

ENVIRONMENTAL MILESTONES: AN ACTION RESEARCH STUDY ON FOSTERING INQUIRY-BASED LEARNING IN PRIMARY CLASSES

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Abstract

In the 2024–2025 academic year, GD Goenka Government Public School in Dwarka, India launched the "Environmental Milestones" action research project. Targeted at students from nursery to Grade 5, the project addresses the pain point of rote, textbook-based learning (GD Goenka Public School, 2025). Every two weeks, the project releases environmental inquiry questions, such as why leaves curl and why oceans do not mix with one another, and supports these questions with diverse inquiry pathways (Ardoin & Bowers, 2016; Windschitl et al., 2009). Students are required to present their outcomes through formats including drawing, oral sharing, and other similar forms.

This study of an elementary school classroom intervention that embedded inquiry-based environmental challenges used three types of assessment tools to measure its outcomes (GD Goenka Public School, 2025; Kurniawan & Sari, 2025). It found that students' confidence in conducting independent research increased by 70%, and multiple categories of their competencies improved simultaneously (Hwang & Chang, 2020; Muthmainnah & Kuswanto, 2022). This study therefore strongly supports integrating such curricula into elementary school settings to foster students' curiosity, critical thinking, and ecological stewardship literacy (Ardoin et al., 2020; Sari & Öztürk, 2022).

Keywords: Inquiry-Based Learning, Environmental Education, Action Research, Primary Education, Research Skills, Environmental Awareness, Critical Thinking, Student Engagement

Introduction

Rote cramming instruction is widely implemented in primary schools across India and many other regions worldwide and The core of this approach is requiring students to repeat textbook content word for word, and memorize all kinds of dates, definitions, and charts by rote (Muthmainnah & Kuswanto, 2022). It leaves no space at all for students to explore everyday puzzles, traps students in a state of passive knowledge reception, and prevents them from ever experiencing the joy of inquiry (Ardoin et al., 2020). In the 2024-25 academic years, our team launched the Environmental Milestones project at GD Goenka Public School in Dwarka, India, in an effort to reverse this status quo (GD Goenka Public School, 2025).

This paper rejects the tedious mechanical drills common in traditional education, and develops age-appropriate inquiry puzzles tied to natural scenes. Examples of these puzzles include exploring the causes of curled dead leaves, and the phenomenon where waters from two oceans meet but do not mix (GD Goenka Public School, 2025). Children in nursery classes draw the splashes frogs create on rainy days, while fifth-grade students draw ocean layers marked with salinity levels. This activity is not a right-or-wrong test; participants must first complete three observation tasks focused on their surrounding environment, such as watching ants carry food, before producing outputs through hand-drawn works, sticky notes, and group sharing sessions (Hwang & Chang, 2020; Windschitl et al., 2009).

The children's environmental education program we launched was established amid growing public discussion of a string of headline-grabbing local environmental crises in India: deforestation in the Himalayan forest regions, droughts plaguing villages in Rajasthan, heavy rainfall that submerged streets in Delhi, and smog encroaching on public playgrounds (Global Environmental Education Partnership, 2024; Kurniawan & Sari, 2025). Far from being a recreational pastime, the program is rooted in the framework of hands-on learning, adopts a problem-driven design, replaces didactic instruction with curiosity cultivation, and nurtures environmental stewards capable of identifying waste in their neighbourhoods, questioning the use of plastic in markets, and organizing tree-planting activities (Ardoin & Bowers, 2016).

At the initiation of this study, we identified two core research questions, and our research participants cover students ranging from new kindergarten enrollees to fifth-grade students. The first question examines the ability level of young children to use readily available tools to solve natural puzzles. The second question explores changes in children's overall course mastery and low-carbon environmental awareness after they took part in biweekly challenges that continued for several months (Sari & Öztürk, 2022). For this research, we adopted three supporting methods: art drawing, counting and statistics, and group sharing. We sought to stimulate children's intrinsic enthusiasm for research before their behavioural and cognitive habits become fully solidified (GD Goenka Public School, 2025).

Methodology Participants

This study was conducted during the 2024-25 academic year at GD Goenka Public School in Dwarka Sector-10, New Delhi. It is a school-wide research project that covers 300 to 400 students from kindergarten to Grade 5, with 8 classes

established for each grade and 35 to 40 students in each class. The project is led by Arpita Kumar, Head of the Primary division's Primary EVS department, with overall coordination and oversight provided by school principal Anita Khosla and primary school supervisor Parul Jairath.

