# Moving Beyond Conventional Education for a Climate Mitigated Future

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## INTRODUCTION

Education is widely, and rightly, seen and promoted as an essential driver of development–one that uplifts scores of people out of their existing socioeconomic conditions to a better one. It is therefore, unsurprisingly, also seen as a marker of resilience and civic participation. However, increase in education is also associated with increasing emissions through resulting economic growth and industrialisation. In this paper, we analyse how climate education can represent a distinct form of transformative education that not only counteracts this effect, but also enables mitigation-oriented behaviour, collective action, and long-term climate resilience.

In this paper, we are defining climate education as a "deliberate, action-oriented form of learning that goes beyond knowledge transmission, to build learner's capacities of understanding climate systems, evaluate solutions, and take deliberate personal and collective action". This approach aligns with the framework promoted by UNESCO, which emphasises institutional approaches, teacher capacity building, and community engagement (Sarabhai & Purohit, 2023).

## LITERATURE REVIEW

Education is largely recognised as a cornerstone of human and economic development, along with social progress. Higher educational attainment is associated with increased productivity, technological innovations, and economic growth. However, there is now a growing body of literature that demonstrates that in aggregate, these pathways lead to higher levels of greenhouse gas emissions, particularly in developing countries (Lutz & Striessnig, 2015; O'Neill et al., 2020).

Education plays an important role in shaping future socioeconomic pathways that influence emissions trajectories. Shared Socioeconomic Pathway (SSP) modelling incorporates educational attainment within future population and economic projections, which interact with consumption patterns and energy demand in baseline scenarios without strong mitigation strategies and policies in place (KC & Lutz, 2010; Lutz & Striessnig, 2015). Higher educational attainment is associated with increased labour productivity and economic growth, thus contributing to higher emissions without targeted mitigative policies in place (Muttarak, 2021).

To further quantify these, O'Neill et al. (2020) has shown the effects of accelerated educational transitions across developing regions using the SSP modelling. They find that faster improvements in educational attainment are associated with roughly **5–25% higher emissions by 2100**, depending on the region, even as population growth slows. This net increase in emissions is driven by higher labour productivity and per-capita economic growth associated with education, which outweigh reductions due to slower population growth in baseline scenarios without strong mitigation policies.

In addition to its role in economic growth, education plays a critical role in shaping civic capacity and democratic participation. Research shows that education enhances citizen's ability to engage with political institutions, consume information, and participate in both formal and informal democratic processes (Levi, 2021; Lee et al., 2015). Recent comparative analyses suggest that education acts as a key enabling condition through which democratic institutions can translate public concern into environmental action (Bromley et al., 2025). At the same time, this literature echoes the earlier concerns above of education fueling economic processes increasing carbon emissions. Education simultaneously expands the capacity for collective action and accelerates growth-related pressures on the environment (Bromley et al., 2025).

However, these findings do not suggest that educational expansion should be curtailed. Rather, they highlight that education alone cannot be assumed to have a net-positive effect on climate change. These relationships highlight the complex role of education in climate change outcomes, and the importance of distinguishing between education, and climate education. Consistent with this view, O'Neill et al. (2020) emphasise that while improved educational attainment is associated with a net increase in emissions, it simultaneously delivers substantial gains in human development and reductions in vulnerability to climate impacts. Rather than questioning the value of education, their findings point to the need for complementary approaches–including education itself–towards a more regenerative mode of development trajectories with mitigation-aligned outcomes.

While the preceding literature largely treats education as a social good, a smaller but growing body of work distinguishes climate education as a qualitatively different intervention with direct mitigation potential. One of the strongest empirical contributions in this area is given by a study by Cordero et al. (2020), who examined the long-term impact of a climate change course on individual carbon emissions. **The authors found that graduates, who received the climate change course, reported an average reduction of 3.54 tonnes of CO2 per person per year (p.9), with a net reduction of approximately 2.86 tonnes per year above regional trends (p.15).** The study also identifies mechanisms through which climate education leads to mitigation. Participants who perceive climate change as personally relevant, or who felt they had experienced its impacts, demonstrated significantly greater emission reductions than those who did not. The course's emphasis on experiential learning, community engagement, and a sense of personal and collective agency suggests that climate education is most effective when it moves beyond information sharing towards empowerment and action.

These findings stand in contrast to scenario-based evidence on general education, which associates rising educational attainment with modest increases in emissions under baseline development pathways. The divergence shows the importance of distinguishing general education, which primarily operates through economic growth mechanisms, from climate education, which is explicitly oriented toward behavioural change, institutional action, and civic engagement (O'Neill et al., 2020; Cordero et al., 2020). **Together, this literature directs us towards the key distinction central in this paper; while general education may increase emissions through development pathways, climate education can actively counterbalance these effects by influencing behaviour, leading to institutional actions and political engagements oriented towards mitigation.** This has important implications for countries like India where education expansion is both a developmental priority and potential driver of rising emissions. The following section delves into how these dynamics interact and manifest in the Indian context, and whether existing forms of climate education are positioned to deliver the mitigation outcomes suggested by the literature.

