# 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.

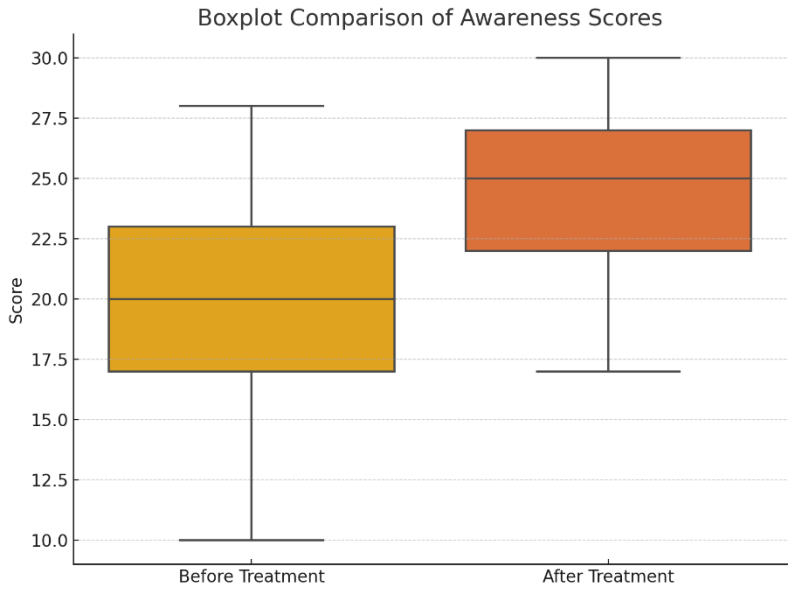


**Figure 1: Showing Boxplot Comparison of awareness of scores before and after treatment.**

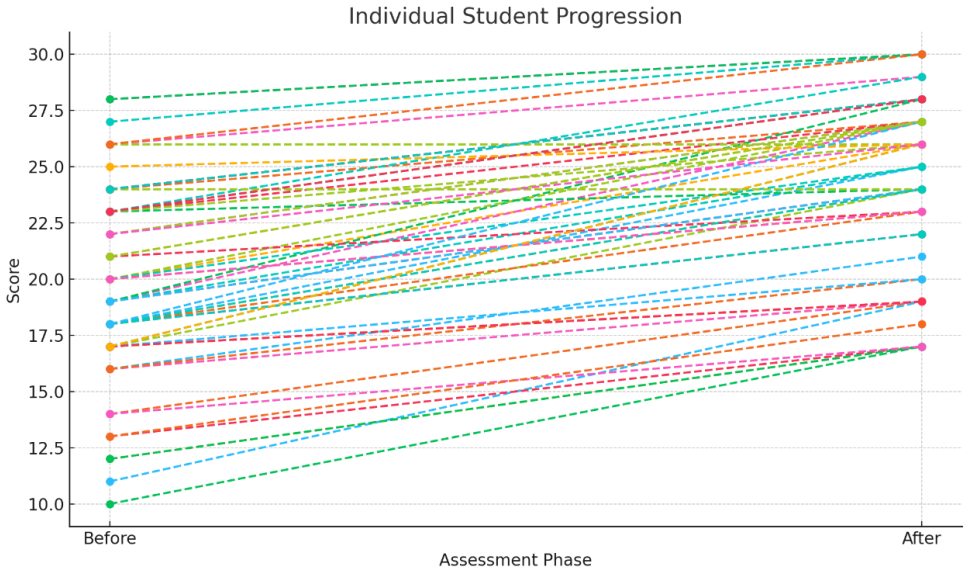


**Figure 2: Showing The line plot of individual trajectories revealing consistent gains among nearly all participants, with minimal regression or plateauing.**

