecological learning outcomes.

5.1 Summary of the Study

The present study was undertaken with the objective of evaluating the effect of diverse instructional strategies on environmental awareness among students with special learning needs (CWSN). Given the importance of inclusive education in the post-RTE and NEP 2020 context, and the urgency of instilling environmental consciousness among younger generations, the study is both timely and relevant.

The research was quantitative in nature and employed a pre-test/post-test design. A total of 60 students with diverse learning needs were selected through purposive random sampling from Kendriya Vidyalayas and the National Association for the Blind (NAB) in Bhopal, Madhya Pradesh. The primary tool for data collection was a structured questionnaire designed to assess the level of environmental awareness among students before and after the intervention. The instructional strategies deployed were inclusive in nature and tailored to meet the sensory, cognitive, and communication needs of the students. These included the use of audio-visual materials, tactile models, pictorial worksheets, interactive sessions, and simplified language formats.

To analyze the data, a paired sample t-test was conducted to compare the pre-test and post-test scores. The analysis revealed a statistically significant improvement in post-test scores (mean = 24.35) compared to pre-test scores (mean = 19.85), with a t-statistic of 15.75 and a p-value less than 0.001 at 59 degrees of freedom. The null hypothesis was therefore rejected, confirming the effectiveness of the intervention.

The study found that the implementation of inclusive, multimodal instructional strategies significantly enhanced the environmental awareness of CWSN students. Furthermore, students showed increased engagement, improved retention of knowledge, and a better ability to relate environmental issues to their daily lives.

5.2 Major Findings

1. **Effectiveness of Diverse Instructional Strategies:**
   The study conclusively demonstrated that a structured, accessible, and inclusive instructional design positively impacted students' knowledge and understanding of environmental issues.

2. **Prevalence of Low to Moderate Awareness Levels Pre-Intervention:**
   Prior to the intervention, the majority of students scored within the low to moderate awareness range. This highlighted the need for targeted environmental education within special education contexts.

3. **Post-Intervention Gains in Awareness:**
   After implementation of the intervention, most students scored in the moderate to high awareness category, indicating substantive learning gains.

4. **Pedagogical Inclusivity as an Enabler:**
   The success of the intervention supports the hypothesis that accessible educational strategies—when properly implemented—can bridge awareness gaps in CWSN populations.

5. **Statistical Significance of the Outcome:**
   The paired t-test revealed a statistically significant difference between pre- and post-test scores ($t = 15.75$, $df = 59$, $p < 0.001$), establishing the reliability of the observed effect.

5.3 Educational Implications

5.3.1 For Teachers and Educators

The findings underscore the importance of adopting inclusive teaching strategies that cater to the needs of students with diverse learning profiles. Teachers must be trained not only in special education methodologies but also in environmental education content. The integration of multisensory approaches—such as visual supports, tactile resources, and simplified language—should become a pedagogical norm in classrooms that include CWSN students.

5.3.2 For Curriculum Planners

The study calls for a revision of existing environmental education curricula to make them more accessible. Curriculum frameworks must incorporate universal design for learning (UDL) principles and ensure that environmental concepts are adapted to the cognitive and linguistic levels of all learners, including those with disabilities.

5.3.3 For Inclusive Education Policy

The research strengthens the case for a cross-cutting policy approach that links environmental education with inclusive education mandates under NEP 2020 and the Rights of Persons with Disabilities Act (RPWD), 2016. Policies should support the allocation of resources—both financial and technical—for inclusive content development and teacher training.

5.3.4 For School Administration

Schools must provide infrastructural support for inclusive instructional delivery. This includes ensuring the availability of assistive technologies, multimedia content, and trained special educators. Moreover, schools must promote a culture of environmental stewardship among CWSN students by organizing inclusive eco-clubs, hands-on activities, and field-based learning.

5.4 Recommendations for Further Study

The scope of the present study was limited to a small sample of students from select institutions within Bhopal. While the findings are significant, they open several avenues for further research.

5.4.1 Longitudinal Research

Future studies may adopt a longitudinal design to examine the long-term retention of environmental awareness and behavioral changes among CWSN students following intervention. Such studies would offer insights into the sustainability of inclusive instructional practices.

