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Green Pedagogies: Ecology, Green Education and the Classroom

Guest Editor

Sayan Dey

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Green pedagogies, rhizomatic possibilities, and praxis: An introduction

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Why green pedagogies?

The thematic dimensions of this special issue were founded on the monograph *Green academia* that I published in 2022. The monograph centered on the different praxis of eco-friendly education systems through various case studies across India, Bhutan, Kenya, New Zealand, South Africa, and other parts of the world (Dey, 2022). Through various lectures, conversations, coffee-table interactions, and social media engagements, the monograph generated multiple appreciations and criticisms, which provoked me to create conversations and debates within a more formal space. This, eventually, ideated the special issue titled "Green pedagogies: Ecology, green education, and the classroom." Despite several scholarships for eco-friendly education systems, there is a massive reluctance to engage with practical concerns and transformations, limiting the scholarships to superficial realms of social media shoutouts, vague promises, classroom theorizations, decorative policy books, and laboratory experiments. This reluctance bothers many of us across the planet because, on many occasions, we are unsure how to convert theories into praxis, or we encounter irreparable gaps between theories and praxis. Without addressing the gaps, it is impossible to locate the initiation points of crises, which are complex, multilayered, cobwebbed, and intersectional.

To explain further, the necessity of practicing green pedagogies stems from issues like unsystematic waste accumulation and disposal, cultural hierarchies, techno-fetishisms, exploitative political propaganda, racialization, and various other intertwined factors that operate in a symbiotic fashion (Dey, 2025; also see Rudolph et al., 2024). To counter such symbiotic challenges, rhizomatic resistance needs to be generated through co-building and co-sharing green or eco-centered pedagogical practices within different dynamics of experience like Indigenous knowledge experiences, English language teaching, graphic narratives, global citizenship education, Artificial Intelligence, primary education systems, higher education institutions, nonwestern ontologies, learners' attitudes towards green education, and curricular transformations. This special issue consists of eleven articles, and they highlight the necessity of practicing green pedagogies in rhizomatic and intersectional ways so that they can be applied within our habitual knowledge production systems within academic institutions and beyond. Just like the roots, sub-roots, branches, sub-branches, stems, and sub-stems of plants, green pedagogies invite us to redesign the teaching-learning practices in such ways that the human-more-than-human social, cultural, emotional, and intellectual assemblages (Harway, 2016) are not understood as 'extraordinary' and 'spectacular,' but as natural processes of existential symbiosis (Karpouzou & Zampaki, 2023).

How to apply?

The articles propose multiple pathways for applying green pedagogies in diverse geopolitical and ecological contexts. In the article "Graphic narratives as pedagogical tools," Anandita Saraswat and Aratrika Das argue how the high NCERT (National Council of Education Research and Training) science textbooks in India assess the entrenchment of extractive pedagogies in the curricula and build upon the notions of Indigenizing and decolonizing the Indian academia. The article also proposes that through graphic narratives, science textbooks should be diversified, and instead of exclusively concentrating on mainstream discourses, the ecological narratives of Indigenous communities, such as the Gonds and others, need to be included.

The necessity of acknowledging the intertwined and rhizomatic characteristics of the Indigenous communities and natural environment is further grounded in Ankita Rathour's article "Intertwined natures," where she brings three diverse perspectives – Hindi film Sherni, Atlanta's Cop City Project, and the genocide against Palestine to explore the decolonial possibilities of curating environmentally-sound anti-war classrooms within the tech-centered academic spaces. Through diverse pedagogical possibilities, Ankita discusses how green mindfulness can be generated within the tech-dominated classrooms of Western academic institutions.

Aman Verma and Arzuman Ara's article "Greening pedagogy" continues the discussion on green pedagogies and environmental consciousness. They discuss how

English language teaching (ELT) is not simply about learning the technicalities, aesthetics, and literariness of the English language but also about generating ecological consciousness. The article discusses how English studies can be taught through eco-pedagogical principles in higher education institutions in India by adopting eco-centered analytical and discursive approaches.

The process of developing intertwined, rhizomatic, eco-pedagogical knowledge-making systems should not be restricted to curriculums and classrooms but should be imbibed within daily life existential spaces as well. For that, as Arthur William highlights, teachers need to be sensible and sensitive environmental educators as well. In the article "Teachers as environmental educators," Arthur explores the perceptions and practices of green pedagogies by teachers in fostering green pedagogies amongst students across educational institutions in Asia, Africa, and Europe. The research was conducted through an interpretivist research approach, as part of which Arthur investigated how educators recognize the necessity of integrating sustainability into curriculums and actively employ innovative methods, such as project-based learning and outdoor exploration, to engage students.

Chantal Noa Forbes, in her article "Theorizing nonwestern ontologies towards a pedagogy of animist practice," invites us to reflect on the theories and methodologies of green pedagogies within animist practices of Indigenous communities. Chantal explores the roles that non-western ontologies play in developing pedagogies that center on animist praxis as a valid and necessary approach to problematizing environmental challenges in the environmental sciences and humanities. In the article, Chantal also highlights that this transdisciplinary pedagogical approach continues to suggest that the challenge of the Anthropocene is an ontological challenge arising from more-than-human planetary knowledge systems rooted in the substance ontology of Euro-Cartesian metaphysics.

The practice of nonwestern ontologies generates a possible rhizomatic pedagogical turn through hands-on experiential learning in schools and higher education institutions, as elaborated by Chitra Sadagopan and Chitra Krishnan in their article "Realisation of Gross National Happiness-inspired green education in Bhutan." Centered on Thakur S. Powdyel's My green school (2014) and its practical implementation in the local schools of Bhutan, the article outlines how holistic development in modern education requires an integrated understanding beyond the explicit meaning of green, which primarily denotes nature and the environment. Through various practical examples, the authors unfold the eight dimensions of green school, denoted by the term 'Sherig Mandala,' which is designed in a concentric sense and holds a critical significance in the eco-centered pedagogical practices in Bhutan within educational institutions and beyond.

The article "Exploring green pedagogy for eco-centric praxis-based learning in higher education" by Adriana Lozjanin, Gitanjaly Chhabra, and Noosha Mehdian, with respect to their personal teaching-learning experiences in higher education institutions talks about a systems-based approach to eco-pedagogy and the greening of curriculums. The authors outline the possible ways to improve the quality and the delivery of education responses to the climate crisis by integrating project-based and learner-centered experiential learning, reflective/critical learning, problem-based, and collaborative learning pedagogies to empower learners to become agents of change and contribute effectively to a more sustainable future.

In "School children's attitude towards green education," Jitendra Garai invites us to understand green pedagogies not only in higher education sectors but at the more grassroots level, like primary and secondary schools. Rooted in the eastern Indian state of West Bengal, this article explores the attitudes of school children towards green education (GE) by examining environmental utilization (UT) and preservation (PR). This work aimed to test the validity and reliability of the Revised 2-MEV Scale of Johnson & Manoli (2010) in the Indian context. The analytical frameworks in this article reveal gaps, raise awareness of environmental concerns, and contribute to the subject by establishing a sound foundation for future research and policy development.

Ritu Pareek further explores the ways of challenging capitalistic curricula and pedagogies in India through the effective implementation of Indian Knowledge Systems (IKS) in English curriculums in the local language medium schools and comparing them with schools that are affiliated with the Central Board of Secondary Education (CBSE). Ritu's study employs the content analysis method to explore the representation of IKS in English textbooks prescribed by the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE). Her findings reveal significant discrepancies in the extent and depth of IKS incorporation between the two boards, with CBSE textbooks demonstrating limited engagement compared to the more localized emphasis in RBSE curriculums.

The rapid evolution and implementation of Artificial Intelligence (AI) within teaching-learning methods have generated multiple levels of confusion, appreciation, and criticism. On the one side, within certain aspects of teaching and learning, like the usage of digital technologies and designing innovative and self-sufficient pedagogies; on the other, humans are becoming overdependent on digital applications, and the originality of human creations is becoming deeply compromised. In the context of eco-centric pedagogies, Soumya Sankar Ghosh flagged these concerns in the article "Building bridges to sustainable education." In this article, Soumya investigates the infrastructures needed to effectively deploy eco-centric pedagogy in various educational environments, focusing on the transformational impact of AI. This research used a mixed-methods approach, incorporating case studies from different geographical regions, to analyze the interaction between infrastructure, curriculum design, instructional practices, and community engagement. The study examines the essential elements of educational infrastructure that facilitate eco-centric teaching methods and assesses the capacity of AI to improve these endeavors.

The issue is impactfully wrapped up with Thomas Kral's "The #TeachSDG movement and global citizenship education," which discusses the methods through which global citizenship education (GCE) is interpreted and understood by the #TeachSDGs movement, an online transnational, cross-level group of educators dedicated to disseminating the UN Global Goals (SDGs) through pedagogical resources. Drawing on Andreotti's (2014) soft-to-critical GCE framework, the study deploys thematic and critical discourse analysis to assess the #TeachSDGs movement's blogs, social media posts, and lesson materials.

The discussions and propositions in these articles are a few of the many eco-centric curricular and pedagogical possibilities that can be applied worldwide within the daily modes of knowledge production. This special issue makes an effort to generate collective and collaborative spaces for such discussions and practices. Enough ideas, policies, and assurances have been theorized, textualized, institutionalized, and jargonized. It is time to convert them into action.

As I conclude the introduction, I would like to express my gratitude to Dr Jürgen Rudolph, Dr Mohamed Fadhil bin Mohamed Ismail, Shannon Tan, and Pauline Seah from the *Journal of Applied Learning and Teaching* for their support and guidance throughout the project.

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Graphic narratives as pedagogical tools: Diversifying the curriculum of science in schools

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Abstract

The dominant techno-scientific narratives on climate change overlook the subtext of colonial anthropocentric modes of thought that conceptualize nature as an abstract resource. The statistical record of increasing emissions and the associated solutions of sustainable management need to accommodate alternate knowledge systems that challenge colonial-extractive epistemes of human exceptionalism. This paper examines the NCERT science textbooks (IX and X) to assess the entrenchment of extractive ideologies in the curriculum and builds upon the notions of decolonizing and Indigenizing Western academia.

We argue that the curriculum of science textbooks should be diversified and ecological narratives should be included by communities such as Gond artists. Graphic narratives of Gond artists can acquaint students with non-anthropocentric ways of engaging with the environment that transcend the questions of resource utilization, productivity, and yield. In doing so, the paper aims to create disciplinary intersectionality and emphasize the peripheral reference to traditional cultures in academic discussions on sustainable futures. The drawings in the graphic narrative can initiate the wider discussion of artistic practices such as environmental art, Indigenous art, and contemporary visual culture that foreground the need for epistemological changes beyond techno-scientific solutions for the climate crisis. Graphic narratives as pedagogical tools would stimulate diverse ways of thinking along with nature and provide a holistic view of the ecological crisis.

Introduction

> Much of what we have been teaching before, and it itself has a history, has been for essentially creating empire as opposed to creating earth communities.
>
> Greg Cajete (2011)

Greg Cajete, in a lecture on "Re-building sustainable indigenous communities: Applying Native science" (2011), points toward the dominance of colonial epistemes in contemporary educational institutions that emphasize positivist, abstract, universal, and anthropocentric knowledge systems. Cajete (2011) raises the need to question this "education for empire" that suppresses the Indigenous ways of intertwined living with the non-humans as foregrounded in the argument of building "earth communities". Reevaluating the curriculum of science in schools becomes important considering the role of colonial-extractive ideologies, which assert dominion over nature, in contributing to the current ecological crisis (Gómez-Barris, 2017; Ghosh, 2021; Ferdinand, 2022; Oppermann, 2023).

The need to question the underlying anthropocentric ways of thinking about nature is suppressed by the dominance of techno-scientific solutions such as geoengineering and the anthropocentric paradigms of sustainability that foreground economic growth. The scientific curriculum needs to extend beyond the techno-scientific narratives of the Anthropocene era, marked by the statistical language of rising emissions (Crutzen & Stoermer, 2000), and incorporate alternative knowledge systems that critique colonial anthropocentric modes of conceptualizing nature as a repository of resources. Our paper builds upon arguments of decolonizing and Indigenizing the Western academia to question the dominant colonial ideologies of nature (Simpson, 2014; Tanaka, 2016; Mignolo & Walsh, 2018; Pratt et al., 2018). The paper focuses on the NCERT (National Council of Educational Research and Training) science textbooks of classes IX and X. NCERT was established by the Government of India in 1961 with the aim of providing guidance and support to Central and State Governments on educational matters. Among its various objectives, NCERT is dedicated to curriculum development and publication of textbooks for school education across India (NCERT, 2024).

The paper emphasizes the hegemony of positivist-colonial knowledge systems that naturalize the ways of seeing nature in terms of resources and energy in NCERT science textbooks. This worldview is contrasted with the Gond tribe's relational ways of thinking along with nature as reflected in their stories of creation in the graphic narratives, *The Night Life of Trees* (2006) and *Creation* (2014). In interweaving the scientific curriculum with Gond graphic narratives, the paper aligns with the notions of "epistemic fluidity" (Dey, 2022) and "pluralizing science" (Mignolo & Walsh, 2018) to question the positivist arguments of maintaining disciplinary boundaries. In questioning disciplinary boundaries, the paper identifies with Cajete's (2000) notion of "Native science" that challenges the singular concept of science grounded in Western Newtonian frameworks to emphasize Indigenous worldviews of relational living with nature. The paper argues for a reassessment of anthropocentric perspectives on the environment and seeks to incorporate alternate knowledge systems of thinking along with nature.

Anthropocentric ways of thinking about the environment, that prioritize resource utilization efficiency and ease of exploitation, are germane to the contemporary climate crisis (Gómez-Barris, 2017; Ghosh, 2021; Demos, 2021; Oppermann, 2023). Heather Davis and Etienne Turpin (2015) describe the contemporary ecological crisis as a nexus of the epistemic, economic, and political system of petrocapitalism that "represents the heightened hierarchical relations of humans, the continued violence of white supremacy, colonialism, patriarchy, heterosexism, and ableism, all of which exacerbate and subtend the violence that has been inflicted upon the non-human world" (p. 7). The paper examines the hegemony of these colonial-extractive ideologies in the NCERT science textbooks of classes IX and X. The predominant use of the language of exploitation and extraction points towards the anthropocentric ways of conceptualizing nature that overlook the bonds of interrelations between humans and non-humans.

In the chapters, "Improvement in Food Resources" (NCERT IX) and "Sustainable Management of Natural Resources" (NCERT X), the focus is on improving production, and the environment is reduced to an inert repository of resources. The graphic narratives can provide alternative ways of thinking along with nature that emphasize the relational and sacred bonds of interdependence between humans and non-humans. The graphic narratives move beyond the peripheral references of traditional knowledge in science textbooks and can help in acquainting students with indigenous non-anthropocentric ways of thinking about nature. In this, the paper draws from the arguments of "land-based education" (Wildcat et al., 2014) that highlight the pedagogical significance of Indigenous stories, spiritual traditions, and ceremonies in decolonizing human exceptional paradigms.

Incorporating graphic narratives into the scientific curriculum questions the rigid disciplinary boundaries (Tanaka, 2016; Mignolo & Walsh, 2018; Dey, 2022). They can help in inculcating non-anthropocentric ways of thinking. Section One of the paper examines the anthropocentric knowledge in science textbooks, which is centered around the discourse of resources and energy. The paper seeks to build "disciplinary intersectionality" (Dey, 2022) by integrating the scientific narratives with the ecological worldviews of Gond tribes reflected in graphic narratives. The second section of the paper explores how graphic narrative can help in stimulating ways of thinking along with nature. This questions the anthropocentric ways of conceptualizing land, as foregrounded in the science textbook of class IX, that prioritizes the aspects of yield and production.