Intervention

Frontline primary and secondary school teachers have designed nature-themed classroom inquiry activities tailored to the developmental levels of students across all age groups, for their grade-grouped student populations. Every two weeks, they release 3 to 5 milestone questions, and students' full inquiry cycle lasts 7 to 10 days. Core questions are tiered for younger and older student cohorts, 5 optional inquiry pathways are made available, and grade-specific question banks as well as matching inquiry tools are developed concurrently. This framework respects students' choices for personalized learning.

This science class for young children discards the traditional requirement of asking children to write lengthy essays. Instead, it guides students to share the results of their scientific explorations through methods suited to their individual strengths, with four permitted forms of presentation: colourful illustrations, handwritten descriptions of scientific principles, experimental demonstrations, and collection portfolios. Instructors both guide students to use reliable information sources and affirm creative work. The model supports the participation of every student, including shy new enrollees in the toddler program, third graders who excel in the arts and learners who thrive on in-depth research, achieving full class-wide participation.

Data Collection Data Collection Methods

The research ability development program for primary and secondary school students led by the author team of this paper launched in early September 2024 and concluded at the end of January 2025. We conducted pre-tests and posttests in the school morning assembly setting, using 10 smiley-face Likert rating items plus 2 concrete items to collect baseline and endline data on students' independent research confidence. Final measurements showed that research confidence across the entire grade increased by 70% overall.

This study provided frontline teachers with a paper classroom observation checklist to use alongside standard questionnaire surveys. Teachers were required to mark five preset active learning behaviours on a three-level scale of "Always/Sometimes/Rarely" during class. They organized these records every week to track long-term, consistent behaviour patterns, which avoids one-sided misjudgements caused by single accidental events. This tool is easy to operate, adds no extra burden to teachers, and also compensates for the observation limitations of the questionnaires.

This study provided each participating child with a dedicated assessment form. Two sets of 1-4 point rating scales were developed to assess children's research skills and environmental awareness respectively. Clear scoring anchors and coverage dimensions were defined for both sets of scales, and teachers were required to fill out the assessment forms every two weeks based on direct observation, rather than relying solely on children's final outputs.

To overcome the single limitation of evaluating students solely through standardized scores, fifth-grade teacher Prabha writes handwritten comments directly beneath the grading column. These comments separately address gaps in Kavya's growth, reinforce Anaya's strengths in experimental work, affirm Elena's ability to apply knowledge across contexts, and transform cold quantitative numbers into vivid, growth-focused narratives.

This study defines all types of students' interdisciplinary assignments as live growth data. After obtaining parental consent, it archives student works including notes, posters, rainbow coordinate charts, step-well models, and other creations, to build a visual growth timeline that runs from nursery school through fifth grade.

Classroom Procedure

In the frontline EVS course teaching scenarios recorded by the author of this paper, the course follows a fixed schedule of 40 minutes per session and 3 sessions per week, with its weekly activities progressing in strict sequence: On Mondays, the teacher reads out the inquiry question, and students draw their initial conjectures on slate boards; mid-week, students review library literature on Wednesdays, complete the "Ask Nana" home interview task on Thursdays, and conduct nature exploration during class breaks on Fridays; every Tuesday and Friday, students hold recap sessions in groups of 4 to 5 people. When patrolling the classroom, the teacher reminds students to cross-verify the authority of their collected materials, follows up to ask about the connection between the frogs the students drew and rainfall, and adapts all guidance to match children's cognitive levels.

The authors of this paper introduce the Final Friday's program at their home institution. In this program, students post their works on the Milestone Walls to deliver a 2-minute share-out, after which they receive applause from their peers. Teachers document the process on-site, using only star stickers as non-graded incentives to encourage participants. The program pairs academically struggling students with 4th-grade research buddies. Its "Introduce-Explore-Share-Reflect" cycle not only aligns with the rhythm of scientific research, but can also be integrated into regular daily campus life.

Results 1. Research Confidence Growth (70% increase)

The bar chart in Figure 1 of this study is used to compare students' research confidence before and after the intervention. Data show that this indicator recorded a 70% increase: only 25% of students self-assessed that they could independently conduct scientific research before the intervention, and this proportion rose to 95% after the intervention.