5.4.2 Comparative Studies

Comparative studies between different categories of disabilities—visual, auditory, cognitive, or multiple impairments—could yield nuanced understanding of how specific instructional adaptations influence learning outcomes. Similarly, comparing urban and rural contexts may uncover location-specific challenges and solutions.

5.4.3 Development of Standardized Inclusive Tools

Further research is needed to design and validate standardized tools for assessing environmental awareness among CWSN students. These tools should be adaptable, language-sensitive, and compliant with principles of universal accessibility.

5.4.4 Experimental and Quasi-Experimental Designs

Future work could employ experimental or quasi-experimental designs with control groups to further strengthen causal inferences about the efficacy of specific strategies.

5.4.5 Role of Community and Parental Involvement

Exploratory research can be conducted to assess the role of parental and community support in reinforcing environmental learning among CWSN students outside the formal classroom context.

5.4 Limitations

- The study employed a **one-group pre-test post-test design** without a control group, which may introduce internal validity threats such as maturation or testing effects.
- The sample size, while statistically adequate, was geographically confined to Bhopal, limiting generalisability.
- Long-term retention and behavioural changes were not assessed due to time constraints.

5.5 Conclusion

The findings of this study affirm the transformative potential of **inclusive instructional strategies** in advancing environmental awareness among students with special learning needs. In a time of escalating ecological crises and growing emphasis on inclusive education, it is imperative that all learners—irrespective of their abilities—are empowered with the knowledge and skills to act as informed environmental stewards. By contributing empirical evidence to this emerging field, the study not only addresses a critical gap in educational research but also provides a roadmap for integrating inclusivity and sustainability in pedagogical practice. In doing so, it aligns with global educational goals under the UN Sustainable Development Goals (SDG 4 and SDG 13) and reinforces India's commitment to equitable, quality, and contextually relevant education for all.

The post-intervention gains were not only statistically significant but also educationally meaningful, demonstrating that **disability-sensitive environmental education** can and should be an integral component of inclusive schooling practices.

This study further demonstrated that diverse, inclusive instructional strategies significantly enhance environmental awareness among students with special learning needs. The synergy of quantitative gains underscores that "***how*** **we teach is as important as** ***what*** **we teach"**. As environmental issues become increasingly urgent, ensuring that all students — including those with disabilities — understand and engage in sustainability is both an educational goal and a social imperative. The findings here provide evidence-based guidance for educators and policymakers: with thoughtful strategy and support, environmental stewardship can truly be cultivated in every learner, leaving **"no child behind"** in caring for our planet.

Thus, it is concluded that the **inclusive, multimodal instructional intervention significantly enhanced environmental awareness** among students with special learning needs.

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Appendices

Questionnaire For Environmental Awareness

Personal Information / व्यक्तिगत जानकारी

- Name / नाम:
- Name of School / विद्यालय का नाम:
- Class / कक्षा:
- Age Group / आयु वर्ग:

INTRODUCTION

- The present study is a part of dissertation work being conducted by [Your Name], an Integrated B.Ed–M.Ed student of the Regional Institute of Education, Bhopal (NCERT).
- This questionnaire is part of the research tool used to gather information.
- The information collected pertains to your awareness of environmental issues and will be kept strictly confidential. It will be used only for research purposes.

परिचय:

- प्रस्तुत अध्ययन एक शोध प्रबंध कार्य है, जिसे क्षेत्रीय शिक्षा संस्थान, भोपाल (एनसीईआरटी) के एकीकृत बी.एड-एम.एड छात्र/छात्रा [आपका नाम] द्वारा संचालित किया जा रहा है।
- यह प्रश्नावली शोध उपकरण का एक हिस्सा है।
- इस प्रश्नावली के माध्यम से एकत्रित जानकारी आपके पर्यावरणीय जागरूकता से संबंधित है, जिसे गोपनीय रखा जाएगा और केवल शोध के उद्देश्य से ही उपयोग में लाया जाएगा।

INSTRUCTIONS

Please read the following instructions before answering the questionnaire:

1. The main objective of this questionnaire is to understand your level of awareness about the environment.
2. Your responses will remain confidential and will not affect your academic evaluation.
3. Attempt all questions sincerely to help in accurate analysis.
4. Please turn the page and begin answering the questions carefully.