The graphic narratives can familiarize students with the wider discussion of environmental art, indigenous art practices, and visual cultures that frame climate crisis beyond the techno-scientific narratives of the Anthropocene era (Davis & Turpin, 2015; Agarwal & Gupta, 2020; Demos, 2021; Hubbell & Ryan, 2022). Ravi Agarwal and Latika Gupta (2020), in the issue "Art and Ecology" of MARG magazine, emphasize the role of artistic expressions in conceptualizing new modes of non-anthropocentric perspectives on nature. While

keeping in consideration the commodifying tendencies of the art world, Agarwal and Gupta assert that "'Nature' will have to be (re)produced, not as something out there, but as integrally present in our everyday life. This is where art excels, finds its home, and indeed may provide a way" (2020, p. 15). The graphic narratives can serve as gateways for facilitating discussions on the forms of artistic expression that emphasize relational living with non-humans within schools.

This paper builds upon the increasing deployment of Indigenous art in acquainting students with traditional epistemologies of relational living (Cajete, 2000; Bequette, 2007; Das, 2019; Bertling, 2023; Bertling et al., 2024). The third section of the paper examines this and explores the significance of graphic narratives as pedagogical tools that can familiarize students with the Gond tribe's ecological worldviews of interconnected living manifested in their paintings. Graphic narratives by Gond artists can add to the ongoing exploration of distinct media for the dissemination of marginalized Indigenous cosmologies within environmental education (Iheka, 2021). Additionally, the emphasis on art aligns with the use of narratives and aesthetics to instill relational worldviews in students for sustainable future (Strauß, 2023). Gond art, as practiced by the Pradhan Gonds—a subsect of the Gond tribe from central India—reflects the myths and oral traditions of the tribe. Pradhans are the bards of the Gond community, preserving knowledge of Gond's myths and folklore (Chatterji, 2012; Wolf & Wolf, 2015; Matsuoka & Shyam, 2019).

Roma Chatterji (2012), in her ethnographic study, sees Gond art as a "hybrid genre" where the artists translate oral narratives into pictorial form (p. 119). The patterns in Gond's paintings are influenced by the traditional art of *Digna* and *Bhittichitra*, which are designs drawn on floors and walls. *Digna* as the Gond artist, Bhajju Shyam explains, replicates Gond's cosmologies that narrate *Bada Dev's* stories of creation. In Gond cosmology, *Bada Dev* is believed to be the originator of all life forms, who resides in the *Saja* tree (Matsuoka & Shyam, 2019). Gond tribe's sacred and animistic beliefs are manifested in their paintings as seen in Padhi and Gosawmi's (2020) analysis of the drawings of the *Saja* tree, *Mahua* tree, and Bamboo that delineate the stories of spirits residing in trees. Gonds' veneration of these spirits stems from the understanding that all forms of life, both human and non-human, are interconnected and interdependent (Padhi & Gosawmi, 2020). These beliefs initiate an ecological way of relational living with the non-humans, a premise explored in the book *Between Memory and Museum: A Dialogue with Folk and Tribal Artists* which is based upon the workshop of tribal artists conducted by Arun Wolf and Gita Wolf (2015). Through the interviews of the Gond artists and their description of the paintings, Gita Wolf and Arun Wolf (2015) delineate how Gond art reflects the interconnectedness between the tribes and nature where art becomes the medium that channelizes Gond's sacred beliefs of intertwined living with the non-humans as seen in Rajendar Kumar Shyam's painting of Gond's granary (examined in the first section) (Matsuoka & Shyam, 2019). Graphic narratives can help in acquainting students with these animistic and ecological worldviews.

Resource-oriented worldviews and disciplinary intersectionality

Critics have identified that the climate crisis entails an epistemological shift from a cause-and-effect approach of empirical scientific narratives to an examination of the underlying anthropocentric ways of thinking about the environment (Heise, 2016; Ghosh, 2016; Agarwal & Gupta, 2020; Ferdinand, 2022; Oppermann, 2023). As Agarwal and Gupta (2020) delineate, "To ensure sustainable future, a more holistic approach is needed and the problems have to be redefined" (p. 372). Students should not only acquire a comprehensive understanding of geoengineering but also engage in a critical reevaluation of anthropocentric ways of being. This raises the need to revise the scientific curriculum that perpetuates anthropocentric thought patterns of perceiving and conceptualizing the environment in terms of resources. Mignolo and Walsh (2018) highlight how universalizing and totalitarian forms of colonial knowledge have imposed a notion of nature that separates humans from their surroundings. Mignolo and Walsh emphasize the "invention of nature" (p.156) to delineate how the colonial introduction of the category of nature systematically subdued the Indigenous practices of interconnected living. These Indigenous practices manifest a holistic and inclusive perspective on nature. The scientific secular understanding of nature propounded by the Enlightenment thinkers naturalizes the delineation of nature in terms of resources (Iseke, 2013; Kerr, 2014; Adese, 2014; Mignolo & Walsh, 2018; Heikkinen et al., 2024).

The secular scientific reduction of nature into a resource emphasizes decontextualized knowledge that prioritizes empirical experiments and objective observations (Hogan & Topkok, 2015). The predominance of decontextualized knowledge disregards other spiritual and relational ways of engaging with nature (Simpson, 2014). The decontextualization of knowledge is facilitated by the dominance of positivist ideologies, which emphasize empirical and rational approaches. Positivist ideologies dominate the theories of education and the construction of disciplinary boundaries where "The universe is separated into its constituent parts, and then these parts—and our experience of them—are examined and understood in isolation from their larger, natural context" (Tanaka, 2016, p. 175-176). These prevailing universalizing and positivist scientific paradigms, which conceptualize nature primarily in terms of resources, are infused in school science textbooks, as seen in the chapters "Natural Resources" (NCERT IX) and "Sources of Energy" (NCERT X). The conceptualization of water, air, and earth solely through the lens of a resource prioritizes extractive ideologies, where the primary concerns are maximizing resource extraction and enhancing efficiency. Students need to be acquainted with alternate ways of imagining the environment. Catherine Walsh (Mignolo & Walsh, 2018) draws on the concept of nature outlined in the Ecuadorian Constitution to underscore the importance of pluralizing scientific curriculum and advocates for the inclusion of ancestral knowledge in educational programs. Mignolo and Walsh (2018) focus on the Indigenous notions of *Pachamama* and *buen vivir* to diversify the colonial scientific understanding of nature as an abstract entity. This paper in contending for the inclusion of graphic narratives

by Gond tribal artists in the curriculum of science aligns with the arguments of Indigenizing and pluralizing Western academia (Pratt et al., 2018; Mignolo & Walsh, 2018). In the graphic narrative *Creation*, the representations of water, air, and earth are combined with fish, birds, and snakes. In the Gond creation story of water, "The Unborn Fish", the painting of fish becomes symbolic of water. The creation story of air represents air through the painting of blue crows, "whirling out from the eye of the storm" (Shyam & Wolf, 2014), and the story of earth, "The Potter of the Underworld" foregrounds the role of earthworms in making the earth habitable. These representations move beyond the arguments of resource use and efficiency to emphasize the interconnections between humans and non-humans. Incorporating these Gond narratives will incite alternative ways of thinking that challenge the abstract reduction of nature into resources.

In naturalizing the scientific resource-oriented perspectives on the environment, the focus of the chapter, "Sources of Energy" (NCERT X) is on optimizing the energy coefficient of the resources. Natural entities are categorized in terms of the energy to be tapped and are labeled as "good resource" and "bad resource". The classification is based upon the economics and ease of extraction, accompanied by anthropocentric considerations, such as, "How long will an energy source last us?" (NCERT X, 2006b, p. 253). Despite the mention of environmental concerns, the focus is on maximizing resource use efficiency. The predominant use of words such as exploitation and extraction emphasize the anthropocentric ways of visualizing the environment as a repository of resources.

Terminology of exploitation points towards the colonial-extractive epistemes that overlook the connection between people and the environment. This perspective marginalizes multiple ways of engaging with nature, focusing instead on energy and resource requirements. In the chapter "Sources of Energy" (NCERT X), water is primarily conceptualized through its dynamic flow, which generates kinetic energy. This understanding underscores the necessity of constructing dams to harness and utilize the kinetic energy of flowing water effectively. The dislocation of the local population caused due to the construction of the dam is reduced to a line, seen as a negative externality of dam construction. There is an effacement of the non-anthropocentric ways of engaging with the water and the multifaceted significance of the river, an aspect that the drawings of Gond artists (Rajendar Kumar Shyam, Dilip Shyam, Pradeep Marawe) in *Between Memory and Museum: A Dialogue with Folk and Tribal Artists* (Wolf & Wolf, 2015) emphasize. The paintings foreground human entanglement with the river. They emphasize the diverse cultural, historical, and spiritual understanding of the river. These paintings and associated narratives highlight the marginalized worldviews. These suppressed worldviews expand the material questions of dislocation to interrogate resource-oriented worldviews of science that evade human and non-human entanglements. Stories and folklore of riverine communities can enable alternate ways of intertwined living with non-human entities (Dahake, 2018). Graphic narratives can emphasize these traditional worldviews in the scientific curriculum.

The predominant ways of thinking in terms of resources contribute to environmental degradation (Oppermann, 2023). The chapter "Natural Resources" (NCERT IX) relates water pollution with, "The addition of undesirable substance to water-bodies", "The removal of desirable substances from water-bodies" and "A change in temperature" (NCERT IX, 2006a, p. 194). This conceptualization of pollution needs to be expanded to address the underlying anthropocentric ways of thinking about nature that emphasize resource extraction for meeting the rising energy demands. The inclusion of graphic narratives would challenge the discourses of exploitation, and ease of extraction, and foster an understanding of the interconnected ways of being.

Resource-oriented worldviews are foregrounded in the chapter, "Sustainable Management of Natural Resources" (NCERT X). Despite advocating for the inclusion of traditional resource utilization techniques, the chapter effaces a critical discussion of the non-anthropocentric worldviews held by traditional communities. The discussion of sustainable forest conservation practices of traditional local communities such as the Bishnois of Rajasthan and the Nomadic shepherds of the Himalayas are subsumed within the positivist-mechanistic understandings of science that emphasize "controlled exploitation" (NCERT X, 2006b, p. 273). The inclusion of local knowledge is limited to the "efficient management of forests" (NCERT X, 2006b, p. 274). An emphasis on resource management with an anthropocentric focus on future human well-being reflects a utilitarian understanding of nature, an aspect highlighted in the notion of instrumental rationality. Instrumental rationality is associated with Enlightenment ideologies that measure the value of nature, "from the perspective of how it increases human well-being and wealth" (Aaltonen et al., 2023, p. 248). The suppression of non-anthropocentric worldviews of nature in the discussion of sustainable practices relates to the "triumph of instrumental reason in Western thought, whereby questions of values and goals are sidelined and become technical in nature" (Heikkinen et al., 2024, p. 1150). Aaltonen et al. (2023), drawing from Stephen Sterling (2001, 2010), emphasize the need to question human exceptional paradigms, "switching from dualistic, hierarchical worldview to systems understanding and relational sustainability competence" (p. 251). While the anthropocentric models of sustainable development are critiqued in the arguments of education for planetary well-being (Aaltonen et al., 2023), what is required is a deeper engagement with indigenous perspectives that transcend the mechanistic worldviews, an aspect emphasized by Fikret Berkes (2008) in the "ethics of sacred ecology" (p. 274). Berkes identifies the distinct worldviews underlying the indigenous understanding of ecosystems that are rooted in spiritual and animistic beliefs (Saraswat & Das, 2024). These spiritual beliefs guide ecological behaviour as Berkes explains with reference to Tukano cosmology. Berkes (2008) seeks to posit "post-positivist ecology" (p. 274) that emphasizes the Indigenous view of ecology based on spiritual beliefs. The curriculum of science needs to acquaint students with such Indigenous understandings of relational living to provide a holistic view that questions the marginal reference and containment of Indigenous traditions within the scientific worldviews of resource management. Indigenous pedagogies can become instrumental in understanding the interconnected

ways of human and nonhuman co-existence. Cajete (2000) emphasizes how in Indigenous traditions, there is no word for education. Instead, the focus is on "coming to know" which emphasizes relationality, "that exists between humanity, creation, and cosmos as an inextricable interconnected web" (Pratt et al., 2018, p. 5). Graphic narratives by Gond artists foreground these relational and reciprocal networks of interconnections.

The chapter on sustainability needs to incorporate relational worldviews and move beyond the peripheral mention of traditional resource management practices to a deeper understanding of non-anthropocentric ways of relating to nature. This gap in science textbooks can be addressed with the inclusion of Gond tribes' sacred ecological views, as reflected in their art such as Rajendar kumar Shyam's painting of a granary (Figure 1). The painting of the granary encapsulates Gond's ecological worldview where each level of the granary is occupied by the distinct representations of animals, humans, nature, spirits, and gods who guard the harvest. This representation emphasizes the interactions and interconnections between the domains of human, nature and spirits. These ecological worldviews are part of Gond's stories of creation as seen in the story "The Egg of Origins". The story and the drawing (Figure 2) delineate the web of interdependencies across species, as Bhajju Shyam describes, "I've thought of the egg as a nest or cradle, which holds all forms of animal life. All these forms are connected, but separate, born from a single source, yet all diverse" (Shyam & Wolf, 2014). This approach of interlacing science textbooks with tribal artistic expressions questions the disciplinary boundaries, a premise that Catherine E. Walsh (Mignolo & Walsh, 2018) highlights with reference to higher education at Amawty Wasi University. Tanaka (2016) underscores the need to challenge the dominance of positivist science where "Knowledge is organized into distinct, seemingly disconnected academic disciplines" (p. 175-176). The inclusion of graphic narratives in the curriculum of science foregrounds "epistemic fluidity" that emphasizes disciplinary intersectionality as Sayan Dey (2022) delineates, "To develop ecologically sustainable curricular structures, it is crucial to disassemble the existing disciplinary systems like humanities, social sciences, sciences, and mathematics and incorporate eco-friendliness, acknowledge epistemic fluidity, and practice disciplinary intersectionality" (p. 71). Graphic narratives can help students in rethinking the anthropocentric narratives of sustainability in science textbooks. This approach of disciplinary intersectionality can help in familiarizing students with traditional ways of thinking along with nature.

Figure 1. Painting of Gond's granary. Art by Rajendar Kumar Shyam, for *Between Memory and Museum: A Dialogue with Folk and Tribal Artists* by Gita Wolf and Arun Wolf, Original Edition © Tara Books Pvt. Ltd, Chennai, India. 2015, image reproduced with due permission.

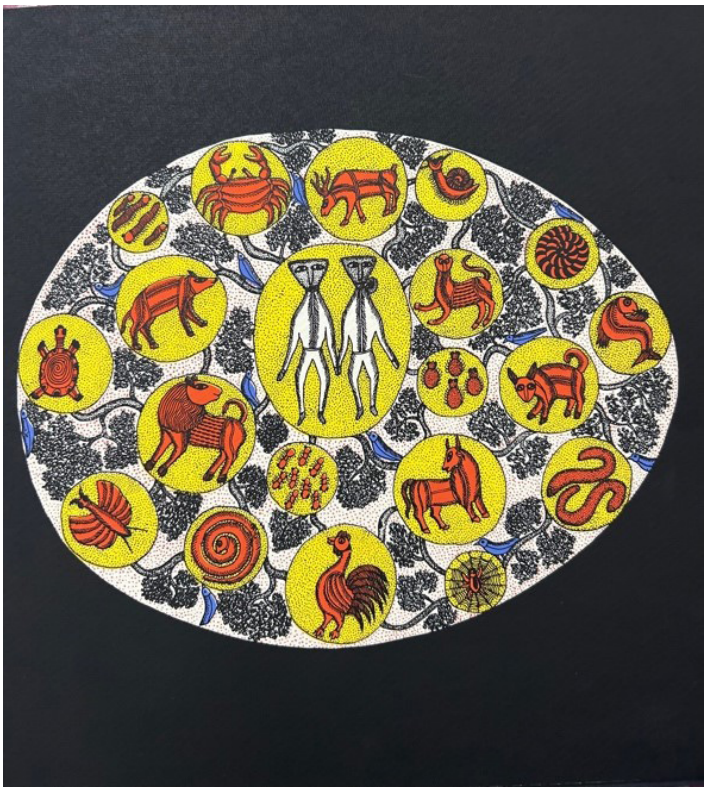

Figure 2. Painting of "Egg of Origin". Art by Bhajju Shyam, for *Creation*, original Edition ©Tara Books Pvt. Ltd, Chennai, India. 2014, image reproduced with due permission.