## CONTEXT IN INDIA

India presents a unique case for looking at the relationship between education, development, and climate action. We know on one hand, expanding the access to education is central to India's development strategy and goals–including labour market transformation and demographic transitions. On the other hand, India faces rapidly increasing emissions along with an increasing vulnerability of climate-induced disasters like extreme heat, floods, food scarcity, and daily disruptions. Education, thus, sits at the intersection of development and climate risks.

Like other developing and emerging economies, increase in education levels in India are closely tied to aspirations of economic growth, socioeconomic mobility, and standards of living. From a large-scale perspective, this trajectory aligns with literature discussed earlier suggesting education growth will lead to increase in energy demands and emissions in the absence of strong mitigation policies (O'Neill et al., 2020). At the same time, India's democratic structure, large youth population, and expanding media landscape also means that education has the potential to strengthen civic engagement and collective action for climate change.

Additionally, education in India shapes climate outcomes through another contrasting pathway. On the one hand, higher educational attainment contributes to increased labour productivity and economic growth, which–under baseline development trajectories–leads to higher energy demands and rising emissions. On the other hand, education also plays a crucial role in reducing vulnerability to climate impacts, with higher educational attainment associated with improved human development outcomes and greater adaptive capacity. Scenario-based modelling shows that in India, faster education transitions are linked to a modest increase in emissions alongside substantial reductions in vulnerability (O'Neill et al., 2020).

Empirical evidence underscores education's role in reducing vulnerability to climate impacts. Drawing on eleven studies across diverse contexts, Muttarak and Lutz (2014) find that higher educational attainment is consistently associated with lower disaster mortality, improved preparedness and response, and faster post-disaster recovery—often with effects that remain significant even after controlling for income and wealth.

This dichotomy underlines a core tension; while education is important for India's social and economic progress, it cannot be assumed to automatically support climate mitigative action. Whether education functions as a driver of emissions or an enabler of climate action depends on the content, pedagogy, and direction towards agency and action.

## EVIDENCE FROM INDIA

Empirical research on climate and environmental education in India highlights existing approaches that have been relatively successful in building awareness and basic environmental literacy, but less effective in producing sustained behaviour. Gurjar and Sharma (2024) find that students demonstrate awareness of environmental issues and express concern for environmental protection. However, they are not consistently translating into responsible, everyday pro-environmental behaviour. The study also notes that while students possess the foundational knowledge, their perceived ability to influence outcomes remains limited. A perception survey done by Asar Social Impact Advisors and Climate Educators Network (2024) confirms this pattern: while a majority reported basic awareness of climate topics, respondents consistently flagged the lack of depth and practical solutions required to tackle these issues. As a result, environmental concern often remains abstract rather than being embedded in a tangible scenario. The study highlights the lack of agency due to its functioning as a one-way information transmission, which our literature identifies as an important prerequisite for mitigation-orientated action.

Insights from educators also give an overview of why climate education in India has struggled to move beyond awareness. Krishna and King (2025), drawing on interviews with environmental educators across Indian schools, find that climate education is commonly framed as a means of sensitising students and cultivating pro-environmental values–values important in and of itself. However, these lead to teachers frequently viewing their role as raising awareness only, rather than enabling action.

Educators also report significant challenges that limit the transformative potential of climate education–namely inadequate training in climate-specific pedagogy, limited access to contextually relevant teaching resources, and a lack of clarity on how to integrate climate change topics into existing subjects. Time pressures, examination-oriented curricula, and the marginal positioning of climate topics further constrain opportunities for experiential learning (Krishna & King, 2025). Importantly, these constraints do not stem from resistance to climate education but from systemic conditions that shape how education is delivered. As a result, this reinforces the model of education that prioritises awareness and understanding, over engagement, agency, and collective action.

Taking these into consideration, the evidence then suggests the limitations of climate education in India are not rooted in a lack of concern or relevance, but in the dominant educational paradigm within which climate, as a topic, is addressed. Climate education in India currently mirrors the broader idea of general education–it is content-driven, assessment-oriented, and barely connected to behavioral outcomes. This explains why the expansion of education in India has not produced the mitigation effects suggested by studies such as Cordero et al. (2020).

In this sense, India reflects the broader paradox identified in the literature. Education contributes to development and, indirectly to rising emissions, while its potential to enable mitigation remains underutilised. This analysis then becomes critical for our argument. It suggests that the challenge does not lie in whether India should invest in education–it is an unquestionable priority–but how climate education must be envisioned within this priority, so that it functions as a corrective force to development-driven emissions.

## DISCUSSION/ANALYSIS

The preceding analysis highlights the central tension we are addressing in the education-climate relationship. On aggregate, expanding education contributes to economic growth and rising demands, resulting in persistent increases in emissions in the absence of a strong climate policy. At the same time, education strengthens democratic capacity, climate awareness, and the institutional conditions necessary to take climate action. Climate education, specifically, has been seen to generate a direct and sustained mitigation outcome when designed intentionally with that in mind.