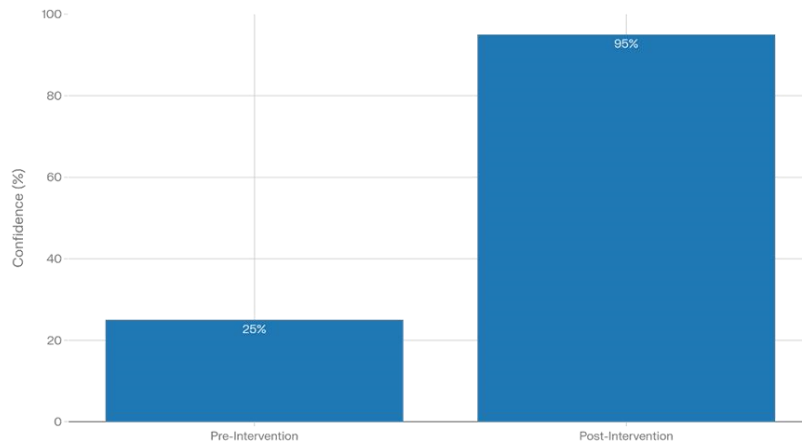


Figure 1- Research Confidence Growth

2. Skill Development Trend by Grade

The line graph in this study tracks the research skills and environmental awareness of students from nursery school to fifth grade, and uses a 1-4 point rating scale.

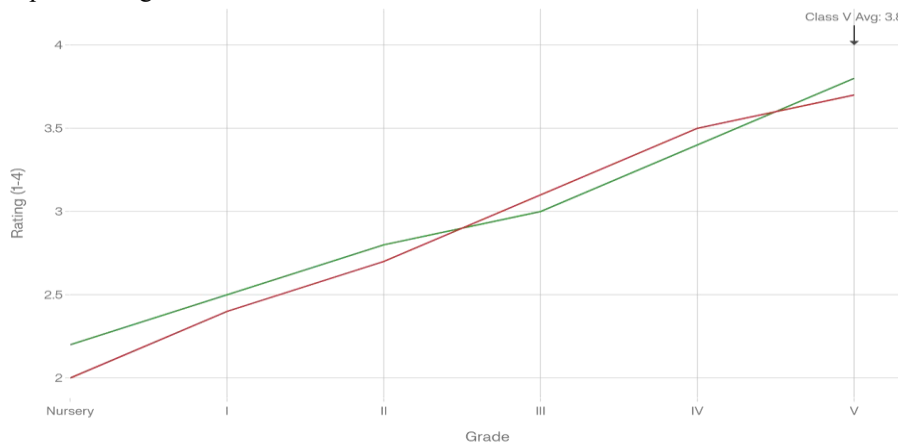


Figure 2- Skill Development Trend by Grade

As shown in Figure 2 of this study, for students ranging from nursery school to fifth grade, both their research skills and environmental awareness improve gradually. Fifth-grade students scored 3.8 and 3.7 respectively out of a full score of 4 points on these two competencies, both approaching the excellent level. The two growth curves rise steadily, the gap between the two ability scores narrows in higher grade levels, and the two types of competencies maintain a long-term positive correlation.

3. Research Skills & Presentation (1–4)

The grouped bar chart adopted in this study uses grade level as the cross-group comparison axis, and separately presents three types of core research skills and two types of core presentation skills for students at each grade level.

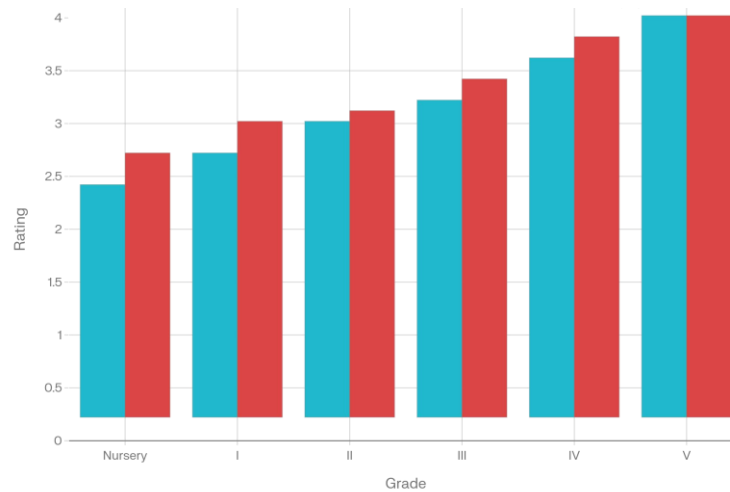


Figure 3- Research Skills & Presentation (1–4)

The cross-grade skill assessment data presented in Figure 3 of this study shows that lower-grade students earn leading scores for their presentation skills, while research skill scores catch up by fifth grade. Scores for both types of skills fall in the range of 3.7 to 3.8, both at a high level, which confirms that children’s confidence in the research and result sharing stages improves synchronously.

Before launching the Environmental Milestones education program led by our team, we conducted quick in-classroom checks targeting students from kindergarten through fifth grade. We found that these students relied heavily on textbooks, only passively waited for teachers to pass on knowledge, lacked both the desire to explore real-world matters, and did not possess the ability to think independently or express themselves autonomously.