Thinking along with nature

The emphasis on instrumental rationality in the discussions of sustainable living is further highlighted in the chapter, "Improvement in Food Resources" (NCERT IX). The primary focus of the chapter is on increasing crop yield and intensifying soil efficiency, "the question thus becomes how do we increase the yields of crop and livestock?" (NCERT IX, 2006a, p. 203). The focus on maximizing production prioritizes the question of yield and overlooks the interconnected ways of relational living with non-humans. The land is conceptualized as an inert entity, with rainfall and weather patterns examined solely in a mechanistic context concerning their effects on crop yield. This secular scientific understanding of land presents a passive view of nature as Jeannie Kerr explains, drawing on Marker's

(2006) and Vokey's (2001) argument, "school privilege a form of knowledge that presumes the cultural neutrality of science" (Kerr, 2014, p. 93) that results in the hegemony of mechanistic approaches to the environment.

Cajete (2000) in *Native Science* questions the hegemony of mechanistic views and seeks to pluralize scientific learning. Cajete identifies Native science with alternative ways of thinking about the environment that emphasizes Native worldviews of relational living with non-humans and integrates spiritual ideas with scientific learning. Cajete underscores the need to acquaint students with Native ceremonies that underscore the bonds of relational living such as the Green Corn Dances of the Southeast Indian tribes and Yurok White Deer Skin Dance. These ceremonies are reminders of the "compact" and "convent" with nature that are effaced in modern academia, "and indeed must be regained in some substantial form in modern life and modern science" (Cajete, 2000, pp. 4-5). It is these relational bonds that are emphasized in the "ethics of sacred ecology" that contrast the mechanistic view of nature (Berkes, 2008). In this context, the paper aims to pluralize the understanding of science and draws attention to the ceremonies of Gond tribes as reflected in graphic narratives. In Gond's worldview corn cobs, referred to as *bijha*, are worshipped and are considered scared, a premise emphasized in the creation story of "The Scared Seed" that underscores the fundamental unity between human and non-human life forms, "All life comes from a source, a germ which holds miraculous possibility within itself, and when the time is right, lets it unfold" (Shyam & Wolf, 2014). These sacred beliefs are manifested in the ceremonies and festivals of sowing. The ceremonies of the "Seedling Festival" that celebrate the sowing season emphasize the networks of interdependence between humans and non-humans. The seedling festival is celebrated for nine days where the pot of sprouting grain is worshipped and on the tenth day, as described in the creation story of the sacred seed "the seedlings are ceremoniously spread on the ground, and watered. We offer thanks to this miracle of creation, which allows us to live" (Shyam & Wolf, 2014).

Gond's sacred beliefs and ceremonies question the passive depiction of land, an aspect foregrounded in the discussion of decolonization and spirituality (Iseke, 2013). Iseke (2013) draws on Tuck and Yang (2012) to highlight the importance of traditional stories of creation in dismantling the passive view of nature. Students need to be acquainted with distinct ways of relating to the land as seen in Gond's perspectives on farming which is, as described by the Gond artist Bhajju Shyam, "not a mechanical extraction of food, dumping stuff on the earth without caring how she's fed. There is observation, care and craft involved" (Matsuoka & Shyam, 2019, p. 52). This non-anthropocentric Gond relational view of the land is foregrounded in the sacred beliefs, ceremonies, and creation stories of the community as seen in the graphic narratives. The graphic narratives can provide alternate ways of relating to nature as seen in the Gond story of "The Birth of the Fruit". The story describes the ceremony conducted when the trees bear their first fruits, "a marriage ceremony is performed for it, just like for people. No one eats the fruit until the ceremony is over, and a holy lamp is lit in honour of the occasion" (Shyam & Wolf, 2014). These spiritual beliefs question the inert visualization of nature and provide alternative perspectives on the interrelationship between the environment and human beings, highlighting their co-dependence. These traditional ways of engaging with nature establish, "a humbler relationship with it, which requires permissions for transgressing and taking from the earth; ways of being which seem totally foreign in the post-Enlightenment epistemologies of land as property, rights as individual (instead of communal) and nature as passive" (Agarwal & Gupta, 2020, p. 14). The stories of creation can facilitate discussions beyond the aspect of yield and productivity.

Gond tribe's stories of creation and ceremonies in graphic narratives emphasize the sacred bonds of co-dwelling and reciprocal relations between humans and non-humans. The ceremonies allude to the wider animistic worldviews as reflected in Gond's sacred beliefs concerning trees. These beliefs form the basis of the graphic narrative *The Night Life of Trees*. The animistic beliefs are fundamental to the notion of Native science that can stimulate an understanding of a vital world where every entity is animate and possesses spirit (Cajete, 2000, p. 75). Gond stories in *The Night Life of Trees* highlight the networks of interdependence between trees and Gond tribes, as Bhajju Shyam explains, "I would say that our connection to trees is formed by paying close attention to the rhythms of nature" (Matsuoka & Shyam, 2019, p. 80). Shyam elucidates how the bud plucking from the Pakri tree is regulated by observations of the tree's leaf-shedding and regrowth cycles in Gond village of Patangarh. It is these relational ways of thinking along with nature that are reflected in the beliefs and stories about trees.

Stories in *The Night Life of Trees* give agency to the trees as seen in "The Tree of the Serpent Goddess". Unlike the passive depiction of the environment, in the painting of this story, "Shyam has nested the earth in the snakes' coiling body and the tree's serpentine root spread to make a beautiful image of creation as an environment of mutual nurture" (Garimella, 2020, p. 42). The story relates how the earth rests on the head of the serpentine goddess, "Disturb her, and the whole earth shakes with fearful earthquakes" (Shyam et al., 2006). It is the acknowledgment of this agency and the vitality of the environment that emphasize thinking with nature (Cohen & Duckert, 2015; Strang, 2013; Oppermann, 2023). Thinking along with nature entails identifying these relational networks where nature has agency and is a co-participant in human activities. This is highlighted in the story of "The Dumar Tree" whose woods are used in the wedding canopy and the tree, "blesses marriages" (Shyam et al., 2006). Non-human agency is foregrounded in these stories of Gond's sacred ceremonies. Through these stories, students can be acquainted with distinct and multiple ways of thinking about nature that transcend the focus on yield. The distinct stories about trees in *The Night Life of Trees* pluralize the relations between humans and nature. The stories emphasize the spiritual, medicinal, and educational significance of trees. These stories do not reduce trees to their functional capacities but visualize them as agentic beings co-dwelling with humans as seen in the story "The Encircling Khirsali", where the tree "surrounds and protects" the tribes. In these stories, the "spiritual, natural and human realms are interrelated" (Hogan & Topkok, 2015, p. 58). The stories in

graphic narrative foreground distinct ways of thinking along with nature as opposed to the conceptualization of nature as a passive resource for profit maximization.

Thinking along with nature involves being attentive to the natural rhythms of the environment and understanding oneself as part of the larger ecosystem that transcends the concerns of utility and yield. The stories in graphic narratives can shift the emphasis from the mechanical relation between the amount of rainfall and the stipulated crop yields (NCERT IX) to an identification with, "micro-connections and ecosystem integrities" (Agarwal & Gupta, 2020, p. 15). Rainfall in the Gond worldview is identified with red caterpillars and the sowing season is decided in accordance with the emergence of "battar" (an insect) (Matsuoka & Shyam, 2019, p. 45). The creation story "Seasons" refers to the insects as messengers. An emphasis on insects draws attention to how rainfall rejuvenates "microhabitats that support species persistence" (Nuttall, 2022, p. 335). This opposes the utilitarian and scientific conceptualization of rain that limits its significance to understanding the changes in crop yield. Cross-species interconnections in the stories of creation explain Gond's worldviews of intertwined living as Shyam delineates, "So our rituals, ceremonies, and stories are connected to the land, to nature, and to our lives in a deeper way. Gond Stories of creation are about this connection." (Matsuoka & Shyam, 2019, p. 49). Here the knowledge is rooted in multispecies relationality that sees rainfall in the context of the formation of microhabitats for various species.

The experiential knowledge and interconnected way of living, as reflected in graphic narratives by Gond artists, have been identified as pedagogical resources to decolonize the knowledge systems underpinning extractivism. Wildcat et al. (2014) emphasize Adese's observation of how the communities have gone from "living with land to living off land" (p. VI). Land as pedagogy focuses on the interrelationships among species and observations accumulated over generations of living close to nature (Wildcat et al., 2014; Simpson, 2014). The relational networks of interdependence between humans and non-humans in the graphic narrative can provide alternatives to scientific narratives of human-exceptional paradigms. For instance, the focus in food chains, where humans occupy the topmost point, is on the energy transfer at each trophic level. The chapter, "Our Environment" (NCERT X) describes the loss of 10% energy at each trophic level in the food chain. The interconnected ways of living in the graphic narrative can pluralize this scientific understanding of the cross-species interactions in the food chain and broaden the concepts of biological magnification. Biological magnification focuses on the chemical accumulation in each stage of energy transfer and since the "humans occupy the top level in any food chain, the maximum concentration of chemicals get accumulated in our bodies" (NCERT X, 2006b, p. 260). This phenomenon is used to explain the adverse impacts of pesticides on human bodies. This anthropocentric understanding suppresses the reciprocal networks of care between human and non-human entities. The science textbooks ought to acknowledge the interdependence among the species. The study of the impact of fertilizers should extend beyond examining their adverse impacts on soil and limiting their use. Classroom discussions ought to address the underlying anthropocentric tendencies that reduce the land to a mere crop-producing unit with a sole focus on increasing yield. In this, graphic narratives can help reevaluate anthropocentric epistemes and stimulate ways of thinking along with nature.

Ecological perspectives in Gond art

Graphic narratives provide insight into Gond tribes' relational ways of thinking along with nature. The stories emphasize interconnected ways of living with the non-humans that question the dominance of utilitarian, colonial, and extractive approaches to nature. The argument for incorporating these graphic narratives in the scientific curriculum aligns with the use of stories as pedagogical tools to instil traditional ways of relational living (Sium & Ritskes, 2018; Simpson, 2014; Aldern & Goode, 2018). Simpson (2014) explores Nishnaabeg stories as pedagogical tools for familiarizing students with the "intimate relationships of reciprocity, humility, and respect with all elements of creation, including plants and animals" (p. 10). The essays in the special issue on "land based education" (Wildcat et al., 2014) explore Indigenous pedagogies such as storytelling to decolonize the colonial-extractive knowledge systems.

Art and storytelling are part of Indigenous teaching methodologies that instil in students the experiential knowledge—acquired over generations of living close to nature—of non-anthropocentric engagements with the environment. As Cajete writes, "Indigenous teachers practice the art of communicating through language, relationship to social and natural environments, art, play, and ritual" (2016, p. XIV). Cajete (2000) emphasizes the importance of art practices in preserving and disseminating indigenous epistemes that foreground human and non-human reciprocal bonds of sustenance. The notion of eco-education, as Cajete delineates, seeks to integrate contemporary learning with the traditional knowledge of relational living for a sustainable future. The intervention of new pedagogical approaches, such as ecopedagogy, draws upon Indigenous epistemologies to question the dominance of objective science in environmental education that overlooks colonial and socio-political underpinnings of the ecological crisis (Bertling, 2023).

The notions of eco-education and ecopedagogy stress the importance of transdisciplinary approaches that provide alternative ways of thinking and acquainting students with traditional epistemologies. In this context, Bertling (2023) emphasizes the importance of art in foregrounding relational worldviews that transcend the strictly scientific outlook of environmental education. The potential of indigenous art practices as pedagogical tools for environmental education is being increasingly explored, as seen in James W. Bequette's (2007) analysis of schools in rural California that integrate Native art practices in curriculum and invite Native artists to delineate the ecological worldviews manifested in traditional art. Bertling et al. (2024) build upon an art teacher education program at a public university in the northeastern United States to emphasize how Indigenous art practices and storytelling can add to the scientific discussions on environmental issues. The focus on the drawings of Gond

artists in the graphic narrative expands these discussions. Gita Wolf and Arun Wolf describe how Gond paintings are becoming the primary medium for channeling Gond cosmologies and myths (2015, p. 108).

Gond paintings are enmeshed in Gond myths and rituals. Bhajju Shyam describes how the various facets of their cultures, "digna, murals, songs, storytelling, festivals" (Matsuoka & Shyam, 2019, p. 197) are amalgamated in the paintings of the pioneer Gond artist, Jangargah Singh Shyam. The paintings become the conduits for the transmission of the folklore told by *bhujrukh* (traditional storytellers). Gond artists draw inspiration for their paintings from the stories told by the *bhujrukhs*. Shyam explains how the paintings are keeping alive Gond traditional cultures and register the eroding customs of storytelling. The abstract patterns in Gond paintings are influenced by the ecological worldviews of the Gond tribe that emphasize the intimate non-anthropocentric relation between humans and non-humans. *Signature: Patterns in Gond Art* (2010), delineate how the patterns in Gond painting are influenced by the lived reality of the tribes. Ramsingh Urveti draws the inspiration for the patterns in painting from the garland of trees, Nikki Singh Urveti's patterns are influenced by the marks left on earth after plowing and Durga Bai Vyam uses the patterns of *dhan* (grain), *kodo* (mustard seed), and moa grass. Kodai Matsuoka (Matsuoka & Shyam, 2019) terms this as "living art" (p. 145). The perspectives of the tribe as reflected in the paintings can help students in understanding the ecological worldviews of traditional communities. This expands the peripheral engagement of the scientific curriculum with the local communities, questions the anthropocentric epistemes, and can help familiarize students with relational ways of perceiving nature.

The non-anthropocentric epistemes of relational living manifested in paintings by Gond artists align with the larger discussion on the importance of art practices in challenging the dominance of techno-scientific understanding of the Anthropocene era (Davis & Turpin, 2015; Agarwal & Gupta, 2020; Demos, 2021; Hubbell & Ryan, 2022). Environmental art is gaining prominence in emphasizing multispecies relationality. Gond graphic narratives can provide a foundational framework for students to recognize the importance of artistic expressions and encourage a more profound engagement with these mediums. This method facilitates a multifaceted comprehension of the climate crisis, transcending purely scientific viewpoints. Zoe Todd (2015) highlights how Indigenous artists foreground the reciprocal relation between humans and non-humans that questions human exceptional paradigms of extractive economies. The intertwined ways of living and relational networks of interdependence are identified by Hubbell and Ryan as one of the facets of environmental art. Hubbell and Ryan (2022) identify Indigenous paintings as precursors of contemporary environmental art and emphasize human-nature interactions in Indigenous art forms across the world.

