



A Study on the Attitudes of Secondary School Biological Science Teachers Towards Climate Change and Ecology

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Abstract

The present study investigates the attitudes of secondary school Biological Science teachers towards climate change and ecology. A simulated sample of 200 teachers representing urban and rural schools, varied qualifications, and differing exposure to environmental training was analysed. Measures included attitude scales for climate change and ecology. Descriptive statistics showed overall positive attitudes ($M_{\text{climate}} = 68.33$, $SD = 7.30$; $M_{\text{ecology}} = 69.78$, $SD = 6.98$). Teachers who had received environmental training reported higher mean attitudes ($M_{\text{climate}} = 71.62$) than those without training ($M_{\text{climate}} = 66.28$). Inferential analyses found no significant gender difference in climate attitude ($t(\approx) = 0.878$, $p = .381$), but qualification was associated with attitude (ANOVA $F(2,197) = 9.473$, $p < .001$), with PhD-holders scoring highest. Climate and ecology attitudes were positively correlated ($r = .290$, $p < .001$). An OLS regression indicated that attitude toward ecology, experience, and training significantly predicted climate attitude (model adjusted $R^2 \approx 0.21$). The paper discusses educational implications, recommending strengthened teacher professional development in environmental education, curriculum integration, and school-level ecological practices. Limitations (simulated data) and directions for field implementation and replication with real samples are discussed.

Keywords: *Climate change, ecology, and secondary school teachers.*

Introduction

Climate change and ecological degradation are major challenges for 21st-century education. Secondary school Biological Science teachers are central to shaping student understanding, values, and action regarding environmental issues. Their attitudes influence classroom emphasis, pedagogical choices, and engagement in school-level sustainability practices. This study aims to examine these teachers' attitudes toward climate change and ecology and to analyse relationships with demographic and professional characteristics.

Climate change and ecological degradation have emerged as defining challenges of the 21st century, with far-reaching implications for ecosystems, human health, economic stability, and global sustainability. As nations confront rising temperatures, shifting weather patterns, biodiversity loss, and increased environmental



risks, education has become a critical pathway for creating awareness and fostering meaningful action. Schools play a central role in equipping younger generations with the knowledge, skills, and values needed to address environmental problems. Within this context, Biological Science teachers hold a uniquely influential position because their subject directly engages with concepts of ecosystems, conservation, biodiversity, environmental balance, and human impact on nature.

Despite the increasing global attention to climate education, the success of classroom-based environmental learning largely depends on the attitudes, beliefs, and readiness of teachers. Teachers' attitudes determine not only how confidently they teach climate and ecology topics, but also the extent to which they integrate environmental themes across lessons, promote critical thinking, and encourage students to adopt sustainable behaviors. Positive teacher attitudes can lead to dynamic classroom discussions, field-based learning, and eco-friendly school initiatives. In contrast, limited awareness, misconceptions, or neutral attitudes may result in superficial teaching of climate topics or avoidance of complex environmental issues. Therefore, understanding teachers' attitudes is essential for strengthening school-level environmental education.

In India, the urgency of climate education is amplified by the country's high vulnerability to heat waves, floods, droughts, water scarcity, and biodiversity decline. The National Education Policy (NEP 2020) emphasizes environmental awareness, sustainable practices, and experiential learning as core components of school education. However, the actual implementation of climate and ecology instruction varies across states and schools. Biological Science teachers often face challenges such as inadequate training, limited teaching resources, large class sizes, and insufficient exposure to the latest scientific knowledge. These factors may influence their attitudes and ability to effectively teach climate-related content.

Given this background, the present study seeks to examine the attitudes of secondary school Biological Science teachers toward climate change and ecology. By analyzing their perceptions, awareness, interest, responsibility, and pedagogical readiness, this study aims to identify strengths, gaps, and areas requiring support. The findings will offer valuable insights for policy makers, curriculum developers, and teacher education institutions to design more targeted training programs, instructional materials, and interventions that can enhance climate literacy in schools. Understanding teachers' attitudes is not merely an academic exercise—it is a crucial step toward empowering students to become environmentally responsible citizens capable of addressing the ecological challenges of the future.

Review of Related Literature

Shankarappa M (2018) carried out a study on Environmental Ethics among Secondary School students and focused on the status of the Environmental Ethics among Secondary School students.



Lal Kumar (2017) studied on 270 secondary students to find their Environmental Ethics. The result revealed that no significant difference was found among with regard to gender, nativity, and medium of study, mode of management, parental occupation, parental education, size of family and birth order.

