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Environmental Justice in the Age of Climate Crisis: Intergenerational Inequities and Eco-Reasoning among Adolescents

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ABSTRACT

Environmental Justice has come to the fore as a key ethical and educational imperative in the climate crisis, particularly for adolescents who will inherit the long-term impacts of the crisis despite their relatively low causal responsibility. Framing the discourse within the context of intergenerational justice, the study explores how adolescents understand climate change as a scientific issue and a justice issue, developing Eco-Reasoning as an integrative construct that bridges Scientific Reasoning and ethical, social, and ecological responsibility. Based on the latest scholarship in Science Education and Environmental Justice, the study argues that adolescents' ability to effectively engage with climate issues is not only dependent on their conceptual understanding of climate systems but also on their ability to reason about the inequitable distribution of risk, responsibility, and decision-making power (Schlosberg, 2013; Krell et al., 2022). Based on global climate assessments and youth-centred policy frameworks, the article locates adolescents as a uniquely vulnerable yet critically positioned group in the climate crisis (IPCC, 2023; United Nations, 2021). This study integrates key findings from the most influential literature to

conceptualise Eco-Reasoning as a multidimensional competency that includes evidence-based reasoning, systems thinking, and justice-oriented ethical reasoning. It also illustrates how intergenerational inequities, expressed through climate-related health risks, educational disruption, and psychological trauma, represent a key Environmental Justice imperative that requires explicit educational attention (Hickman et al., 2021; WHO, 2021). By linking Eco-Reasoning to sustainability-oriented educational reforms and global policy agendas, the paper presents a theoretically grounded framework for reframing climate education as a site of justice formation rather than a simple knowledge transmission. The study concludes by articulating implications for curriculum development, pedagogy, and future research, situating Eco-Reasoning as a critical component of preparing adolescents to critically, ethically, and constructively engage with the climate crisis in the context of escalating intergenerational inequality.

Introduction

The climate crisis is a deep moral, social, and educational issue of the twenty-first century. Climate change is generally understood as a scientific and environmental issue, but evidence is accumulating that it is also a justice issue, with a focus on intergenerational justice. Adolescents, who have contributed very little to greenhouse gas emissions, are expected to bear the brunt of the most serious long-term effects of climate change, including climate instability, health effects, educational disruptions, and psychosocial impacts (Intergovernmental Panel on Climate Change [IPCC], 2023; United Nations, 2021). This mismatch between responsibility and impact places adolescents at the forefront of current debates on Environmental Justice.

The literature on Environmental Justice has expanded from its early roots in the study of pollution impacts to a more inclusive framework that covers distributive, procedural, and recognition justice (Schlosberg, 2013). This framework has highlighted intergenerational justice as a key but still under-theorised aspect of Environmental Justice, especially in educational settings. Educational institutions around the world continue to emphasise climate education as content knowledge, often at the expense of the ethical reasoning required to think about climate change as a justice issue (UNESCO, 2023).

In light of these concerns, the paper proposes Eco-Reasoning as an integrative concept that bridges Scientific Reasoning and Environmental Justice frames for adolescents. Eco-Reasoning is conceptualised as a higher-order learning outcome that enables learners to reason about climate phenomena using evidence-based reasoning, while also critically examining the inequities of risk distribution, decision-making, and future responsibility. By integrating insights from science education research, environmental justice theory, and global climate policy, the paper makes a case for a justice-driven transformation of climate education that places adolescents not only at the centre of future climate change impacts but also at the forefront of current climate justice concerns as moral actors.

Literature Review

However, the study of Environmental Justice has evolved from a localised concern with pollution disparities to a more complex, multifaceted approach that includes distributive, procedural, and recognition justice (Schlosberg, 2013). More recent scholarship on Environmental Justice increasingly identifies climate change as a primary concern, highlighting the disproportionate risk distribution associated with climate change across social groups. Global climate change assessments have made it clear that children and adolescents will be subjected to more extreme climate change conditions throughout their lifetimes, despite their minimal contribution to climate change causes, thus establishing intergenerational injustice as a defining feature of the climate crisis (Intergovernmental Panel on Climate Change, 2023).

Scientific Reasoning has been widely studied in education research as a fundamental science learning skill, including the assessment of evidence, causal thinking, and systems thinking (Krell et al., 2022). However, researchers have argued that Scientific Reasoning by itself is not adequate for dealing with socioecological problems that have inherent ethical and political undertones. Research on socioscientific issues learning highlights the importance of combining moral reasoning and value-based judgment in science learning to promote good citizenship (Sadler, 2011; Zeidler, 2014).

Parallel research studies on youth and climate change shed light on the psychosocial aspects of environmental injustice. Hickman et al. (2021) describe the prevalent climate anxiety among youth, correlating emotional suffering with the perceived lack of government action and lack of participation in decision-making. These studies highlight the procedural and recognition justice faced by youth in climate decision-making. International policy agreements further emphasise the educational need to address these issues. The United Nations and UNESCO both emphasise that education for sustainable development

must address learners' engagement with ethical issues, intergenerational justice, and participatory decision-making (United Nations, 2021; UNESCO, 2023).

However, the literature shows a conceptual gap between Scientific Reasoning and Environmental Justice in youth climate education. Few studies have attempted to conceptualise the integration of climate science knowledge with justice-based reasoning among adolescents. The paper argues that Eco-Reasoning can be considered an integrative construct that addresses the need for justice-based climate education by combining epistemological rigour with ethical and intergenerational awareness.