Indigenous art practices reflect the ecological worldviews of the communities, an aspect highlighted in the Gond tribal art of *Digna*. The Gond paintings in graphic narrative draw upon the artistic traditions of *Digna* and *Bhittachitra*. Digna elucidates the convergence of artistic and ecological worldviews. Colours for Digna are collected in accordance with the natural rhythms and patterns of the environment as Vyam et al. (2011) delineate, "We would collect various kinds of coloured matti (soil), available seasonally, to make dignas. The white chuhi matti is available only in January and February in the Barenda jungle. Ramraj, yellow, is found on the Amarkantak hill… In Phagun (February-March), we collect the black kaali matti in Ghar ka Matta" (p. 97). This explains how *Digna* art incorporates the observations of living close to nature. Although natural colors are being increasingly replaced by artificial colors, the patterns are rooted in the everyday ecological worldview of the community, "our aesthetics draws on our village experience" (p. 97). The use of acrylic paints underscores the scarcity of traditional raw materials and reflects the broader transformations in cultural practices induced by the degradation of the natural environment. Matsuoka and Shyam (2019) discuss how deforestation has transformed Gond's traditional construction of houses and impacted the art of wood carving. Discussions on the changing traditional art practices in classrooms can provide distinct perspectives on environmental education that highlight ecological worldviews embedded in traditional art practices and register their gradual erosion, a premise explored by Bequette (2007) in the argument for incorporating Native art practices in the curriculum. Gond art in graphic narrative helps in the transmission of ecological worldviews (Das, 2019). Gond graphic narratives as pedagogical tools can enable discussions on traditional art practices, which foster ecological behaviors, in the classroom setting of schools.

Conclusion

The graphic narratives can diversify the syllabus of science textbooks and counter the dominance of colonial-extractive epistemes that reduce nature into resources. The histories of scientific disciplines are intertwined with colonial expansion and "technological endeavour continue to enact certain salient features of colonialism—such as extraction, and the exploitation of land and people" (Mitra et al., 2023, p. 2). Arguments for decolonizing and Indigenizing the curriculum of higher education challenge these colonial-extractive epistemes that continue to exacerbate the ecological crisis, obscured by the perceived objectivity and neutrality of sciences. In examining NCERT science textbooks, the paper situates these discussions in the framework of the school curriculum. This becomes pertinent since NCERT science textbooks lay the groundwork for the decontextualized forms of learning encountered in technical fields, where the focus shifts to highly specific, atomistic knowledge related to physical properties and detailed technical processes. Gond graphic narratives can provide alternate ways of thinking about nature. Including graphic narratives in the curriculum pluralizes scientific learning and builds disciplinary intersectionality that can stimulate alternate ways of thinking about the environment beyond resource utilization. This perspective questions the dominance of techno-scientific narratives and techno-optimism that are rooted in human exceptional paradigms (Agarwal & Gupta, 2020; Demos et al., 2021; Mitra et al., 2023).

The hegemony of anthropocentric worldviews is being questioned in the curriculum of higher education as seen in Mitra et al. (2023) identification of "colonial ideologies of extractivism" (p. 3) in the disciplines of engineering and Anke Strauß's recognition of the predominance of "resource-based view on nature" in management studies (2023, p. 291). Tan et al. (2023) argue for a more holistic framework for the incorporation of sustainability discourses within higher education. The intersectional approach of this paper, that introduces Gond tribes' ecological worldviews of relational living in the curriculum of science, can also work as a point of reference for rethinking the anthropocentric discourses of sustainability in higher education. Tribal art in graphic narratives can initiate engagement with alternative and holistic worldviews on sustainability where, as Strauß (2023) identifies, "Crafting narratives about sustainable futures and participating in negotiating these futures with others are aesthetic matters" (p. 294). Additionally, organization of workshops by Gond artists in academic institutions, such as the workshop organized in IIIT (International Institute of Information Technology) Hyderabad in April 2024, students engagement with tribal communities through CRDT (Centre for Rural Development and Technology) in IIT (Indian Institute of Technology) Indore, and the exhibition of Gond paintings in IIT (Indian Institute of Technology), point towards the initiatives of familiarizing students with tribal cultures. The inclusion of graphic narratives in the curriculum can then acquaint students with Gond tribe's ecological worldviews, a premise that can be explored further for integration in higher education.

The incorporation of Graphic narratives by tribal artists in curriculum would question an essentialized notion of Western science. In this context, the paper aligns with the ongoing reevaluation of positivist curriculums that subsume environmental education within a scientific and mechanistic worldview as seen in the arguments of eco-education and ecopedagogy. The paper has focused on the Gond narratives and aims to function as a stimulus for the inclusion of other tribal arts in the school curriculum. This position does not promote an uncritical appreciation of traditional ways of living, nor does it disregard the difficulties experienced by traditional communities that necessitate some degree of technological intervention. The paper instead argues for a deeper engagement with the worldviews of traditional communities that emphasize cross-species interdependence, integrate sacred beliefs with ecological outlook, and can provide alternative ways of thinking about the environment to stimulate a post-positivist idea of ecology (Berkes, 2008). This transcends the peripheral references to the traditional resource utilization techniques, that maintain the dominance of extractive ideologies, in the arguments for integrating traditional practices with scientific innovations for a sustainable future (NCERT X, 2016b).

Art and storytelling provide an insight into the traditional worldviews of relational living. Graphic narratives as pedagogical tools expand the exploration of Indigenous methodologies and pedagogies in decolonizing the curriculum (Cajete, 2016; Iheka, 2021). Our paper draws upon the pedagogical innovations that deploy indigenous art practices to provide a holistic understanding of ecological crisis for sustainable future (Cajete, 2000; Bequette, 2007; Bertling, 2023; Bertling et al., 2024). Gond ceremonies and sacred beliefs in graphic narratives emphasize reciprocal bonds of care with non-humans that transcend the notions of resource use and efficiency. The stories of creation highlight the interactions between humans and non-humans, an aspect emphasized in the argument of land as a pedagogy. These perspectives diversify the understanding of the land and critique the predominant ways of seeing land in terms of yield and productivity. The graphic narratives acknowledge the importance of microhabitats for species survival and question the mechanical relation between weather patterns and crop yield. These alternate ways of thinking along with nature defy extractive ideologies. They question the hegemony of instrumental rationality that reduces nature into a passive entity, an aspect foregrounded in the notion of managing natural resources for sustainable futures. Graphic narratives highlight the agency of non-human entities and represent them as co-inhabitants alongside humans. Gond paintings can acquaint students with the larger discussions of environmental art and visual culture. Art practices question the hegemony of techno-scientific narratives of the Anthropocene era that overlook the fundamental issue of anthropocentric thinking underpinning extractive ideologies. Environmental art emphasizes ways of thinking that defy human exceptional paradigms and foreground multi-species relationality. Graphic narratives as pedagogical tools can initiate discussion on artistic practices in the scientific discourses on sustainability. These narratives would stimulate students to unlearn the anthropocentric ideologies in science textbooks and inculcate alternate ways of thinking along with nature.

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Intertwined natures: Reflections on green pedagogy in a tech classroom

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Abstract

In this article, I demonstrate that the Hindi film Sherni (Masurkar, 2021), Atlanta's Cop City project, and genocidal violence against Palestinians intertwine in their decolonial possibilities to create an environmentally and anti-war conscious classroom. I have utilized the above-mentioned Hindi film, Atlanta's environmental concerns, and the war on Palestinians to encourage green mindfulness in an otherwise tech-dominated western academic space. "Cop city" is what activists call a police and fire department training center that is currently under construction. This $90- million police training facility would be one of the largest militarized police training centers in the country—all built by clear-cutting Atlanta's largest green space. Hence, the project faces massive opposition. It also maintains a relationship with the Israeli Defense Forces, creating an exchange of oppressive mechanisms between the two settler colonial nations. In such a case, I raise a political green consciousness among my students beginning with the Hindi film Sherni, which shows how the rhetoric of expansion, extraction, and land development in a postcolonial world is often based on the erasure of indigenous farming practices, forcible relocation of population from their lands, and recruitment of law, criminals, and political figures to build oppressive regimes. Once the tone is set, discussions on the local issue of cop city and the global case of Palestinian territories help drive the arguments home that colonization is deeply rooted in the erasure and control of natural resources and often a postcolonial nation-state functions through such colonial mechanisms that give rise to intra-national green neocolonialism.

Introduction

> "We need to stop being complicit with the silencing structures of the colonizing university. We need to share information, stories, and knowledge"
>
> Lorgia Garcia Peña

As a postdoctoral fellow at Georgia Institute of Technology, Atlanta (US), I mostly engage with STEM majors in my classes – a young generation that puts their unabashed faith in technology for a better future. This optimism often remains comfortably distanced from the imperial footings of technology. So, how can teaching a Hindi film, Atlanta's Cop City project, and the ongoing genocidal violence against Palestinians create an environmentally conscious and anti-imperial learning experience? I reflect on those pedagogical possibilities here by discussing the imperial foundations of the western education system, positioning myself as the "other", the anti-green context that needs centering in western academic spaces, and briefly discussing the ways I follow decolonial teaching in my classrooms and beyond. Through designing themed English courses on postcolonialism, film, and literature, I have used the Hindi film *Sherni* (Masurkar, 2021), Atlanta's environmental concerns, and Israel's occupation of Palestinians as a critical lens to encourage decolonial green mindfulness in an otherwise tech-dominated western academic space. Though seemingly disparate, these three subjects expose the intertwined capitalist imperial machineries of land control, resource extraction, and subjugation of people that a tech-obsessed academic space must become aware of.

The Hindi film *Sherni* functions as a starting point to understand how the rhetoric of expansion, extraction, and land development in a postcolonial world is often based on the erasure of indigenous farming practices, forcible relocation of population from their lands, in addition to recruitment of law, criminals, and political figures to build oppressive regimes. Once the tone is set, discussions on the local issue of cop city and the global case of Palestinian territories help drive these major arguments home: 1) colonization is deeply rooted in the erasure and control of natural resources and 2) often a postcolonial nation-state functions through such colonial mechanisms that give rise to intra-national green neocolonialism. It is crucial to note that I inhabit a space in the United States of America, where "settler colonialism triumphed"–a country which is a "fragment of Europe" (Mamdani, 2015, pp. 596–598). Thus, it is not impertinent to ask: what does it entail to practice an anticolonial/anti imperial/environmentally conscious pedagogy in a land rooted in genocide, slavery, and white supremacist ideology? But first, a brief look at the colonial footings of US academia follows.

Colonial residues and green crimes of the US empire

In the book *Unsettling the University: Confronting the Colonial Foundations of US Higher Education*, Sharon Stein (2022) skillfully argues that the liberal foundations of US universities are still "rooted in long-standing architecture of dispossession and accumulation" calling it a "colonial template" on which US higher education has been founded (p. 4). Scholars have also uncovered the connections between colonialism, capitalism, and climate change that continue to this day. Stein goes on to state that:

> these connections point to the close relationship between...the systemic, historical, and ongoing racial-colonial violence that enables the US socioeconomic system and the comforts and securities it promises its citizens (especially white citizens) and... the inherent ecological unsustainability of a socioeconomic system that is premised on infinite extraction, growth, and accumulation, given that we inhabit a finite planet. (p. 10)

It is thus critical to be aware of the green crime that the US continues to commit with impunity. For instance, a cursory look at the Wikipedia page of Bhopal Gas Tragedy unveils that the Union Carbide Corporation has been responsible for what is considered the world's worst industrial disaster. More than 500,000 people in the small towns around the UCC plant were exposed to the highly toxic gas methyl isocyanate. A Yale Review's report titled "The Colonial Legacy of Environmental Injustice in U.S. Territories" (Rudge, 2022) holds the US responsible for violating environmental laws and damaging Puerto Rico, Guam, American Samoa, and Marshall Islands, to name a few and continuing "environmental oppression" (Rudge, 2022).

In the case of Gaza, the United Nations (2024) has notified that removal of the 40 million tons of rubble left in the aftermath of US-funded Israel's bombardment could take 15 years and cost between $500-600 million. TRT World (2024) also reports that more than half of Gaza's agricultural land, which could have been crucial for feeding the starving population, has been ruined by the carnage. United Nations collected data that reveals a rise in the destruction of orchards, field crops and vegetables in the Palestinian enclave. In "Beyond famine and chaos: The case of Gaza", Mohamed Buheji and Amir Hasan elaborate how agricultural de-development has been a trusted agent in times of war and chaos. During the Vietnam War from the early 1960s to 1973, the extensive bombing campaigns conducted by the US destroyed infrastructure displaced millions of civilians, and disrupted agriculture and daily life while chemical agents destroyed jungle areas resulting in long-term environmental devastation and health issues (2024, p. 3). Similarly, the Israeli Defense Forces' deliberate "destruction of the food stores, food convoys, and other civilian food market infrastructure exacerbate the humanitarian situation in Gaza and impact food security." Reports show that "the damaged agricultural land has risen from 6.6 per cent in October 2023 to 34.2 per cent in January 2024", which means a "418.8 per cent increase in the damaged agricultural land in four months" (2024, pp. 5, 12).

Likewise, Atlanta contains the most tree canopies in the US, which cover around 48% of the city. The South River Forest greenspace is known as the lungs of Atlanta, which is now slated to be turned into a police-military training complex. *Columbia Climate School* report (2023) states that in DeKalb County, which contains the neighborhoods surrounding South River Forest, the population is predominantly Black.

The majority live at or below the poverty level and also have some of the country's highest rates of poverty, asthma, and diabetes. The South River Forest is considered one of the largest unspoiled areas left in the Atlanta metro area, and the tree canopy is critical to reducing the urban heat island effect that raises temperatures in Atlanta by up to 10 degrees. Furthermore, with a 75% increase in heavy rainfall in Atlanta, green space is needed to reduce stormwater runoff. These benefits will be lost due to the deforestation of Cop City (Desai, 2023).

It is therefore not surprising that the environmental cost of war on Gaza and the Cop City project remains decentralized and actively removed from students' cognizance as learning about them destabilizes the "ivory towers of western education systems" that have "appropriated knowledge as an exclusionary, ego-centric, and universalized system of capitalistic pleasure" (Dey, 2023, p. 2).

In his book *Green academia: Towards eco-friendly education systems,* Sayan Dey (2023) connects such practices to colonialism-controlled knowledge creations and states that "the knowledge systems that were rooted in the natural environment were systematically, epistemically, and institutionally disrupted by the European colonizers" (p. 2). Thus, when it comes to the question of green pedagogy within US academic spaces, drawing connections between European colonial empires, US imperialism, capitalism, and nature is hardly a beginning point for environmental concerns. Consequently, an anti-imperial green consciousness among young students remains severely underdeveloped. So, what happens when an immigrant woman of color from a previous British colony attempts to develop a green pedagogical foundation? What anxieties and fears cripple her?

Positioning the other

A tectonic shift occurred in the US academic spaces after October 7, 2023. Conversations on colonialism, environmental issues, and decolonizing academia which were common around me came to a sudden halt. Several of my peers and friends confided in me how their attempts at discussing the genocide of Palestine have been met with silence, microaggressions, or in many cases, retaliation. They were asked to stay mum. Opportunities were taken away and microaggressions followed. I was at the receiving end of such imperial attitudes too. One of colleagues invited proposals for a workshop on innovative pedagogical practices. As she had worked with me on a committee dedicated to challenging white hegemonic pedagogical practices before, I promptly proposed a session on "Teaching Palestine and its Benefits in a Communication Class." Three weeks went by. I did not receive any response, and my so-called friend simply stopped talking to me. I was reminded yet again not to read white niceness as solidarity. Even though, my experience at my current institution was comparatively more positive, I feared being suspended, and losing a job I loved, or the worst–being deported.

In the 2022 book *Community as Rebellion: A Syllabus for Surviving Academia as a Woman of Color*, Dr. Lorgia García-Peña, a writer, activist, and scholar specializing in Latinx Studies with a focus on Black Latinidades, narrates the various ways she struggles to "to find [her] place in [US] academia" (p. xv). Quite similarly, as an Indian immigrant woman from a working-class background with strong postcolonial training, I navigate the multitudes of power dynamics and imperialist restrictions to raise students' consciousness in decolonial concepts and perspectives. My chosen decolonial pedagogical ethos often keeps me on edge. Harsh judgements and negative evaluations could cost me my career. Such suspicions remain abundant. Most importantly, as a postcolonial educator who centralizes praxis in her classrooms and scholarship, I often find myself as an outsider in the US academic space. In this settler colonial and imperialist space, such an "unbelonging" leads to what Peña terms as "violence of exclusion" that continues to shape universities as per the European colonial racist structure (p. xv). This violence can be silent but is nonetheless piercing and painful.