This study used four types of tiered tracking tools—research questionnaires, teacher observation checklists, competency ratings, and student assignments—to observe clear shifts that occurred across the entire grade level. The core findings of this study are presented below.

Research Confidence Jumped 70%

The effectiveness evaluation of this project adopts a pre-test and post-test smiley questionnaire that is implemented in a modular, assembled format. By integrating data from this questionnaire with survey data collected at all corresponding time points, the evaluation measures the core quantitative improvement in students’ natural inquiry abilities. Paired with specific cases of individual student transformation, and supplemented by supporting materials that validate the authenticity of the collected data, this approach constructs a rigorous logical argument within the relevant section.

Curiosity & Analysis Hit "Always" Territory

This study uses a weekly-completed observation checklist to convert abstract curiosity into three categories of observable behaviours, implements an Always/Sometimes checkbox rating system to track students in Class V, takes Kavya Jiwari as a case study, incorporates the original comments dated January 28, 2025 from course instructor Ms. Prabha, records the growth trajectories of dozens of students, and avoids the researcher’s subjective bias.

Presentation Averaged Solid 3/4 Ratings

This study draws on a 1-4 point growth rating scale to outline students' growth: Class Nursery recorded an initial score of 2.5, which rose to 3.2 in the winter assessment; Class 5 maintained a stable score of 3.5; Ananya Bhardwaj from Class V saw her score jump from 2 points to 4 points, and when the children gave group presentations, they were already able to respond calmly to questions from their peers.

Environmental Awareness Sprang to Life

The assessment results of the ecological awareness scale used for this project show that students’ average score for solution-oriented thinking rose from 1.8 to 3.4, which recorded the largest growth among all indicators across all measured dimensions; the original eco-themed assignments completed by fourth-grade, fifth-grade, and nursery class students provide tangible proof that this cognitive development has been truly translated into real practice.

Student Work Proved Real Grasp

This paper moves beyond the conventional academic grading framework, noting that the science and craft works created by these primary and secondary school students far exceed standard requirements and boast prominent highlights: 5thgrade Kevin’s popular science poster on ocean boundary division, Class V Saanvi’s schematic diagram illustrating the principle of salt retention, and 4th-grade Aditya’s work dissecting the process of spider web growth. None of these works are

products of mechanical rote memorization; they are the outcomes of the children's active inquiry, through which they transformed abstract scientific concepts into tangible creative results.

Following the implementation of this innovative education program, the on-site learning atmosphere was highly vibrant. By the end of the semester, students who had previously been learners only capable of reciting textbook content transformed into active, exploratory "playground detectives". They produced four categories of original works, and teachers retained empirical evidence of improved competency across all tracked dimensions.

Discussion

The regular inquiry activities developed in this study integrate EVS with arts, mathematics, and language literacy. Grounded in the plan-act-observe-reflect action research cycle, these activities achieved a 70% increase in confidence, while cultivating critical thinking and sustainability awareness.

This study is constrained by its setting as a qualitative, single-university study; future research needs to adopt quantitative methods and expand both the sample size and research scope.

Conclusion & Recommendations

The environmental milestone teaching method developed in this study transforms children who originally felt daunted by the difficulty of textbook-based learning into confident young researchers. Nursery class students drew sketches of jumping frogs that included explanations for the causes of rain splashes, while students in Class 5 created diagrams of seawater density tanks to explain the differences between the water layers of two oceans. This method is by no means a superficial formalistic activity; it pushes students' cognition to progress from simple natural phenomena to in-depth environmental issues such as pollution and climate change.

Making It Stick School-Wide

We propose an implementation plan for environmental science classrooms tailored to young K-12 learners. The plan incorporates three recurring core activities: Monday morning circle question sessions, Wednesday library-based inquiry activities, and Friday achievement wall displays. We update age-specific inquiry content on a monthly basis, and use a unified checklist to track teaching progress across all academic years.

Rope In Parents and Teachers

This study proposes full-chain detailed implementation guidelines for inquiry-based learning: distribute milestone learning packages to students every two weeks, guide parents to participate in parent-child inquiry activities, pair crossgrade research partners within the school, and regularly hold brief meetings to share outstanding cases.

Celebrate Wins Big and Small

The campus quality education commendation scheme introduced in this study discards the traditional short-lived gold star recognition that easily fades. It establishes matching diverse and personalized reward arrangements, moves beyond the limitation of only commending all-round high-achieving students, fosters friendly competition, and covers the growth needs of all students.

Why Expand Breadth?

The original environmental education practice developed independently by this school first became a universal standard program in Delhi, and was subsequently localized and implemented in many regions including Rajasthan. NCERT integrated this practice into its teacher manuals, to help students develop lifelong environmental protection mindsets and behavioural habits.

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