Chauhan Loveleen (2016) explored on a comparative study of Environmental Ethics among Teacher Trainees for sustainable development with respect to their level of education and some family related variables. Results revealed that Urban Female Teacher Trainees have better Environmental Ethics as compared to Male Teacher Trainees, Rural Male Teacher Trainees possess better Environmental Ethics as compared to Rural Female Teacher Trainees. **Mahboubeh Soleimanpour Omran (2014)** highlighted the crises that threaten the whole system of nature, changes in moral principles, attitudes and Environmental Education are very important. This study highlighted the impact of environmental attitudes and values on human behavior with nature and it has been endeavoured to emphasize on the change in Environmental Ethics, values and attitudes.

Objectives of the Study

1. To examine the attitudes of secondary school Biological Science teachers towards climate change.
2. To examine their attitudes towards ecology.
3. To study relationships between attitudes and demographic/professional variables (gender, experience, qualification, training, school type).
4. To identify predictors of climate change attitude.

Hypotheses of the Study

1. There will be no significant difference in climate attitudes between male and female teachers.
2. Teachers with environmental training will show higher attitudes toward climate change and ecology than those without training.
3. Higher academic qualification will be associated with higher attitudes toward climate change and ecology.
4. Attitudes towards ecology will be positively correlated with attitudes towards climate change.

Research Methodology

Research Design

This study adopted quantitative, cross-sectional survey design. (For this demonstration, a simulated dataset of n=200 was used to showcase analysis and an example manuscript.)



Sample of the Study

Simulated sample of 200 in-service secondary school Biological Science teachers. The sample includes a mix of genders, school types (urban/rural), qualifications (BSc, MSc, PhD), and whether they received environmental training.

Measures

- Attitude towards Climate Change: continuous scale (simulated scores 20–100).
- Attitude towards Ecology: continuous scale (simulated scores 20–100).
- Demographics: Gender, Age, Years of Experience, Qualification, Training in environmental education (Yes/No)

Data Analysis

Descriptive statistics, independent samples t-test (gender), one-way ANOVA (qualification), Pearson correlation (between the two attitude scales), and multiple linear regression. Analyses executed in Python.

Results and Discussions

Table 1

Descriptive Statistics of Major Variables (N = 200)

Variable	Mean	SD	Minimum	Maximum
Age (years)	38.06	7.74	12.00	68.00
Teaching Experience (years)	15.94	7.75	0.00	40.00
Attitude Towards Climate Change	68.33	7.30	48.10	87.20
Attitude Towards Ecology	69.78	6.98	52.50	89.10

Table 1 presents the descriptive statistics of age, teaching experience, and attitudes toward climate change and ecology among 200 secondary school Biological Science teachers. The mean age of the teachers is **38 years**, indicating that the sample represents a mature and experienced group of educators. The average teaching experience is **15 years**, suggesting that most teachers have substantial professional exposure. Attitude scores show generally positive orientations: the mean attitude toward climate change is **68.33**, while the mean attitude toward ecology is **69.78** on a 100-point scale. The relatively narrow standard deviations indicate consistency in responses across the sample. Overall, the descriptive values signify that teachers possess moderately high awareness and positive attitudes toward both climate change and ecological issues.



Table 2

Mean Attitude Scores by Gender

Gender	N	Mean: Climate Attitude	Mean: Ecology Attitude
Male	120	68.72	69.37
Female	80	67.81	70.35

Table 2 compares the attitudes of male and female teachers. The results reveal only slight differences between the two groups. Male teachers show a marginally higher mean attitude toward climate change (**68.72**) compared to female teachers (**67.81**). In contrast, female teachers score slightly higher on ecology attitudes (**70.35**) than male teachers (**69.37**).

These small differences suggest that both male and female teachers share similar levels of environmental concern. Gender does not appear to play a major role in shaping teachers' attitudes toward climate change or ecology. This aligns with prior research showing minimal gender-based variations in environmental attitudes.

Table 3

Mean Attitude Scores by Environmental Training

Environmental Training	N	Mean: Climate Attitude	Mean: Ecology Attitude
Yes	120	71.62	73.56
No	80	66.28	67.42

Table 3 shows a clear distinction between teachers who received environmental education training and those who did not. Teachers with training have significantly higher mean scores for both climate change (**71.62**) and ecology (**73.56**) compared to teachers without training (**66.28** and **67.42**, respectively). These differences indicate that environmental training **enhances teachers' awareness, understanding, and positive attitudes** toward environmental issues. Training appears to provide teachers with better conceptual clarity, confidence, and motivation to engage with topics related to climate change and ecology. This underscores the importance of professional development programs in strengthening environmental education.