The feeling of unbelongingness intensifies while bringing issues like the Israeli occupation of Palestine to an American tech classroom as ramifications follow. *The Intercept* reports (2024), "when scholars themselves espouse support for Palestine and opposition to the Israeli state, professional consequences have frequently been grave" (Lennard, 2024). Atlanta's Emory University's students and professors led a series of courageous nonviolent protests only to be assaulted by the police and thrown into prison. Writing for *Common Dreams* (2024), Julia Conley reports how Dr. Caroline Fohlin and Dr. Noelle MacAfee were pushed to the ground and handcuffed simply for intervening police violence against protesting students. People I know have been teargassed, hit in the face, and called terrorists. *Al Jazeera* (2024) reports how international scholars face "heightened consequences" for their involvement in pro-Palestinian protests (Gohn, 2024). In the essay "The coloniality of academic freedom and the Palestine exception", Jairo I. Fúnez-Flores (2024) meticulously details his ordeal after he voiced support for Palestine at his university. He received death threats, was put on leave, and did not receive any institutional support. He argues that educational institutions weaponize antisemitism and "knowingly violate academic freedom and speech" (pp. 466-467).

These attitudes reek of privilege and orientalist attitudes of Western academia that Edward Said talks about in his book *Politics of Dispossession* (1995). Teaching Palestine is criminalized in such spaces and is "made worse by the incredible silence of Western academics and intellectuals" (Said, 1995, p. 131). Speaking of such attitudes, Professor Peña has rightfully stated, "While strangers...are invited to be part of the elite university through neoliberal practices of diversity and inclusion... [women of color in academia] are also asked to assimilate via silence or erasure" (2022, p. 9). The expectation is to be likeable by the average white population and their imitators. Thus, criticizing an ongoing genocide and annihilation of a civilization is deemed *complex* and *controversial*. The silence on this subject around me exacerbated my fears. While colleagues appreciated my efforts to teach about the subject – hardly anyone volunteered to share the load. This load was also emotional as my close Palestinian friends were battling colonial violence in Gaza and Hebron, West Bank. When I

shared the nightmares that kept me from sleeping, I received a "Oh, that is sad. I am sorry" in a typical American way– performative and hardly interested in building solidarity– "words of consolation...offered in private" (Peña, 2022, p. 43). I was alone on my journey. Furthermore, technologically driven learners place undying optimism in the successful future that severs them from the ground realities of colonial expansion, environmental degradation, and genocidal governmental policies. Tech-oriented solutions are hyped in such spaces and hardly any consideration is put into the rise of tech colonialism. Helga Tawil-Souri's 2012 essay "Digital occupation: Gaza's high-tech enclosure" is a good beginning point to understand how technology strengthens colonial and imperial occupying powers. How can I make my students realize that not being encouraged to study Palestine and Cop City is a colonial project that is "framed around narratives aimed at sustaining dominant structures of power?" (Peña, 2022, p. 15).

One of the ways to challenge this hegemony of US education systems was to wear my unbelonging as a "badge of honor" (Peña, 2022, p. xv) and continue the ethical work of shaping decolonial intellectualities. But I also noticed that the Gen Z generation I was teaching was more environmentally conscious than their previous generation. This group was also "inheriting significant sustainability, climate change and socio-economic challenges compared to their predecessors... and were more inclined towards sustainability concerns" (Tan et al., 2023, 317). At my institution, recently, an organization called *Students Organizing for Sustainability* held an event to mark the 40-year anniversary of the Bhopal disaster. Two female survivors spoke about the continued health issues and lack of reparations their families face. I found this an opportune moment to teach colonial, "environmental and social issues...together rather than separately" (Tan et al., 2023, 316). For this pedagogical praxis to materialize, I also understood the need for a safe learning community that encourages "problem-posing, authentic democratic dialogue, and praxis-based learning outcomes" (Tan et al., 2023, p. 316). I began this journey by first connecting the ecological disasters across the globe and using a narrative film in the process.

From India to Atlanta to Palestine: The (anti)green context

The images below fictional or otherwise, point towards state-led deforestation, restructuring of indigenous lands in ways that restrict people's mobility, and most importantly capitalist greed. The Hindi film Sherni, the construction of a massive police training center by obliterating a large green space, and the environmental disasters that will continue to affect heavily bombed Palestinian areas reinforce the fact that the colonial tool of expansion, abuse of natural resources, and apathy of the state and its repressive apparatuses converge. In the 2024 book *Beyond Cop Cities: Dismantling State and Corporate-Funded Armies and Prisons*, Joy James states how studying Atlanta's Cop City project reveals the links between militaristic policing and genocidal wars (p. 2).

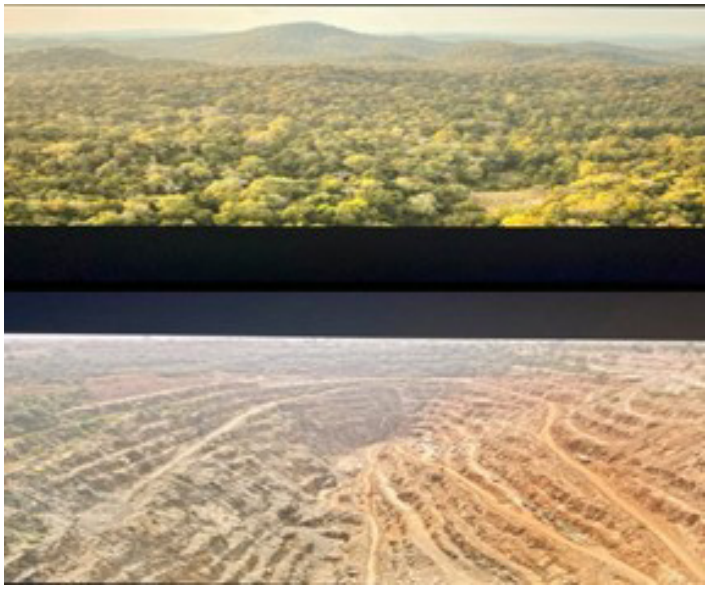

Figure 1: *Sherni* (2021), Amazon Prime.

Figure 2: "Atlanta Police Foundation unveils preliminary renderings of new training center." The Atlanta Journal Constitution.

Atlanta's environmental activists attribute the name "Cop City" to an 85-acre police and fire department training center currently under construction. The city of Atlanta wants to build a $90 million police training facility that would be one of the largest militarized police training centers in the country—by clear-cutting Atlanta's largest green space. *Unicorn Riot* notes that this facility costs $90 million for its initial phase and will be built on an 85-acre land "within a huge swath of forested land in unincorporated DeKalb county southeast of Atlanta." That part of land was formerly a city-run prison farm from 1920 to 1989. "The facility was used to house prisoners from Atlanta who were forced to work on the farm raising food for the city's prison population." Previously the land was used by Atlanta city as a "dumping ground", and the forest around it has continuously been a victim of such "carceral infrastructure." (Fatica, 2022). This project faces massive opposition in the city as local activists argue that "Israel's Defense Forces (IDF) may become a component of Atlanta's Cop City, thanks to the Georgia International Law Enforcement Exchange (GILEE) program, a university-based police exchange program that focuses on enhancing homeland security efforts through international cooperation and training programs (Herskind, 2023)." The interconnected imperial mechanisms of the US

empire on local and global level motivated me to center these concerns in my post/de-colonial themed classes.

Furthermore, I have previously written about how in the film *Sherni* "a nature-wildlife-human triad illuminates the environmental deterioration at the hands of a powerful few" (Rathour, 2022, p. 31). Scholars like Nasooha (2024) have astutely explored how the destruction of Palestinian land, olive trees, and its indigenous ways of living has led to "environmental apartheid." She states,

> The appropriation of land and ecology is just one of the various methods employed by Israel to support Zionist claims. In an effort to erase Palestinian traces from the land and establish Jewish settlements, Israel has engaged in environmental apartheid, by which they systematically exploit the Palestinian environment through discriminatory practices like water and land restrictions, destruction of agriculturalland, and uprooting or burning of trees. (Nasooha, 2024, p. 114)

The natural habitat, the environment, and the indigenous lands have mercilessly fallen victim to the colonial, neocolonial, and neoliberal western empires–or to the postcolonial states who frantically aim to construct themselves in the image of the west. As such, teaching these connections "mak[e] sure that the planetary effort to transform ego-centric education systems into ecofriendly education systems never ceases" (Dey, 2023, p. xvi). However, when educational institutes actively nurture an oppressive police and imperial US state, practicing this pedagogy as an immigrant woman of color automatically becomes an act of rebellion. The application of green pedagogy can be thus considered a political, antiracist, and decolonial instrument as an environmental one.

Training the self to transgress

In order to create an ecofriendly and antiimperialist education space, one must take time to train themselves to transgress these oppressive imperial boundaries of western academia. I began armoring myself with the wisdom of educators like Bell Hooks (1994) and Paulo Freire (2017). Sayan Dey's 2023 book *Green Academia: Towards Eco-Friendly Education Systems* brought together the anticolonial, antiracist, class-conscious, and environmental orientation I needed before beginning such a pedagogical endeavor. The reality of Palestine is often misrepresented in the US. Palestinian American scholar Edward Said's work has "illustrate[d] how knowledge systems are constructed to serve imperial benefits and fulfil their colonial visions" (Ismail et al., 2024, p. 11) that have largely distorted Arab histories and culture. Within this context and considering the US state's unabashed military support to the Zionist regime in Israel, it is essential to question and critique the colonial foundations of US knowledge production.

Professor Hatem Bazian states that "pro-Israel groups in the [US] are the primary funders, producers, organizers, and distributors of Islamophobic content, which dominat[es] political and public discourses in Western societies." In such a context, because of the "existing fear of being targeted for writing or highlighting Israeli links... an academic distance from the subject of Palestine is reinforced" (2015, p. 1058). Furthermore, the Israeli colonial regime maintains deep ties with the Atlanta Cop City project, as stated above.

Centering activists' voices in academia

To gain a deeper understanding of the ties between Israeli imperialism and Cop City, I reached out to student activist Garrett Brand, asking if he would want to be interviewed and quoted for this essay. Brand readily agreed. During our video chat, he revealed the explicit connections between Israel and Cop City. He said that the "idea of Cop City is directly modelled off an IDF (Israeli Defense Forces) training facility called 'Little Gaza'–a miniature version of Gaza to train [the] IDF soldiers" that can be verified by reading *Wall Street Journal's* article titled "A look inside little Gaza" (Rasmussen et al., 2023). The second connection, Garrett revealed, exists between the GILEE program within which the Georgia Law Enforcement Officers "get shipped off across the world but most notably to Israel to train with the IDF and in exchange the IDF officers come and train [in Atlanta and the US]" creating a collaboration of oppressive police and military power (G. Brand, personal communication, June 18, 2024). While one would emphatically agree that teaching about the environmental degradation of our local community and Palestine seems urgent, one would also agree that doing so in the heart of Georgia, the US, as an immigrant woman of color seems like a step towards career suicide. US academic spaces discourage practices of anticolonial green pedagogical practices by obscuring its complicity "under the glossaries of capitalism/colonialism that consist of terms like 'modernism,' 'industrialization,' 'sustainability,' 'green capitalism,' 'ecological balance,' environmental stability,' and 'economic growth'" (Dey, 2023, p. 10). Thus, while events and conversations around environmental issues frequent US college campuses, they hardly play a part in turning passive students into active critical thinkers and action-takers. When someone like Garrett Brand does so, they immediately turn into a threat to the status quo. But Brand also reminded me that to puncture the imperial core, sacrificing personal interests is a requirement. Additionally, utilizing activists' voices as a pedagogical tool helps ground academic discussions into material realities affected by colonialism and eco-imperialism. Also, Bell Hooks reminds us that for women like me "our devotion to learning... was a counter-hegemonic act [and] a fundamental way to resist every strategy of white racist colonization" (1994, p. 2). Like Hooks, I adhere to centralizing pleasure and excitement in a classroom dedicated to decoloniality and green consciousness in opposition to the western expectation of seriousness in learning (1994, p. 7). From Paulo Freire, I commit to establishing *conscientização* in the classroom–"learning to perceive social, political, and economic contradictions, and to take action against oppressive elements of reality" (2017, p. 9). This form of radical, decolonial and green pedagogy requires an "increased commitment to the position one has chosen, and thus ever greater engagement in the effort to transform concrete, objective reality" (Freire, 2017, p. 11). I never forget Sayan Dey's words that "human existence is always attributed to nature" (2023, p. 2). Thus, an ethical

necessity arises to reorient my learners into realizing that Palestine's colonization is deeply connected to Atlanta city's neocolonial practices towards its "local environmental and economic systems" (Dey, 2023, p. 3). Moreover, Edward Said's advocacy for interdisciplinary approaches in academia that could encourage the dissolution of artificial barriers between disciplines (Ismail et al., 2024) encouraged me to teach these different yet connected eco-cultural identities. I hope that learners can be motivated to examine power dynamics between the colonizing and the colonized world that could eventually create a sense of social responsibility, and global awareness embedded with empathy (Ismail et al., 2024).

Empowered by these educators, activists, and thinkers, I remind myself that "no education is politically neutral" (Hooks, 1994, p. 37) and that I am no longer going to be the "objectified" postcolonial educator within a white/west "bourgeoise" space (p. 16) that cages one into "ivory tower isolation" and that I was going to create pathways to holding dialogues with my students and practice "problem-posing" pedagogy to get them thinking about solutions or the lack of it (Freire, 2017, p. 50). But how exactly does a fictional Hindi film fit into this ambition? Because fun is essential to resistance, an escape in a fictional world is sometimes needed.

Film and its radical pedagogical possibilities

For the Senegalese filmmaker, Ousmane Sembène films were like a "night school"–a tool to educate and encourage the masses to question their reality and the world (Gadjigo, 1993, p. 2). I use cinema as an anti-imperialist tool in my classes. Teaching the Hindi film *Sherni* (Tigress in English) provides a brooding environmental commentary on the growing intra-national neocolonial practices that endanger indigenous populations whose livelihood remains dependent on nature and wildlife. The intricate connections between environmental conservation, bureaucratic corruption, wildlife preservation, and indigenous proletariat rights are explored through Vidya Vincent in the film – a newly appointed Divisional Forest Officer who must solve the case of a human-eating tigress that puts local villagers' lives in danger. Soon, Vincent finds that between the iron mining capitalists, landowners, and the local officials who side with the powerful, the tiger and the human population remain neglected, abused, and in a continued "state of injury" (Mbembe, 2019, p. 21).

In the context of green pedagogy, this film provides numerous possibilities. Firstly, students are introduced to Hindi cinema beyond white-western assumptions that classify them as a form of unserious cinema or as Madhava Prasad argues, "not yet cinema" (1998, p. 2). Including such movies also "afford the college instructor an opportunity to provide students with a window into what for many of them is a foreign culture while also focusing on a specific topic" (Mehrotra & Gibbs, 2022, p. 11). Secondly, one can analyze how the rhetoric of capitalist development, progress, deforestation, and/or industrialization in postcolonial societies mirror the European colonial practices of pillaging, land grabbing, feudalism, and resource exploitation. The film shows how an iron mining project has led to massive deforestation and has made travelling for villagers excruciatingly longer or nearly impossible. The shortcuts through the forest are no longer accessible as the forest officers have asked the villagers to stay away from the danger of the tigress. The tigress emerges as the scapegoat for governmental practices, very much like the indigenous populations who are often categorized as troublemakers or terrorists when they rise against their subjugation. Thirdly, the film puts forward the issue of gendered environmentalism for discussion. While patriarchal ethos requires the success-oriented male figure to be profit-focused, concerns about the climate and nature are often termed as feminine virtues. Through the character of Vidya Vincent, one clearly understands this dichotomy as those who make her work difficult are exclusively men: local political parties, her supervisor, and the hunter hired to kill the tigress.