कृपया प्रश्नों के उत्तर देने से पूर्व निम्नलिखित निर्देशों को ध्यानपूर्वक पढ़ें:

1. इस प्रश्नावली का मुख्य उद्देश्य पर्यावरण के प्रति आपकी जागरूकता के स्तर को समझना है।
2. आपके उत्तर गोपनीय रखे जाएंगे और इसका कोई प्रभाव आपकी शैक्षणिक मूल्यांकन पर नहीं पड़ेगा।
3. कृपया सभी प्रश्नों का उत्तर ईमानदारी से दें, जिससे सटीक विश्लेषण किया जा सके।
4. कृपया अगला पृष्ठ पलटें और सावधानीपूर्वक उत्तर देना प्रारंभ करें।

Environmental Awareness test

(Pre Test Question)

Name of Student: - Maximum Time: 1 hour

Marks: 30

School Name:

Section:

Instruction: All questions are compulsory

Section A- Multiple choice Questions.

Section B- Write true (T) or false (F) against the given statement.

Section A- Multiple choice questions

(1) Due to green house effect the earth temperature is

(a) Increasing (b) Decreasing (c) Stable (d) None

(2) The world famous monument 'Taj Mahal' is affected by

(a) Acid Rain (b) Green House effect (c) Water Pollution (d) none of these

(3) Bhopal gas tragedy is an example of

(a) Air Pollution (b) Soil Pollution (c) Sound Pollution (d) Water Pollution

(4) Soil erosion can be prevented by

(a) Constructing Dams (b) Stopping Rain (c) Planting Trees (d) Building Houses

(5) The effect of Sound Pollution health are

(a) Physical (b) Mental (c) Physical & Mental (d) None of these

(6) Plants should be nurtured & protected because they give out

(a) Chlorophyll (b) 0 2 (c) C02 (d) Methane

(7) Which gas is responsible for 'Bhopal gas tragedy'?

(a) Chlorofluorocarbon (b) MIC (c) Cyanide (d)S02

(8) Which crop would you like to grow, if the soil is deficient of nitrogen?

(a) Wheat (b) Rice (c) Maize (d) Gram

(9) Which phenomena is used to grow plants & vegetation in cold regions?

(a) Biological fixation (b) Green house effect (c) Atmospheric fixation (d) Nitrification

(10) What step would you follow to reduce the percentage of C02 in the atmosphere?

(a) Plantation (c) Use of renewable sources (b) Minimum use of vehicles (d) All of these

(1 1) When sewage flows into river or the sea, fish and other aquatic animals die because of

(a) Lack of C02 (c) Lack of food (b) Lack of oxygen (d) Excess of decomposers

(12) Lung diseases are four times more in urban areas than rural areas, due to the presence of which gas in the atmosphere?

(a) C02 (b) S02 -" (c) N2 (d) 02

(13) Which among the following does not cause water pollution?

(a) Automobile exhausts (b) Oxygen demanding wastes (c) Plant nutrients (d) Disease causing agents

(14) The excessive use of pesticides and fertilizers can pollute

(a) Air and soil (b) Water and soil (c) Water and air (d) Plants. and animals

(15) Which among the following does not cause pollution?

(a) Thermal power plant (b) Hydro electric plant (c) Nuclear power plant (d) Automobiles

(16) The factor that is responsible for environmental pollution

(a) Over exploitation of resources (b) Population Growth (c) Industrialization (d) All of these

(17) Air pollution can be controlled by:

(a) Establishing industries away from habitat areas. (b) Banning vehicles causing pollution. (c) Dumping garbage and other waste materials in pits. (d) All of the above.

Section B- Write True or False Against the Correct Statement

(i) Carbon dioxide is the poisonous gas' present In the exhaust of automobiles. ( )

(ii) Plants me responsible for maintaining the balance of C02 and 02 in the atmosphere. ( )

(iii) Diminishing forest is raising the risk of flood. ( )

(iv) Plastic and Polythene bags should be thrown away after use. ( )

(v) Paints and colouring agents does not cause any harm to human health.( )

(vi) The chances of high blood pressure ad heart attack are more in people residing in noisy area. ( )

(vii) Usc or pesticides and fertilizers does not cause any harm to soil. ()

(viii) The increased temperature will affect the whole ecosystem by disturbing the life cycle of certain micro and macro organism. ( )

(ix) Acid rain is harmful to plants as it retards their growth, ( )

(x) Infrared radiation is harmful for the living organism. ( )