Climate Change and Intergenerational Environmental Justice

Intergenerational justice refers to the moral duty of the present generation to avoid causing excessive environmental damage to the next generation. Climate change is considered the quintessential example of intergenerational injustice, characterised by the mismatch between the timing of emissions and their effects (IPCC, 2023). The current generation of adolescents is expected to face more frequent and severe occurrences of extreme heat, food and water scarcity, forced migration, and climate-related health hazards during their lifetime (United Nations Environment Programme [UNEP], 2023).

Theories of Environmental Justice emphasise the importance of three interconnected aspects: distributive justice (equitable distribution of environmental advantages and disadvantages), procedural justice (equitable participation in decision-making), and recognition justice (acknowledgement of marginalised identities and experiences) (Schlosberg, 2013). Adolescents are disadvantaged in all three aspects, characterised by increased susceptibility to environmental damage, lack of political representation in climate policy, and neglect of youth perspectives in decision-making (United Nations, 2022).

The psychological aspects of intergenerational injustice are becoming increasingly apparent with the rising incidence of climate anxiety among the youth. A worldwide study conducted by Hickman et al. (2021) revealed that the majority of adolescents reported experiencing emotions such as fear, anger, and betrayal in response to their perceived lack of governmental action on climate change. The study highlights the importance of considering the emotional and moral aspects of climate injustice, which affect the sense of agency and institutional trust among adolescents.

Scientific Reasoning and Climate Education

Scientific Reasoning is a major science education goal, involving tasks such as hypothesis formulation, evidence evaluation, causal reasoning, and systems thinking (Krell et al., 2022). In the context of climate change, Scientific Reasoning enables students to make sense of climate information, understand feedback processes, and critically evaluate rival claims about causes and solutions. However, Scientific Reasoning by itself is insufficient to deal with the ethical issues that are necessarily part of climate change.

Studies in science education have highlighted the shortcomings of approaches that dichotomise scientific knowledge from social and moral issues. Students can develop conceptual understanding of climate science but remain alienated from issues of accountability, equity, and response (Sadler, 2011). This dichotomy is part of what has been termed the "knowledge-action gap" in climate education (UNESCO, 2023).

The integration of justice issues with Scientific Reasoning helps adolescents transition from descriptive to normative assessment. For example, the understanding of carbon cycles becomes ethically charged when linked to the question of who benefits from carbon-driven development and who faces the risks. This integration is in line with recent demands for a new kind of socioscientific reasoning that integrates ethical assessment, perspective-taking, and civic engagement (Zeidler, 2014).

Eco-Reasoning as an Integrative Framework

Eco-Reasoning is offered as a conceptual link between Scientific Reasoning and Environmental Justice. Eco-Reasoning is defined as the ability to reason about ecological issues using evidence-based analysis, systems thinking, and justice-focused ethical reasoning.

Eco-Reasoning has three interconnected aspects:

- Epistemic aspect – understanding and using scientific knowledge and concepts about climate systems.
- Ethical aspect – assessing ecological issues using justice, responsibility, and equity criteria.
- Socio-ecological aspect – acknowledging the interconnections between ecological processes and social structures, including power and inequality.

This approach draws on the theory of Environmental Justice (Schlosberg, 2013) and current models of Scientific Reasoning (Krell et al., 2022), and extends these into an educational setting with an adolescent

focus. Eco-Reasoning situates learners as moral reasoners who can critically assess existing systems and envision alternative futures based on sustainability and justice.

Adolescents as Moral and Ecological Agents

Adolescence is a developmental stage that is marked by increased moral sensitivity, identity formation, and the ability to reason at an abstract level. These factors make adolescence an important stage to address issues of intergenerational justice. Research has shown that adolescents are able to reason at a high level of moral sophistication when given adequate pedagogical support (UNESCO, 2023).

Adolescent-led climate movements have shown that adolescents are able to frame justice-based critiques of climate inaction, which go against the dominant narrative that sees adolescents as passive victims (United Nations, 2022). However, the education system has been slow to acknowledge adolescents as legitimate participants in climate discourse. Eco-Reasoning offers a way to legitimate adolescents' moral agency in the education system.

Educational Implications

Curriculum

Climate education should explicitly integrate intergenerational justice themes by linking scientific content with ethical inquiry. Curricula can highlight questions such as responsibility, rights of future generations, and equity in climate adaptation.

Pedagogy

Pedagogical strategies can highlight dialogic learning, argumentation, and case-based reasoning. Climate scenarios from real-world contexts can promote Eco-Reasoning by requiring students to assess evidence and ethical considerations simultaneously.

Assessment

Assessment strategies can shift from factual recall to assessing reasoning processes, ethical reflection, and systems thinking. Formative assessments, reflective writing, and debates are particularly well-suited to this end.

Implications for Policy and Research

In terms of policy, Eco-Reasoning is consistent with international agreements on Education for Sustainable Development (UNESCO, 2023) and youth-friendly climate governance (United Nations, 2021). Integrating Eco-Reasoning into secondary education can help build sustainable resilience in society by promoting well-informed and morally sound citizens.

Future research should investigate the development of Eco-Reasoning in educational settings and cultures. Design research can examine the role of pedagogical interventions in developing justice-minded Scientific Reasoning in adolescents.

Conclusion

Climate change is, at its core, an issue of intergenerational Environmental Justice, and adolescents are a uniquely situated group within this context. The paper has argued that education as a means of addressing climate change must move beyond the realm of scientific knowledge and instead focus on the development of Eco-Reasoning as a means of integrating evidence-based knowledge with ethical and justice-informed thought. Through the development of Eco-Reasoning as an educational competency, the paper provides a framework for thinking about climate change education as a site of moral development. The preparation of adolescents to meet the challenge of the climate crisis with rigour, empathy, and responsibility is both an educational imperative and a moral one.

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