These findings suggest that the question is not whether education should be pursued in the context of climate change, but rather how education should be oriented towards a climate-impacted reality. Its climate impact is dependent on whether it reinforces development-as-usual trajectories, or actively equips learners to participate in mitigation decisions, behaviours, and civic processes. For countries such as India, this distinction is especially important.

Education expansion remains a non-negotiable development priority, yet without deliberate integration of a climate education discourse, education risks amplifying emissions through growth pathways alone. Climate education therefore emerges not as a competing objective, but as a necessary supplement that can help ensure education delivers net climate benefits.


## WAY FORWARD

Across global and Indian evidence, several common features distinguish climate education that leads to meaningful action.

First, personal relevance consistently emerges as a critical driver of behavioural change. Evidence shows that learners who perceive climate change as affecting their own lives or communities tend to adopt mitigation strategies more openly. Climate education that remains abstract or global in framing is less effective in this scenario.

Second, agency and empowerment are central mechanisms in motivating climate action. Climate education that merely communicates the scale of the crisis risks reinforcing helplessness or disengagement. In contrast, education that builds a sense of individual and collective efficacy–by demonstrating how actions accumulate and how systems can be influenced–supports sustained engagement and mitigation behaviour.

Third, action oriented and experiential learning plays a decisive role. Programs that integrate projects, applied solutions, and opportunities to practice decision-making enable learners to translate the knowledge acquired into action. These approaches also help normalise climate action as part of everyday life rather than an optional activity.

Finally, linking climate action to civic and democratic participation is essential for scaling impact beyond individual behaviour. Evidence further suggests that education strengthens the institutional capacity required to interpret, legitimise, and implement climate policy, indicating that climate education can amplify mitigation not only through individual behaviour change but also through democratic and governance processes.

Long-term evaluation of a university course on climate change found graduates reducing their individual CO2 emissions substantially–roughly 3.5 tCO2 per year on average–showing that climate education can deliver measurable mitigation at the individual level (Cordero et al., 2020). More broadly, causal studies using changes in schooling show that each additional year of education is associated with single-digit percentage increases in pro-environmental behaviours (roughly 7–8% per year in

one European study), while meta-analyses of environmental education report moderate effect sizes for behaviour (g≈0.4) (van de Wetering et al., 2022), meaning that students exposed to environmental education display behaviour levels higher than roughly two-thirds of those not exposed . These indicate that attainment of climate education at scale can also shift behaviour at scale. However, we would also like to point out that these figures come from a mix of intervention evaluations, natural experiments and meta-analyses. Many of them rely on self-reported behavioural measures and context-specific samples.

Climate mitigation ultimately depends on policy choices, institutional change and support, and collective action. Education that strengthens the learner's capacity to engage with democratic processes–whether through advocacy, civil society, or informed public discourse–extends the reach of climate education from private behaviour to systemic change.

## IMPLICATIONS ON GROUND

For educators, the evidence from this study points to the need for greater support–particularly in terms of pedagogical frameworks, locally relevant resources, and institutional space for action-oriented learning. Without such support, climate education risks remaining peripheral and symbolic.

From a policy perspective, these findings caution against assuming that investments in education will automatically yield climate benefits. Education policy and climate policy must be explicitly aligned if education is to function as a mitigation level rather than an emission multiplier. Climate education should be recognised as a strategic component of mitigation efforts, alongside other technological and regulatory interventions.

Lastly, the analysis underscores significant research gaps. There is a need for more longitudinal and context-specific studies–particularly in developing countries–that examine how different forms of climate education influence behaviour, civic participation, and emissions over time. Moving beyond attitudinal measures toward outcomes related to decision-making and mitigation will be critical for advancing policy.

# CONCLUSION

Taken together, we can see that education is not climate-neutral by default. While expanding education levels supports economic growth and reduces vulnerability to climate impacts, it can also contribute to rising emissions in the absence of strong mitigation measures. At the same time, we have seen evidence from climate education interventions which show that climate education can lead to a direct and sustained reduction in carbon emissions. They also indicate that learners can reduce their individual carbon emissions by several tonnes of CO2 per year, highlighting the potential of climate education to function as a meaningful mitigation strategy, rather than merely raising awareness.

The analysis of the Indian context also reveals a critical gap between this potential and current scenario. While climate and environmental education in India has contributed vastly to raising awareness, it has not yet been designed to consistently enable mitigation-oriented behaviour or collective climate action. In a context where emissions are rising alongside climate risks, this gap is especially significant. The findings highlight the need for a deliberate design that builds agency, links learning to action, and connects education to mitigation efforts. Without such an approach, education risks reinforcing emissions intensive development pathways. With this, education can become a central component of India's climate mitigation response while continuing to support development and resilience.

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