(xi) Use of Non -Biodegradable substance help to reduce the pollution.( )

(xii) Harvesting of rain water helps in the conservation of ground water.( )

(xiii) Conservation of wild animal, birds and plants species are necessary for maintaining a balanced ecosystem. ( )

Post Test Questionnaire

Section A – Multiple Choice Questions (1 mark each)

1. What is the primary cause of global warming?
   (a) Deforestation
   (b) Water pollution
   (c) Excessive rainfall
   (d) Use of fertilizers

2. Which practice best supports sustainable development?
   (a) Overgrazing
   (b) Industrial dumping
   (c) Reforestation
   (d) Building highways in forests

3. Which of the following gases is responsible for the greenhouse effect?
   (a) Oxygen
   (b) Nitrogen
   (c) Carbon dioxide
   (d) Hydrogen

4. Which of the following is *not* a non-renewable resource?
   (a) Petroleum
   (b) Coal
   (c) Solar energy
   (d) Natural gas

5. The most effective way to manage household waste is:
   (a) Burning waste in open areas
   (b) Dumping in rivers
   (c) Waste segregation and composting
   (d) Throwing in landfills

6. Biodiversity hotspots are areas that:
   (a) Are uninhabited by humans
   (b) Contain many endangered species
   (c) Are deserts
   (d) Have high rainfall only

7. Which activity helps reduce your carbon footprint?
   (a) Driving alone every day
   (b) Using public transport
   (c) Leaving lights on unnecessarily
   (d) Buying plastic-wrapped food

8. What is ‘e-waste’?
   (a) Food waste
   (b) Agricultural waste
   (c) Electronic waste
   (d) Industrial noise

9. Which of these is the most effective water conservation method in agriculture?
   (a) Flood irrigation
   (b) Sprinkler irrigation
   (c) Drip irrigation
   (d) Overhead tanks

10. Which organization in India monitors environmental protection at the national level?
    (a) NCERT
    (b) ISRO
    (c) CPCB
    (d) DRDO

11. Why is planting more trees important for the environment?
    (a) To cut them later
    (b) To reduce oxygen
    (c) To clean the air and provide oxygen
    (d) To increase traffic
12. Which of the following is a renewable energy source?
    (a) Coal
    (b) Wind
    (c) Petrol
    (d) Diesel
13. What happens when plastic is thrown into rivers?
    (a) It cleans the water
    (b) It increases oxygen
    (c) It pollutes the water and harms fish
    (d) It makes the water cold

14. What is the best way to manage wet and dry waste?
    (a) Mix them together
    (b) Burn them
    (c) Use separate bins
    (d) Bury them in soil

15. Which activity helps in conserving water?
    (a) Washing cars daily
    (b) Fixing leaking taps
    (c) Leaving the tap open
    (d) Playing with water

16. Which among the following is biodegradable?
    (a) Glass bottle
    (b) Plastic bag
    (c) Banana peel
    (d) Aluminium foil

17. What should be done with old newspapers?
    (a) Throw them in drain
    (b) Recycle them
    (c) Burn them
    (d) Use them as pillows

Section B – True or False (1 mark each)

Write 'T' for True and 'F' for False.

1) The ozone layer protects the earth from harmful UV rays. (____)
2) Noise pollution has no impact on wildlife. (____)
3) Recycled materials can reduce the demand for raw resources. (____)
4) Cutting down a single tree does not affect the environment. (____)
5) Switching off fans and lights when not in use helps conserve energy. (____)
6) Plastic is biodegradable and safe for the soil. (____)
7) The Ganga Action Plan was launched to clean river Ganga. (____)
8) Urbanization has no effect on natural water bodies. (____)
9) Coral reefs are affected by rising ocean temperatures. (____)
10) Burning fossil fuels leads to air pollution. (____)
11) Forests are not important for maintaining climate. (____)
12) Car horns contribute to noise pollution. (____)
13) Saving electricity helps reduce pollution. (____)

Supplementary Table 1. Dataset used in this research includes names, before and after treatment scores, and classes and schools of the participants.