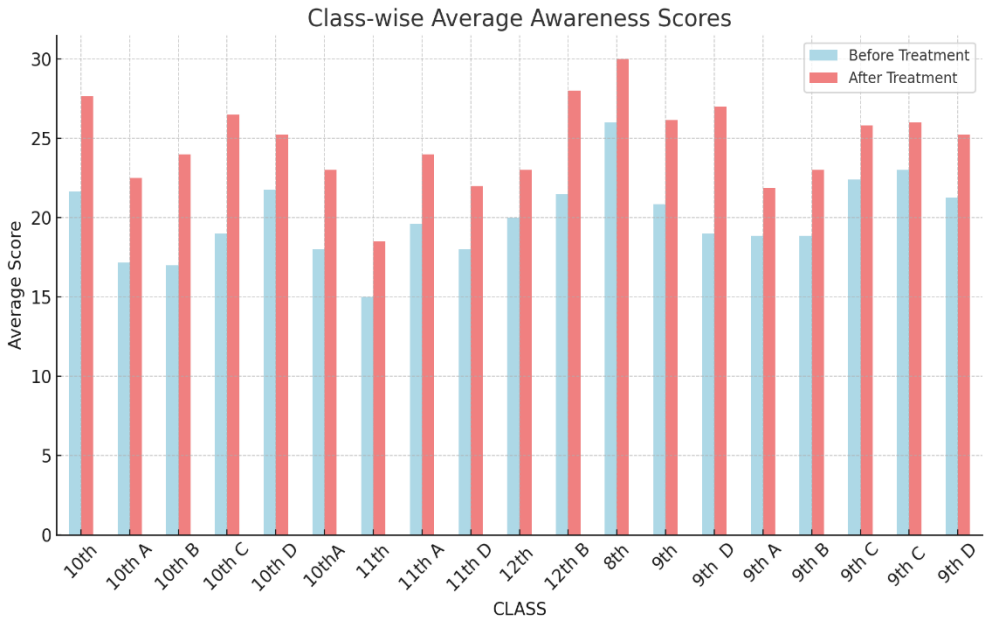


**Figure 3: Showing class-wise average awareness scores**

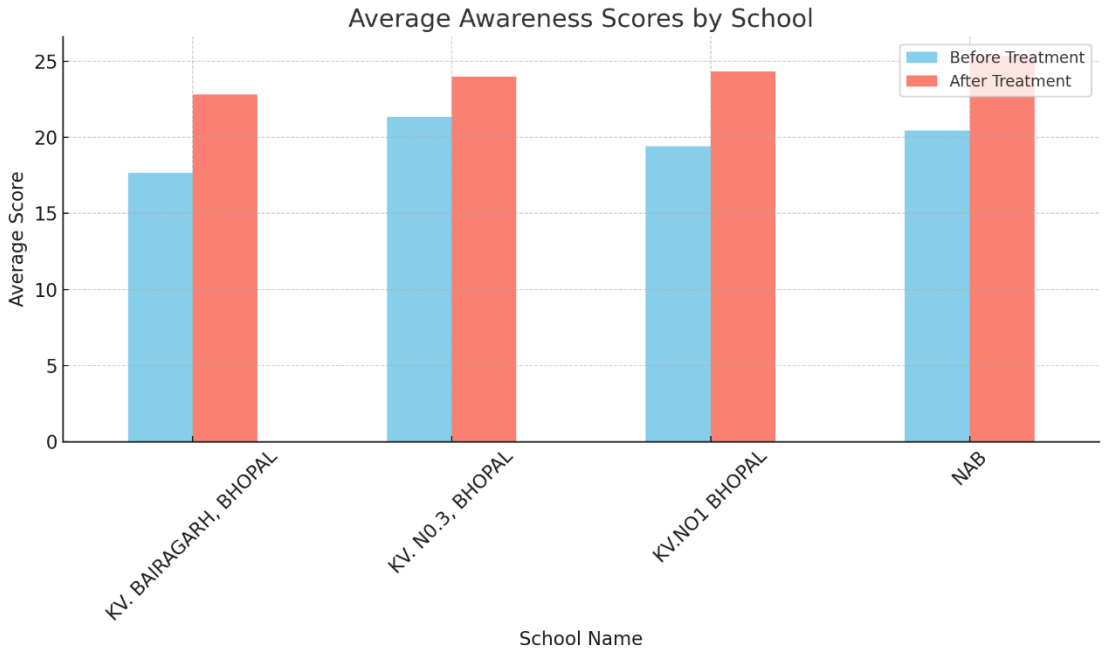


**Figure 4: Showing Average Scores by Schools**

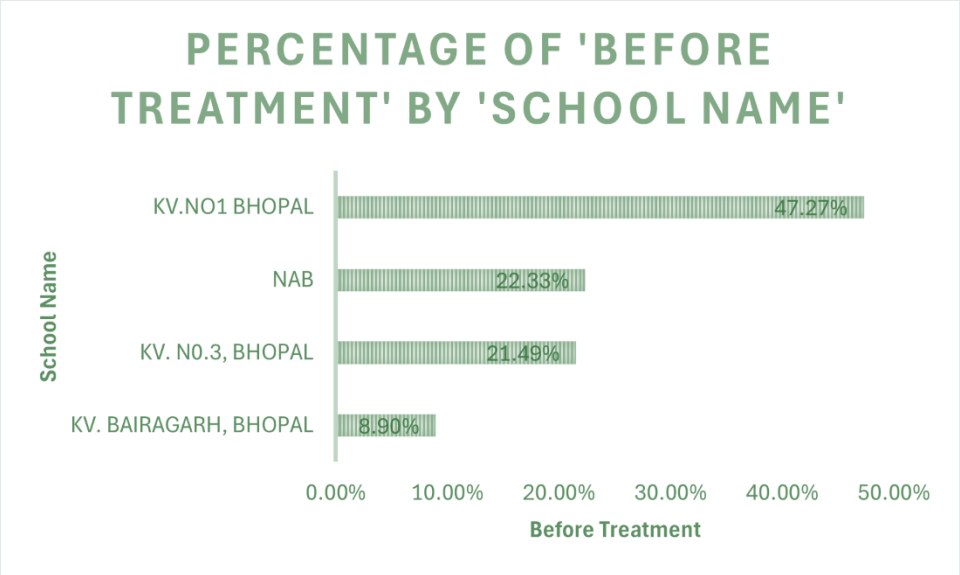