The Indian film *Sherni* proves useful in discussing global environmental issues. Moreover, by placing a fictional film besides the issues of police brutality and genocide, students can be led to discuss the need of green storytelling and filmmaking. In an American institute that often holds tech-savvy and sports-obsessed student population, Sherni can severely dismantle the culture of gadgetry obsession that reduces the human component in learning. An institute like mine boasts about its majority-minority population–more than 40% carrying Asian, South Asian, Hispanic, and Native ancestry–populations that navigate East and the West carrying a strong dose of postcolonial ambivalence within them. That is why, Hindi films like *Sherni* come in handy in creating a solid postcolonial foundation upon which discussions on Palestine or a police state can take place with some ease. And of course, one must not underestimate the power of joy and pleasure that Hindi films carry. Bollywood (as the Hindi film industry is popularly called) is immensely helpful in providing a relief when teaching intense topics like colonial violence, apartheid regimes, and American imperialism to those who have been majorly trained to glorify US exceptionalism.

Teaching Cop City

In my close to a decade of experience of living and engaging with progressive/liberal chatter in the US, I have noticed a shameless hypocrisy. On one hand, the neoliberal population, academic or otherwise, hails a figure like Greta Thunberg while remaining willfully ignorant of the environmental crisis caused by their favorite celebrity Taylor Swift's private jets. When I was organizing events around Iranian women and their rights during my graduate school, liberal white feminists cheered me on overwhelmingly. They also made sure to teach and talk about the subject without any fear. The same feminists, Thunberg-supporting-warriors, fell silent when mothers in Gaza lost their children. This silence still continues. Maybe this sounds like a bitter opinion but in a settler colonial state, such opinions carry obvious patterns of truth. Sharon Stein (2022, p. 15) says that:

> Dominance of the Western university significantly narrows which (and whose) knowledges, experiences, and forms of education are perceived

> to be legitimate and worthy of study, and this narrow range of possibilities is repeated in most mainstream US higher education history texts.

Within this colonial capitalist context, it does not seem surprising why issues affecting the poor, racially marginalized, or Arab and Muslim women remain ignored. Stein also states that this model of growth, expansion, and wealth accumulation hardly worries about "its negative impacts on the human and other-than-human beings" (2022, p. 3). Paulo Freire says that one can "witness the oppressed becoming the oppressors by remaining silent today" (2017, p. 20). While the US culture boasts of progress and caring for human rights, talks hardly translate to action. Teaching Cop City and especially its connection to Palestine's occupation is essential as it holds a mirror to the proponents of human liberty. In an imperialist context, the creation of knowledge, no matter how progressive, still positions the white colonial system as a de-facto zone of culture and knowledge production. Edward Said in *Culture and Imperialism* painstakingly discusses this very phenomenon that "invent[s] a tradition" for knowledge production laced with imperialist connotations (1994, p. 191). Here, the Western point of view still remains unchallenged and escapes accountability.

Teaching Cop City is the ethical test for those liberals whose theories do not match their actions and who cannot create "links between themes" (Freire, 2017, p. 81). Moreover, it poses the questions: "how can one focus on their local communities and create a bridge between theory and practice? How can learners commit to praxis of refection and action" and "perceive... and understand [their immediate reality] in order to transform it" (Freire, 2017, pp. 25–27).

Georgia, Atlanta consists of a strong Jewish population–both who resist Israeli occupation of Palestine and those who support it. A classroom in such a context can be a troubling place for an educator like me. However, teaching about Cop City and its collaboration with the Israeli Defense Forces can be used to discuss the global reach of US policing systems. Connecting this topic to reproduceable colonial tactics which will go on harming the Black communities in the longer run can encourage the learners to move beyond their personal beliefs and think about other vulnerable populations. In this way, green pedagogical practices can challenge the hyper-self-indulgence of US culture that often gets popularized as self-care.

Palestine: The ultimate moral test of anticolonial principles

The necessity to teach about Palestine and its environmental crisis must begin with a strong decolonial responsibility. Sharon Stein (2022, p. 263) recommends the following ways to do so:

> *attributability*, or recognition that the privileges and benefits [US Americans] enjoy are rooted in historical and ongoing colonial, racial, and ecological harm; *answerability*, or recognition of one's role in the systemic dimensions of harm; and *accountability*, or recognition that one is both systemically culpable and individually complicit in harm and that there is thus both an individual and collective obligation to interrupt the reproduction of harm, enact restitution, and repair harms already done.

The attributability begins with the horrid fact that the US imperialist state is majorly responsible for the genocide (human, livestock, and environmental) of Palestinians. Truthout reports (Zhang, 2024) that "nearly $25 million in weapons and military assistance sent to Israel each day." Since this report, three months have passed (Zhang, 2024). One must also recognize that to support decolonization of Palestine is not antisemitic. If it was, one would not have Jewish educators, scholars, activists, and Holocaust survivors working relentlessly for Palestinian liberty.

Once this recognition has been made, the path to recognize one's role in this colonial setup would be a natural urge. As an educator, the recognition of my caste's role in maintaining a casteist hegemony was mentally and emotionally torturous. However, the reduction of harm is impossible without this step. Several anti-Zionist scholarships/art/films from Jewish writers, activists, organizations, and scholars like Noam Chomsky, Naomi Klein, Normal Finkelstein, Miko Peled, *Jewish Voice for Peace, Rabbis for Ceasefire,* Gabor Mate, Jonathan Glazer and many more are readily available to unlearn that one's sovereignty must not be attained via another's annihilation. And to undo the harm, teaching and talking about Palestine is a good first step. For example: In my case, teaching excerpts from Israeli historian Ilan Pappe's *The Ethnic Cleansing of Palestine* (2006) has proved eye-opening for my students. Throughout the years, several have expressed how much they appreciated that conversation on Palestine-Israel was normalized in the classroom. In the next section, I most humbly share my experiences and continued work to bring green consciousness to my students and the larger Atlanta community.

Green pedagogy in praxis

Urban Atlanta is a city of possibilities but also a strong reminder of a decaying culture with severely segregated urban and green spaces. Accessing nature takes special trips and detailed planning. One cannot even open the window to let the breeze get in. We live in apartment complexes that resemble prisons. Closed off, fenced off, on higher mounds signaling its expansiveness. In this pronounced difference between natural/corporate-like and rich/poor, one is reminded of the "imperial tradition which serves to underwrite a managerial and instrumental approach to nature" (Jorgenson, 2011, p. 51). The ways to implement decolonial and green pedagogy came as an epiphany.

One fine day, as I was preparing to embark on my postdoctoral position at the prestigious and highly revered Georgia Institute of Technology, my laptop reminded me of a new email, musically. In that typical before-you-begin type of long note, I noticed the sender's signature saying this at the end in italics: "Georgia Tech is located on the ancestral lands of the Muscogee (Creek) Nation, ceded as part of the coerced First Treaty of Indian Spring in 1821." The framing

of this sentence was peculiar. The words 'located,' 'ceded', 'treaty' hid the settler colonial intent of dividing and ruling the Muscogee and the Creeks and thwarting their alliance against a common enemy. Such land grabs under white man's laws have always meant getting rid of the native ways of living–entwined with nature. To turn this epistemological violence on its head, I wrote the following in the header of the syllabus for Fall, 2023: "*Georgia Tech occupies the lands of the Mvskoke (Muscogee/Creek) peoples*."

The class was called *Postcolonial Narratives*. The first step towards a green pedagogy is to centralize the European capitalist-colonial occupation of Native Americans. Georgia Tech, hence, is not *located* but actively *occupies* the Native lands still. Relegating the reality of settler-colonialism to a last sentence in an email signature while reducing the impact of its inherent violence through passive voice and hence making the perpetrator invisible is exactly what is wrong with the US colonial education model: performative action that leads to no mental registration of the meaning of the sentence. Frantz Fanon has argued that the practice of decolonization means "The last shall be first and the first last" (2004, p. 14). Pedagogically, I began so with a simple rewriting and repositioning of a last sentence in an email signature. Beyond that here's what I did and continue to do:

1) Addressing the wounds on both sides: Rolando Vazquez's "Pedagogies of relationality" ask one to recognize the "paths into the future that have been severed by coloniality" (2020, p. 173). This positions us "toward a path of healing the colonial wound"... mourning on the connected patterns of loss and trauma on both Jewish and Palestinian sides so that one can teach to "create the possibilities for unlearning, listen¬ing, receiving, sensing, creating, recovering, and healing that is necessary for knowledge cultivation" (Bibi-Sheik, 2022, p.102). Teaching Palestine must not begin by overlooking the horrors of the Holocaust that created a dire need for Jewish safety. Once I explain the human condition on both sides, I use Vox as my trusted media source. Its 2023 YouTube explanation "How Palestinians Were Expelled from their Homes" exposes the mastermind behind it all: The British Empire. How two vulnerable communities were lied to, and how Palestine became the sacrifice zone for Europe and Germany's desperate attempts to leave behind its Nazism-ruled past proves eye opening for my US students growing up in the prime of US propaganda.

2) Getting educated to educate: I attend teach-ins and workshops locally and online on a variety of subjects: Zionism, Israel, and Settler Colonialism, Environmental Aftermaths of US-led Wars organized by scholars, academics, and organizations like *Jewish Voice for Peace*. Additionally, the scholarships of Edward Said, Rashid Khalidi, Noam Chomsky, to name but a few, continue to deepen my understanding of the issue at hand. I also collect social media educational resources and watch numerous YouTube videos from trusted sources like Vox, Al Jazeera, and Democracy Now. Whatever I learn, I share with my students and encourage them to bring their existing knowledge to the classroom. I often emphasize that I do not claim authority on this subject.

3) Recognizing bias, creating dialogue and synthesis: When we engage with the first step, my students and I create a Google document including a table divided into three sections: a) What have I heard about Palestine-Israel? b) What research have I done, and what sources have I used? c) What would I like to know? The document was editable by everyone in the classes. In the Spring and Fall of 2024, we looked at one column and row and discussed the points in detail. I projected that Google document that enabled students to see various and differing points of view. We ended with the synthesis of these ideas and questions that needed further research. I call this activity "cutting the noise." The rationale is to question what we know, how we know, and what we do not know. This exercise also involves students in the process of their learning (Lorenz & Guan, 2023, p. 273). Since October 7, 2023, western media outlets have engaged in biased reporting on Gaza and Palestine. By engaging with examples of biased reporting, my students understand how English language as a tool of empire has dehumanized Muslims and Arabs in the American minds.

5) Connecting colonialism, modern state, and environmental concerns: Cameroonian scholar Achille Mbembe (2019)'s essay "Necropolitics" proves to be a masterpiece when it comes to connecting colonialism, the foundation of violent sovereignties, and the colonization of Palestine. Teaching this has always shown my students that the state has a monopoly on violence, and it kills with impunity. To kill is to self-define and self-actualize. Linking these points to the far-right Zionist propaganda against Palestinians then becomes easy. Furthermore, the discussion of slave plantations, the construction of Nazi concentration camps, and the apartheid regime in Palestine drive the points home. Additionally, sources like Nelson Mandela's speech (1997) on solidarity with Palestine and explaining the similarities between South African and Palestinian colonial conditions prove hugely beneficial.

6) Building community: I successfully created an assignment called "Walk with Me on the Atlanta Beltline" as an extra credit option during my Spring 2024 English class. While our class had built a truly de-hierarchal learning community based on the principles of "pedagogical fluidity", I was tired of the monotoned classroom walls that still kept our new formed anticolonial green consciousness within the confines of a tech institute (Dey, 2023, p. 79). I saw this as an attempt towards "de-authorizing and de-monopolizing an English curricula...where the individuals do not merely function as suppliers and consumers but collectively participate in ecological" learning and "community building" (Dey, 2023, p. 75). As we walked in groups, we discussed how urban spaces are designed, why our walking routes are accessed mainly by upper middle-class Americans, why some houses are built on higher mounds, and what could be the implications of carving out streets from lush jungles. These questions also made students critically evaluate the Cop City project and find commonalities with the Hindi film *Sherni*. Furthermore, I invited my students to participate with me on a symposium panel titled "Postcolonialism and Media." As a panel, we prepared and presented work ranging from reality TV shows, Taylor Swift's role in environmental damage, and Palestinian short films *The Present and Bonbone* that skillfully show the limitations to accessibility for Palestinians and the reshaping

of indigenous lands to put Israeli apartheid systems into play. As Dey rightly asserts "eco-centric, community-based [pedagogical] methodologies" accentuate the advantages of teaching practices that are "anti-capitalistic, collaborative, and [based on] shared agencies" (2023, p. 79). Beyond building communities with my students, I also reached out to several student organization on campus. Student activists were involved in sustainability initiatives, Stop Cop City movements, centering Palestinian narratives, and demanding Georgia Tech to disclose its involvement with US military and Israeli war machinery and dissociate itself completely. In my unbelongingness in white imperialist US academic spaces, these young leaders became my hope. By attending their events, I have continued my goal of getting educated to educate.

7) Resistance cinema and the role of environmental films: It was the summer of 2024. Empowered by successful implementations of my decolonial, non-white pedagogical standards and local and national student activism against Palestine's occupation and Cop City projects, I was desperate to create a city-wide educational initiative. In May, my husband, a fellow postcolonial educator enthusiastically introduced *Refaat Mobile Library*, a "traveling volunteer-run liberation library in Atlanta in honor of martyred Palestinian poet and professor Refaat Alareer" (https://www.refaatlibrary.com/home). We both immediately joined as volunteers, which opened the much-needed floodgates of decolonial, anti-war, and environmental organizing.

In June of the same year, my husband and I decided to merge our cinephilia and love of teaching in the form of *Resistance Cinema* – a free monthly film collective aimed at radical education via cinema. Since June of 2024, our collective has screened thirteen films including a 3-film series on Palestine and a short documentary, Cop City. To bridge the gap between education and activism, we invited Georgia Tech's *Stop Cop City* members for a panel discussion after the screening. The event was attended by more than 50 people. In November, we hosted a South Asian film and teach-in series including films/documentaries on Kashmir and the Bangladesh Student Protests of 2024.

Resistance Cinema also screened essential documentaries like *The Settlers* and *1948: Creation and Catastrophe*, which shows the loss of Palestinian land, livelihood, and continued ecological colonialism practiced by the Israeli government and military. As the war continues, "the planet-warming emissions generated during the first two months of the war in Gaza were greater than the annual carbon footprint of more than 20 of the world's most climate-vulnerable nations," *The Guardian* reports. The report further states "the climate cost of the first 60 days of Israel's military response was equivalent to burning at least 150,000 [tons] of coal." As I write this, Palestinians have endured more than 400 days of non-stop killing and relentless bombing.

Conclusion

Climbing on trees, getting bitten by bugs, or drenched in rain were the best times of my childhood. Interacting with nature was highly encouraged along with its relishes and dangers. I come from a family that has been displaced multiple times. My father worked as a bank manager in Hindustan Fertilizer Township, Barauni, in the Indian state of Bihar. The township was built in the late 1970s where the employees of The Hindustan Fertilizer Corporation of India lived. As HURL's (Hindustan Urvarak & Rasayan Limited) new fertilizer plant was announced to take over the township, the displacement of existing residents was announced. Being a bank employee, my father had no choice but to leave as soon as possible. We had no funds to buy a house or build one. I choose to leave this story incomplete. However, I must confess that my life made me acutely aware of corporations, their logic of appropriation of natural resources, and their manipulation of the local population for profit.