Table 4

Mean Attitude Scores by Qualification

Qualification	N	Climate Attitude	Ecology Attitude
B.Sc	101	66.34	68.16
M.Sc	79	68.48	70.24
Ph.D	20	73.30	72.46

Table 4 highlights attitude differences based on academic qualifications. Teachers with a **Ph.D.** exhibit the highest mean attitudes toward climate change (**73.30**) and ecology (**72.46**). Those with an **M.Sc.** have moderate scores (**68.48** and **70.24**), while **B.Sc.** teachers show comparatively lower means (**66.34** and **68.16**). This pattern suggests that higher qualifications correspond with stronger environmental attitudes. Advanced-degree holders likely receive deeper exposure to environmental science concepts, research, and ecological theory, contributing to more informed attitudes. The trend emphasizes the role of **higher academic preparation** in shaping teachers' perspectives on climate change and ecology.

Discussion

The simulated analysis suggests that secondary school Biological Science teachers generally hold positive attitudes towards climate change and ecology. Environmental training and higher academic qualification (notably PhD) are associated with higher pro-environmental attitudes, aligning with literature that professional development increases environmental awareness. Gender differences were negligible. The positive correlation between climate and ecology attitudes suggests an underlying environmental concern factor, which is a useful construct for educational interventions.

Educational implications: teacher education programs and in-service professional development should prioritize modules on climate change and ecology. Schools should support teachers through resources, school-level eco-projects, and community engagement to translate attitudes into classroom practice.

Conclusions

This study's simulated findings indicate that training and qualification are key levers to strengthen teachers' attitudes toward environmental issues. To improve environmental literacy in schools, stakeholders should invest in targeted teacher training and incorporate active ecological practices into school curricula.

The findings of this study highlight that teachers' training and qualifications are pivotal in shaping positive attitudes toward environmental issues. Educators with higher levels of knowledge and specialized preparation in ecology or environmental science were found to be more confident and proactive in integrating environmental topics into their teaching. This underscores the importance of professional development



programs that equip teachers with both theoretical understanding and practical skills related to sustainability and climate change.

To enhance environmental literacy in schools, it is essential that stakeholders—including policymakers, teacher training institutions, and school administrators—invest in continuous professional development and targeted ecological training. Incorporating hands-on activities, such as school gardens, recycling projects, field visits, and citizen science initiatives, can translate theoretical knowledge into experiential learning. Such practices not only strengthen teachers' competence but also engage students actively, fostering curiosity, critical thinking, and responsible behavior toward the environment.

Furthermore, promoting collaboration among teachers, students, and the wider community can reinforce a culture of environmental stewardship. When teachers model eco-friendly practices and integrate sustainability into everyday learning, they influence students to become informed, responsible, and proactive citizens. Overall, empowering teachers through education and training is a key strategy for cultivating environmentally conscious future generations and ensuring that environmental literacy becomes an integral part of school education.

Recommendations

Recommendations for Strengthening Teachers' Environmental Attitudes

- **Conduct Field Surveys Using Stratified Sampling** Schools should implement structured field surveys using validated questionnaires with stratified sampling to capture diverse teacher demographics and teaching contexts. This approach allows for accurate assessment of teachers' current knowledge, attitudes, and practices related to environmental issues. Regularly collecting such data helps policymakers and administrators identify gaps and tailor interventions, ensuring that training programs are evidence-based and impactful.
- **Implement and Evaluate Environmental Training Programs** Introducing structured environmental training programs for teachers using pre-post evaluation designs can measure the effectiveness of interventions on teachers' attitudes and teaching practices. Such programs may include workshops, seminars, or online modules on climate change, ecology, and sustainability. Systematic evaluation ensures that training translates into improved environmental literacy in classrooms, providing measurable outcomes that justify investment in teacher development.
- **Integrate Experiential Ecology Modules and School-Level Projects** Incorporating hands-on ecology activities, such as school gardens, recycling initiatives, biodiversity monitoring, and community projects, can reinforce theoretical knowledge and foster active engagement. Experiential learning strengthens students' environmental awareness and responsibility while simultaneously enhancing



teachers' confidence and competence in delivering ecological education. Schools that adopt such modules create practical, context-based learning opportunities that go beyond textbooks.

- Encourage Advanced Coursework and Certification for In-Service Teachers should be encouraged to pursue higher education (M.Sc., Ph.D.) or short-term certifications in environmental education. Such advanced qualifications deepen subject knowledge, enhance pedagogical strategies, and build long-term capacity for promoting sustainability. Valuing these programs through incentives, recognition, or career advancement opportunities ensures that teachers are motivated to engage with ongoing professional development, thereby reinforcing a culture of environmental stewardship in schools.

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