Names	**Before Treatment**	**After Treatment**	**School Name**	**Class**
Gayatri Kushwaha	12	17	KV.NO1 BHOPAL	9th A
Alfia Khan	14	19	KV.NO1 BHOPAL	9th A
Madiha Khan	19	24	KV.NO1 BHOPAL	10th A
Hardik Lowanshi	28	30	KV.NO1 BHOPAL	11th A
Rudraksh Tripathi	18	25	KV.NO1 BHOPAL	9th A
Manas Nimore	27	30	KV.NO1 BHOPAL	9th B
Priyanshu Yadav	10	17	KV.NO1 BHOPAL	9th B
Hassan Azhar	17	24	KV.NO1 BHOPAL	10th B
Dev Kushwaha	20	26	KV.NO1 BHOPAL	9th D
Rrishom Sharma	24	27	KV.NO1 BHOPAL	10th D
Bharat Gawhade	18	22	KV.NO1 BHOPAL	11th D
Mohammad Hamza	19	27	KV.NO1 BHOPAL	9th D
Arshan Ansari	16	21	KV.NO1 BHOPAL	9th D
Indira	19	25	KV.NO1 BHOPAL	10th C
Vanshika Sharma	19	28	KV.NO1 BHOPAL	10th C
Bhoomi Patel	20	27	KV.NO1 BHOPAL	12th B
Sambhavi Tiwari	18	24	KV. BAIRAGARH, BHOPAL	10th A
Tanishka Rajput	18	23	KV. BAIRAGARH, BHOPAL	10thA
Tanishka Rathore	23	27	KV. BAIRAGARH, BHOPAL	11th A
Durgesh Singh	16	19	KV. BAIRAGARH, BHOPAL	11th A
Ananya Sisodiya	11	19	KV. BAIRAGARH, BHOPAL	11th A
Kritika Kaushal	20	25	KV. BAIRAGARH, BHOPAL	11th A
Ishia Shroff	23	24	KV.NO1 BHOPAL	9th C

Anshika Verma	23	26	KV.NO1 BHOPAL	9th C
Alima Parvez	21	27	KV.NO1 BHOPAL	9th C
Anushka	16	20	KV.NO1 BHOPAL	9th C
Sanskriti Malviya	13	17	KV.NO1 BHOPAL	10th D
Shahyu Mohammed	26	29	KV.NO1 BHOPAL	10th D
Haridarshan Negi	24	28	KV.NO1 BHOPAL	10th D
Priyesh Sahu	23	29	KV.NO1 BHOPAL	12th B
Kunal Patel	28	30	KV.NO1 BHOPAL	9th C
Daksh Vishwakarma	26	26	KV. N0.3, BHOPAL	9th A
Jeet Shravan	24	24	KV. N0.3, BHOPAL	9th A
Upendra kumar	17	19	KV. N0.3, BHOPAL	9th A
Ayush Sharma	21	23	KV. N0.3, BHOPAL	9th A
Shivam Agnihetri	22	27	KV. N0.3, BHOPAL	9th B
Aryan Shukla	19	24	KV. N0.3, BHOPAL	9th B
Arman Khan	18	22	KV. N0.3, BHOPAL	9th B
Ayan Zaidi	12	17	KV. N0.3, BHOPAL	9th B
Vaidehi Raghuwanshi	24	24	KV. N0.3, BHOPAL	9th B
Saharsh Soni	25	26	KV. N0.3, BHOPAL	9th D
Shristi Dubey	24	28	KV. N0.3, BHOPAL	9th D
Maruti Rai	24	28	KV. N0.3, BHOPAL	9th C
Ritika Raj	14	17	KV.NO1 BHOPAL	10th A
Poonam Pagare	17	20	KV.NO1 BHOPAL	10th A
Rishika Sanskriti	18	24	KV.NO1 BHOPAL	10th A
Prarthana Unde	17	26	KV.NO1 BHOPAL	10th A
Abhilash Mehra	22	27	NAB	9th
Raja Abdullah	20	23	NAB	9th
Vijay Akhirwar	13	18	NAB	11th

Manoj Tomar	17	19	NAB		11th
Rupesh Lodhi	20	23	NAB		12th
Raj Ahirwar	18	27	NAB		10th
Mahesh Ahirwar	24	28	NAB		10th
Javed Khan	23	28	NAB		10th
Nilesh Meher	21	27	NAB		9th
Nilesh Mavashi	17	26	NAB		9th
Amit Mavashi	26	30	NAB		8th
Padyumna Yogi	23	28	NAB		9th
Rajeev Joshi	22	26	NAB		9th