Through this essay, I have shared my utilization of the Hindi film *Sherni*, Atlanta's Cop City project, and genocidal violence against Palestinians to create an environmentally conscious and anticolonial learning community. I have also shared my implementation of green pedagogy in and beyond the classroom spaces. These pedagogical practices encourage learners to think about governmental and institutional policies and put into practice the "ecopedagogical conceptual framework for sustainability education" as discussed by Tan, Wanganoo, and Mathur (2023, p. 218). While still a work in progress, I hope these musings provide some insight into enabling and strengthening green academic practices. I also hope they initiate more conversations on "the oppressive regimes use [of] science and technology for manipulation and repression" (Freire, 2017, p. 34). But most importantly, I hope my essay activates a global teachers' solidarity movement so that we can "deal with the problem of oppressed and oppressor consciousness" and initiate a longlisting green-minded "conversation leading to love" (Freire, 2017, pp. 29–30).

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Greening pedagogy: Ecopedagogical approaches to English language teaching

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Abstract

In the current era of neoliberalism and globalization, the pedagogy of English studies must undergo a radical transformation. This entails integrating cultural components and reconstructing canonical paradigms to address contemporary human and environmental crises within pedagogical frameworks. Greening pedagogy advocates for climate activism, empowering learners to become eco-warriors by fostering critical consciousness about environmental issues facing our planet. In the realm of language education, the National Curriculum Framework (NCF 2005) of India asserts, "Language education is not confined to the language classroom. A science, social science, or mathematics class is ipso facto a language class" (n. p.). According to the NCF, learning a subject goes beyond acquiring knowledge; it involves understanding terminologies, grasping complex concepts, and being able to articulate and critically discuss them.

In the educational landscape of India, English is taught in conjunction with other subjects, functioning as a medium of instruction across the curriculum. These intertwining positions underline the fact that all teaching as a form of language education, effectively bridging the gap between 'English as a subject' and 'English as a medium.' With this perspective in mind, the current study aims to focus on English studies through the lens of Ecopedagogy, utilizing it as a framework and approach to foster eco-awareness.

Adopting an analytical approach, this study seeks to apply Ecopedagogical principles to develop a curriculum for English language instruction in higher education institutions.

Introduction

There is an urgent need for English studies in India to embrace a more innovative and contextual approach in today's educational landscape. Historically, the British colonial regime significantly influenced English education in India, aiming to 'civilize' the colonized population. This strategy resulted in the establishment of rigid canonical viewpoints and often overlooked the diverse voices and challenges faced by marginalized groups.

Education must address the various forms of oppression, including those based on caste, gender, and race. It is essential to develop a curriculum that responds to these challenges and empowers learners to act. The introduction of courses such as Women's Studies, Dalit Studies, and Environmental Studies marks a significant step toward a socially relevant and inclusive educational framework. Inclusion of such courses in the field of English Studies incorporates understanding the position and reasons for the social exclusion of women, Dalit communities and environment. This makes the learners socially aware, the discipline more socially oriented and more relevant for social reformation which is the major aim and objective of education as a whole. However, environmental issues are often neglected within our educational contexts. While some courses may cover concepts related to environmental issues, they frequently fail to inspire actionable change.

Integrating environmental concerns with English studies can enhance awareness and consciousness among learners, making the curriculum more inclusive and relevant. Ecopedagogy offers a pedagogical approach that can bridge the divide between traditional English studies and contemporary global environmental challenges. By incorporating environmental themes into language instruction, this framework can empower learners to become "eco-warriors."

This research paper explores the potential for integrating Ecopedagogy with English Language Teaching (ELT) in higher education. It aims to reconcile traditional pedagogical approaches with the demands of modern education by effectively applying Ecopedagogical principles to create strategies that embed environmental concerns within the English curriculum.

Literature review

Drawing from Paulo Freire's foundational concepts in critical pedagogy, ecopedagogy underscores the intricate relationship between humans and the natural environment. It highlights the injustices and unsustainability stemming from this complex interaction, focusing on the essential connection between social justice and environmental concerns (Strauß, 2023). This approach critically examines the links between environmental degradation and social injustices, similar to how critical race theory investigates the intersections of racial inequities and other forms of oppression (Kahn, 2008).

Rooted in Latin American educational theory, particularly in the work of Paulo Freire (2000), ecopedagogy expands Freirean principles of social justice and human liberation to include ecological issues. According to Gadotti and Torres (2009) and Misiaszek (2011, 2015, 2018), ecopedagogy utilizes transformation-based teaching models in which educators critically analyse the politics of environmentally damaging actions from both local and global perspectives, drawing connections to social violence.

Freire's concept of environmental pedagogy is central to enhancing our understanding of ecopedagogy. In his posthumously published work, *Pedagogy of Indignation* (2004), Freire addresses the ecological crisis, asserting that ecology must be a fundamental component of any radical, critical, or liberatory educational approach. He critiques practices that harm the environment, emphasizing that such actions are fundamentally at odds with progressive educational ideals. He says:

> Ecology takes on fundamental importance at the end of the 20th century. It has to be present in any radical, critical or liberationist educational practice. For this reason, it seems to me a lamentable contradiction to engage in progressive, revolutionary discourse and have a practice which negates life. A practice which pollutes the sea, water, fields, devastates forests, destroys trees, threatens birds and animals, and does violence to mountains and cities, as well as our cultural and historical memories… (pp. 46-47).

According to Richard Kahn (2008), ecopedagogy has a dual focus: it integrates Freirean aims of humanization and social justice while also prioritizing ecological conservation. Furthermore, it opposes the globalizing tendencies of neoliberalism and imperialism and emphasizes collective eco-literacy. Ecopedagogy values culturally relevant ecological knowledge—including Traditional Ecological Knowledge—and seeks to understand sustainability, planetarity, and biophilia (Kahn, 2008). As an approach, it critiques prevailing capitalist and neoliberal norms through an ecological lens and seeks to develop eco-literacy informed by global cultures that sustain life rather than destroy it. Unlike traditional environmental education, which often focuses merely on imparting information about the natural world, ecopedagogy deepens the knowledge about nature while empowering learners to devise actionable strategies to address the ongoing ecological crisis. It engages participants in activities that promote meaningful change.

As noted, ecopedagogy fosters action-oriented learning toward environmental well-being, characterized by 'praxis.' Praxis encompasses a nuanced understanding of the relationship between theory and practice. Gadotti (1996) defines praxis as a dialectical concept that blends reflection and action, emphasizing that true discovery must be reflective and lead to tangible change. Freire (2000) reinforces this idea, asserting that action loses its human essence if it is disconnected from reflection and that true discovery necessitates deeper reflection to be transformative. Praxis challenges the hegemony of unjust power structures connected to environmental violence, enabling learners to recognize and understand issues of

unsustainability and oppression, while also inspiring them to take informed action. Misiaszek (2023) advocates for demystifying ecopedagogy theories in environmental teaching, emphasizing the importance of contextualizing and making these concepts relatable for a better understanding of the complexities of socio-environmental violence. Theoretical frameworks are important for broadening our understanding, but ecopedagogy ultimately emphasizes taking action to resolve the identified problems (Misiaszek & Torres, 2019).

Freire (2004) asserts that "Action is human only when it is not merely an occupation but also a preoccupation, that is when it is not dichotomized from reflection" (p. 53). He argues that reflection leads to discovery, which must involve action rather than mere intellectual acknowledgment. According to Gadotti (1996), education cannot be considered critical or ecopedagogical without the pursuit of praxis-oriented goals, demonstrating the necessity of implementing theories in real-world applications, such as within language education. Grigorov and Fleuri (2012) highlight the use of participatory action research and workshops as methodologies in ecopedagogy, rooted in Freire's methodologies. These methods are aimed at developing environmentally conscious communities that prioritize self-sufficiency over reliance on the ideologies of capitalism and consumerism. They propose techniques, such as 'scenarios' and 'backcasting',' drawn from future studies that can be effectively employed within ecopedagogy. These scenario-based methods allow for the exploration of alternative futures based on various hypotheses, facts, and trends, providing valuable insights into potential outcomes and policy options. Prior research has begun to explore the implementation of ecopedagogy within curriculum reform across disciplines and has even developed an intensive English program under the English for Academic Purposes (EAP) framework based on these principles, focusing on students from Utah Valley University (Eyraud, 2020).

Ecopedagogy, in recent times, has emerged as an innovative educational approach rooted in critical pedagogy, emphasizing the interrelationship between ecological issues and social justice. It goes beyond traditional Environmental Studies (ES) by actively engaging learners with environmental challenges. Ecopedagogy prioritizes 'praxis,' while intertwining theory with action, empowering learners to take meaningful steps toward resolving ecological issues in fostering eco-literacy and awareness of local challenges. This literature review sets the stage for exploring how these principles can be effectively applied within English Language Education (ELE), as discussed in the subsequent sections.

Theoretical foundation

Historically, experts have played a significant role in the development of technologies that are now detrimental to cultural diversity while threatening our natural ecosystems. According to Bowers (2002), these same experts are responsible for shaping educational policies that will influence the future of societies worldwide. A central aim of education today should be to include all social groups—especially marginalized communities—in decision-making processes. Decisions have often been confined to elite and privileged sectors of society, leaving marginalized groups without a voice, thereby adversely affecting their lives.

The necessity of including diverse social groups in educational objectives has been affirmed by the American Association for the Advancement of Science (AAAS). This organization primarily represents mainstream scientific and technological viewpoints. In a report from a symposium held in 1999, AAAS stressed that "decisions on scientific and technical issues should incorporate inputs from affected communities and other members of the public, as many European nations have done" (p. 2). The primary challenge lies in recognizing the connection between marginalized communities and the educational goals we establish. Currently, these goals are often framed around the individual rather than the community. Bowers (1995, 1997) argues that the notion of the individual as a rational and autonomous entity is an ideological construct rooted in Western political thought. Earlier theorists failed to adequately interpret how language processes reproduce specific patterns of thought informed by distinct cultural histories. Thus, it is crucial to recognize and embed individual perspectives within culturally relevant community approaches, which can inform a curriculum centred on democratic values. These approaches are also key to integrating marginalized communities into an Ecopedagogy-based curriculum.

An Ecopedagogy-based curriculum must reflect the interconnectedness of community and education. Learners should acquire background knowledge that fosters effective communication with the communities they study. This knowledge can be enriched through regular interactions and the sharing of perspectives between learners and these communities. Bowers (2002) emphasizes that true understanding extends beyond abstract concepts; it includes "an explicit understanding of relationships and processes, an embodied knowledge of community relationships and the ecology of place, and an awareness of the layered nature of the interdependencies of life-sustaining processes" (p. 152). To create an ecologically focused curriculum rooted in Ecopedagogy for schools and universities, educators must first assess the current knowledge of their learners. Curriculum content should stem from an understanding of interdependent communities and how these communities impact natural systems. Existing curricula must be evaluated through an ecopedagogical lens, asking critical questions: Do current environment-oriented courses cultivate awareness that leads to action? Do these courses equip learners with the skills and understanding necessary to live less consumer-dependent lives? (Bowers, 2002).

To effectively address these questions, active participation from teachers and educators in the learning process is essential. Numerous psychological and cultural forces shape learner experiences, often undermining the value of their daily lives. Therefore, educators must work to reconstruct these everyday experiences into a foundation for recognizing ecological challenges. This will enable the development of a curriculum that aligns with local contexts and cultures. Bowers (2002) notes, "the ability to explicate the patterns that contribute to morally coherent forms of community and to examine the patterns and technologies

that undermine them is also a matter of choice" (p. 156). This perspective affirms that an environment-oriented curriculum should effectively address cultural dynamics and local contexts while reflecting ecopedagogical principles.

Schubert (2009) contributes to this conversation by posing an essential question for curriculum and pedagogy: "What is worthwhile?" This inquiry complements Bowers' (2002) emphasis on community and ecological understanding. Schubert prompts us to consider, "What is worth knowing, needing, experiencing, doing, being, becoming, overcoming, sharing, contributing, and wondering?" (p. 23). He et al. (2015) argue that curriculum transcends mere considerations of content delivery; it embodies a practical and philosophical framework aimed at understanding the human condition within and beyond educational contexts.

Daisaku Ikeda (2010) highlights the interconnectedness of culture and socioecological factors in his concept of global citizenship. He emphasizes the importance of wisdom, courage, and compassion as foundational attributes of humanity. For Ikeda (1991), this transformative process, which he terms "human revolution," moves individuals from isolation towards a deeper connection with the essence of the universe. This notion resonates with Bowers' emphasis on individuals as part of a larger social unit or community. Therefore, an Ecopedagogy or eco-justice-based curriculum must foster "rigorous transformation" from isolated individuals to collective identities representing their communities. The insights of Bowers, Schubert, and Ikeda challenge traditional individualistic approaches to education. They advocate for a curriculum that is community-centred and promotes meaningful teaching, integrating personal growth with ecological consciousness and awareness. These perspectives underscore the critical need for a curriculum grounded in ecopedagogical principles, which will not only enhance awareness among learners but also guide them toward more sustainable living practices.

Praxical implications

We endeavour to create a curriculum for English Studies in Higher Educational Institutions (HEIs) that is grounded in ecopedagogical principles. English serves as a globally recognized 'lingua franca,' but its history is intertwined with colonial rule and the dominance of hegemonic power (Errington, 2001, 2008; Pennycook, 1994, 1998; Phillipson, 1992, 2008). During the colonial era, English was utilized as a medium of communication to facilitate trade and interactions between colonizers and the colonized, bringing with it cultural ideologies that promoted globalization and industrialization. These ideologies often conflicted with efforts to preserve and conserve cultural and environmental values (Martusewicz et al., 2015). Scholars such as Kumaravadivelu (2006) advocate for a complete restructuring of English Language Teaching (ELT) curriculum in a postcolonial scenario. He asserts that "English, in its role as the global language, creates, reflects, and spreads the import and imagery of global flows" (2009, p. 1), emphasizing how English is deeply rooted in processes of consumerism, globalization, and commodification (Blenkinsop, 2012; Bowers, 1997, 2000, 2012; Goulah, 2011, 2017). Consequently, the curriculum for English studies needs to be reimagined to be more local, contextual, and place-based.

Kumaravadivelu (2006) suggests that restructuring ELT can draw from pedagogical and philosophical insights found in the field of environmental studies. Along similar lines, Bowers (2012) notes that "understanding how words (metaphors) reproduce earlier ways of thinking, including the silences and prejudices, is essential to the educator's craft" (p. 2). Thus, ELT can play a crucial role in fostering awareness and consciousness among learners. A place-based Ecopedagogy, integrated with "value-creative" approaches (Goulah, 2017), could effectively transcend the limitations of conventional curricula.

English Studies in India as a discipline has evolved through various phases, from the colonial imposition of the language to its recognition as one of the official languages in the Indian Constitution. The onset of globalization has further elevated the status of English, transforming pedagogy multiple times and encompassing diverse cultures in various forms.

The National Curriculum Framework (NCF 2005) emphasizes the importance of bilingual and multilingual education. It states, "Language education is not confined to the language classroom. A science, social science, or mathematics class is ipso facto a language class" (p. 38). This indicates that any subject can serve as a language class, as concepts, theories, and terminologies are all conveyed through language. Consequently, learners must achieve proficiency in the language to critically engage with and discuss these concepts. The NCF specifically addresses English language education, asserting the need for learners to attain basic proficiency akin to natural language acquisition, which can be developed into a tool for abstract thought and knowledge acquisition, including literacy. This positions English as a medium integrated across curricula, bridging the gap between 'English as a language' and English as a medium of instruction.