**Figure 5: Showing Percentage of schools on Environmental awareness before treatment**

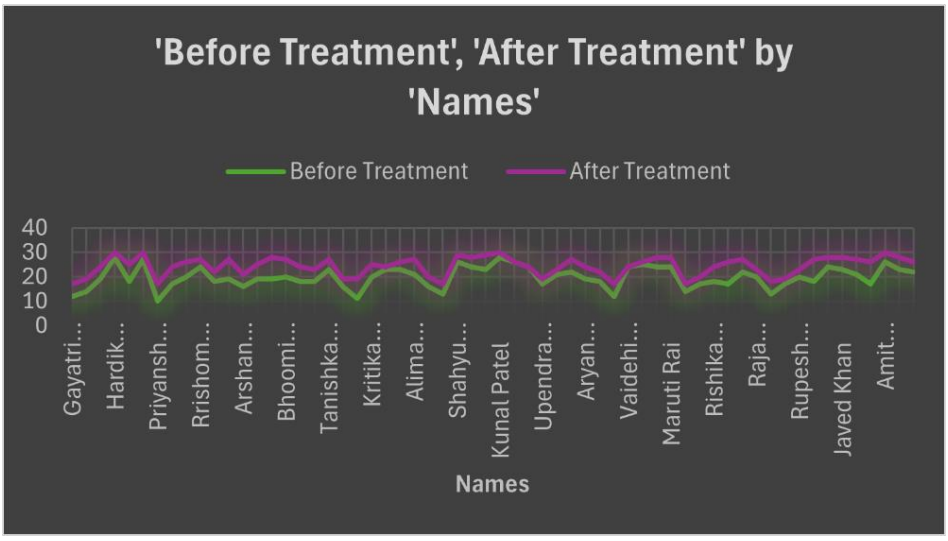


**Figure: Showing improvement of students' score after treatment**

### 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.