The National Education Policy (Government of India, 2020) advocates for an educational approach that is inquiry-based, problem-posing, inclusive, and interdisciplinary. However, it does not specifically address English language learning. While the NEP encourages utilizing English for preparing teaching and learning materials in Science and Mathematics, it overlooks other domains such as ecology, environmental studies, and social sciences. Thus, it is crucial to develop a curriculum that incorporates these fields. The NEP emphasizes the importance of elective courses in Environmental Education (EE) and Environmental Studies (ES), which are essential for introducing concepts and issues related to the environment. These courses can provide a framework to enhance learners' awareness of environmental interconnections with social, political, and cultural issues. Several ecological themes and concerns, such as plastic waste, consumerism, and the exploitation of nature and natural resources, can be leveraged to cultivate awareness and consciousness among students.

Eco-curriculum for English studies

Nirajana Bardhan (2024) employs the ecological approach to writing, drawing inspiration from Van Lier's principles of ecological linguistics, as outlined in the table below. This paper utilizes these ecological principles to propose a curriculum grounded in the previously mentioned themes.

Table 1: Principles of the ecological approach adapted from Van Lier (2011).

1. Relation	a. Language use is inherently relational and context-dependent. b. Meaningful utterances connect to prior and subsequent discourses, as well as to the mental and social frameworks of the speaker. c. Consequently, the study of language necessitates an examination of this relationality.
2. Context	a. Language and context mutually shape one another, with meaning arising from linguistic expressions rather than merely being contained within them.
3. Patterns and Systems	a. Language acquisition involves understanding the organizational patterns unique to specific genres or professions, which often govern language more effectively than traditional linguistic rules.
4. Emergence	a. Language learning emerges through participation in linguistic practices rooted in local, historical, and cultural contexts.
5. Variation	a. Social and religious linguistic variations are both unavoidable and fascinating. b. Rather than striving for a set proficiency level, language education should empower learners to reflect on the identities they wish to express.
6. Agency	a. Ecological language learning prioritizes learner agency, cultivated through perceptual learning, initiative, discourse participation, and critical reflection.

Curriculum based on principles of the ecological approach

Table 2: Modules based on ecopedagogy and the ecological approach in english language teaching.

Module	Objectives	Activities	Skills Developed
1. Critical Analysis of Environmental Narratives	a. Enable learners to analyse environmental narratives across various media. b. Help learners comprehend the relational nature of language.	Learners will analyse how different media represent environmental issues (e.g., global warming, plastic waste), focusing on the language used.	a. Enhances reading comprehension. b. Fosters critical thinking skills. c. Develops the ability to critically analyse complex texts.
2.Context and Environment	a. Facilitate understanding of the relationship between context and language. b. Develop context relevant to the environment, emphasizing local communities.	Learners will compare the language used in diverse writings and speeches reflective of different contexts (e.g., social, local).	a. Improves speaking and writing abilities. b. Equips learners to critically engage with various cultural contexts.
3. Communication in Ecological Study	Introduce students to diverse writing genres within an environmental framework, such as policy documents and reports.	Students will examine various genres of environmental writing to identify patterns, followed by a writing exercise using similar themes.	a. Cultivates advanced writing skills. b. Enhances adaptability to different writing styles and patterns.
4.Environmental Engagement	Integrate language learning with active field engagement.	Students will form groups to visit local communities, subsequently creating field reports and journal entries based on their experiences.	a. Improves writing and speaking skills through real-world engagement. b. Connects learners with local socio-environmental issues.
5. Media and Environment	Foster learner agency in language acquisition through social media campaigns.	Task students with creating posters, charts, or videos for campaigns on selected environmental issues.	a. Develops creative skills. b. Enhances persuasive language skills aimed at driving social change.

This curriculum is grounded in the principles of the aforementioned ecological approach, comprising five distinct modules. Each module is designed with specific objectives that aim to enhance particular skills, all rooted in the tenets of ecopedagogy and focusing on local environmental issues. A key aspect of this curriculum is the active engagement of learners with their surrounding communities. Each module is activity-based, fostering critical understanding and awareness of environmental challenges while simultaneously advancing language skills. These modules can be integrated into existing English studies curricula or offered as elective courses in Environmental Studies at higher education institutions. Additionally, they are cross-disciplinary in nature and can be adapted for projects across various fields, including media studies.

The first module encourages learners to analyse texts, media, and other literary forms through the lens of ecopedagogical theories. The second module provides context for further exploration, which may include a focus on local areas, communities, or indigenous populations. The third module introduces a variety of media representations of ecological issues, prompting learners to recognize prevailing 'hegemonic' narratives in current systems. Armed with insights and skills acquired from these representations, learners will create reports addressing local environmental concerns. The fourth module builds upon the previous one, requiring learners to conduct field studies and compile detailed reports. The final module empowers learners to cultivate their agency in addressing and advocating for solutions to environmental challenges.

Assessment for these modules is based on field reports, journal entries, essays, and presentations. Developed holistically, the modules tackle contemporary issues and challenges. Following theoretical analysis, learners will engage in practical application, or 'praxis,' allowing them to connect theoretical concepts with real-world action. Throughout these activities, learners will also enhance their English language skills.

Conclusion

In conclusion, this paper has provided an in-depth exploration of the nature of education, particularly within the realm of English studies, while emphasizing the significance of cultural and contextual factors in language learning. It has highlighted the relevance of Environmental Pedagogy, or Ecopedagogy, in today's educational landscape, arguing for its transformative potential in shaping learner attitudes toward environmental issues.

The research illustrates the intricate connections between English Language Education (ELE) and Ecopedagogy, detailing the foundational theories and principles that undergird this framework. A key focus has been the proposed development of a curriculum for English studies at the higher education level, designed explicitly in alignment with Ecopedagogical tenets. This curriculum seeks to foster a heightened sense of environmental consciousness and awareness among students, equipping them with the knowledge and skills necessary to engage thoughtfully with ecological issues.

Furthermore, the paper acknowledges the interdisciplinary potential of this curriculum, suggesting ways it could be integrated into various academic disciplines. This multidisciplinary approach could enrich the learning experience and broaden the impact of Ecopedagogy beyond conventional English studies. However, the implementation of this intervention faces substantial challenges, particularly the difficulty of incorporating new curricula within the existing frameworks established by educational institutions. This limitation underscores the need for flexibility and collaboration across departments to integrate elements of the ecopedagogical curriculum into diverse fields of study.

Despite these challenges, this research opens avenues for future exploration. There is significant potential for specific components of the proposed modules to be adapted and incorporated within other disciplines, fostering a collaborative approach that addresses environmental education across the academic spectrum. By merging ecopedagogy with various fields, we can cultivate a more holistic understanding of environmental issues and encourage learners to become proactive agents of change in their communities.

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Teachers as environmental educators: Exploring perceptions and practices of green pedagogies in fostering eco-literacy

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Abstract

This study explores teachers' perceptions and practices of green pedagogies in fostering eco-literacy among students across diverse educational contexts in Africa, Europe, and Asia. Data were collected from an online questionnaire completed by 90 university educators from various disciplines, and we employed an interpretivist research approach. Thematic analysis revealed five key areas: definitions and understanding of green pedagogies, practical implementation strategies, fostering active citizenship, emotional impacts of eco-education, and perceived effectiveness of these approaches. Findings highlight that educators recognize the necessity of integrating sustainability into curricula and actively employ innovative methods, such as project-based learning and outdoor exploration, to engage students. However, challenges, including an exam-oriented culture and resource limitations, impede effective implementation. This research contributes significantly to the literature on environmental education, shedding light on teachers' perspectives that have been historically overlooked. It emphasizes the need for enhanced professional development and institutional support to cultivate eco-literacy, promoting responsible environmental citizenship in an increasingly complex global landscape. The insights gained from this study offer actionable strategies for educators and policymakers, reinforcing the importance of embedding eco-literacy within educational frameworks. These insights could inform the design of targeted professional development programs to enhance eco-literacy.

Introduction

There has been a growing emphasis on environmental sustainability and eco-consciousness in educational settings. Integrating sustainability concepts into school curricula has significantly increased students' environmental awareness and sustainable behaviors (Frank & Ricci, 2023). A bibliometric analysis reveals that sustainability consciousness research primarily focuses on education, with students as the main subjects (Gulzar et al., 2023). Teachers' identities are essential to successfully implementing environmental education for sustainability, with school leaders playing a vital role in supporting these initiatives (Almeida et al., 2018). Some teachers unconsciously apply eco-pedagogic principles in language learning, orienting lessons towards the local environment and using project-based activities (Anggawirya et al., 2023). Creative play and learning in natural environments can effectively develop creative eco-literacy in elementary students, fostering adaptive, aesthetic, cognitive, communication, sensorimotor, and socio-emotional skills (Maulidah et al., 2021). Green education promotes environmental conservation, sustainability, and ecological awareness (Adnyana et al., 2023). It aims to transform social and cultural contexts by integrating nature as a central educational focus, fostering critical thinking and environmental consciousness (Duque-Romero & Bastidas, 2021). Basic environmental concepts are introduced in primary education, while secondary and higher education delve deeper into environmental issues and specialized programs (Adnyana et al., 2023). Green learning approaches have positively impacted student performance and confidence levels (Shannaq et al., 2012).

In light of escalating climate change challenges and environmental degradation, enhancing eco-literacy through educational frameworks has never been more critical. Educators are pivotal in cultivating awareness and behaviors that foster sustainability among future generations.

Anterior research argues that environmental education (EE) significantly impacts students' eco-literacy and environmental behavior. Studies have demonstrated that EE programs can enhance students' ecological knowledge, awareness, attitudes, and participation in environmental issues (Jannah et al., 2013; Hsu, 2004). Implementation of EE through faculty policies, curriculum, instructional methods, and campus culture has been found to effectively scaffold students' ecological literacy (Ikhsan et al., 2019). Using specialized EE kits can also improve environmental literacy, although knowledge levels may remain low compared to attitudes and behaviors (Jannah et al., 2013). Social studies teacher education students perceive EE as beneficial for developing cognitive, affective, and behavioral dimensions of ecological literacy (Durmuş & Kinaci, 2021). However, prior research has largely overlooked the perspectives of teachers responsible for delivering this education. Additionally, existing research has focused on specific teaching strategies or interventions without comprehensively understanding how teachers engage with green pedagogies in their daily practices. Despite the increasing recognition of the importance of eco-literacy, there is limited research on how teachers perceive and implement green pedagogies in the classroom.

This study seeks to address this gap by exploring teachers' perceptions and practices in the context of green pedagogies. This study aims to build upon existing literature by exploring teachers' perceptions and experiences with green pedagogies in diverse educational settings.

This study's research question is formulated as follows:

How do teachers perceive the implementation and impact of green pedagogies in fostering eco-literacy among students? Therefore, this study has two main objectives.

- The first is to explore teachers' understanding and engagement with green pedagogies in the classroom.
- The second is to examine teachers' perceptions of the effectiveness of green pedagogies in cultivating eco-literacy among students.

This research is significant as it provides insights into teachers' challenges and opportunities in integrating green pedagogies into their teaching practices. By understanding teachers' perspectives, this study contributes to developing strategies and policies that promote eco-literate educational practices and empower students to become environmentally responsible citizens.

This paper is structured as follows: The following section overviews key concepts related to eco-literacy, green pedagogies, and teacher perceptions. It also displays the study literature review. The subsequent section presents the study's theoretical underpinnings. The methodology section outlines the research design and data collection methods. Section Five presents and discusses the study's findings. Finally, the conclusion summarizes the key findings and contributions of the study.

Literature review

Definition and importance of eco-literacy in the context of environmental education

Eco-literacy is a multifaceted concept encompassing the ability to understand, analyze, and actively engage with environmental issues (Ginju, 2020). It involves developing skills to make informed environmental decisions and becoming "global citizens" (Ginju, 2020). Eco-literacy can be categorized into three levels: nominal, functional, and operational, reflecting increasing environmental awareness and action (Ginju, 2020). It is crucial for building a sustainable society that values and conserves the natural environment through a holistic approach (Sharma, 2023). Environmental education, however, has been criticized for its entanglement with neo-liberal and industrialized processes, leading to epistemological blind spots regarding environmental degradation (Daprano, 2020). A food eco-literacy approach has been proposed based on critical pedagogy, transformative learning models, and experiential encounters with food (Daprano, 2020). This approach aims to overcome the limitations of traditional environmental education and foster a deeper understanding of ecological

principles and their application in creating a sustainable human society (Sharma, 2023; Daprano, 2020).

Eco-literacy is essential for fostering environmental awareness and protection, mainly when introduced early in children's education (Kadarisman & Pursitasari, 2023). Studies indicate that novels can effectively elucidate complex ecological concepts, contributing to environmental consciousness (Khasanah et al., 2024). However, implementing environmental education in primary schools has been problematic, with limited success. Research suggests that primary school teachers often function at a level of ecological illiteracy or nominal ecological literacy, tending to prioritize attitudes and values over knowledge in environmental education (Cutter-Mackenzie & Smith, 2003). This lack of ecological literacy among educators poses a significant challenge to developing an ecologically literate citizenry. The integration of eco-literacy in science learning, literature, and teacher education presents opportunities for further research and improvement in environmental education practices (Kadarisman & Pursitasari, 2023; Khasanah et al., 2024; Cutter-Mackenzie & Smith, 2003).

Overview of green pedagogies and their theoretical foundations

Green pedagogy is an emerging approach to education that emphasizes environmental awareness and sustainability. This approach employs confrontation and provocation to promote sustainability skills, appealing to emotions and uncovering learner values to foster new perspectives (Fox & Wogowitsch, 2021). Green pedagogy aligns with Education for Sustainable Development (ESD) principles and implements evidence-based strategies such as concept change (Fox & Wogowitsch, 2021). While traditional pedagogical theories like cognitivism and constructivism remain relevant, emerging concepts such as social pedagogy and Education 3.0 are gaining traction (Halupa, 2015). In technical and vocational education and training (TVET), ESD pedagogy is a framework for developing generic green skills. However, a significant gap exists between theoretical approaches and practical implementation (Pavlova & Chen, 2019). Additionally, the animal turn in environmental education research has incorporated critical pedagogy, ecofeminism, and posthumanism perspectives, expanding the scope of green pedagogies to include human-animal relations (Spannring, 2017). Critical pedagogy plays a vital role in addressing the planetary ecocrisis, with eco-pedagogy emerging as a philosophy that challenges dominant eco-literacy paradigms and calls for the reconstruction of critical pedagogy in light of current ecological conditions (Kahn, 2010).

The role of teachers in promoting eco-literacy and sustainability education

Studies have found that teachers generally possess satisfactory environmental knowledge and attitudes but often demonstrate low degrees of environmental action (Liu et al., 2015). Implementing environmental education in schools has been problematic, with many primary school teachers functioning at ecological illiteracy or nominal ecological literacy (Cutter-Mackenzie & Smith, 2003). However, teachers can contribute significantly to environmental education, with female teachers showing more sensitivity to the subject (Daraz et al., 2023). Measuring instruments have been developed to assess teachers' environmental literacy, revealing relationships between their literacy levels and academic training, learning area involvement, and environmental education training (Swanepoel et al., 2002).

Studies show a significant increase in publications and citations related to teacher education for sustainability over the past three decades (Gavinolla et al., 2022). However, the integration of sustainability into higher education curricula varies across institutions and countries (Lovren, 2017). In Finland, research indicates that teacher education programs may not adequately prepare student teachers to teach sustainability (Hofman-Bergholm, 2018). A survey of Finnish lower secondary school teachers revealed significant differences in their perceived competence and frequency of incorporating various sustainability dimensions in their teaching. Subject teachers were classified into three groups based on their approach to sustainability education, with biology, geography, and history teachers most likely to use holistic sustainability approaches (Uitto & Saloranta, 2017).

These findings underscore the importance of teacher professional development programs and school environmental education policies in enhancing eco-literacy among students and creating an environmentally informed citizenry. Moreover, previous research underscores the importance of effectively enhancing teachers' awareness and competence in sustainability education to implement it across disciplines. However, the current body of literature needs a comprehensive understanding of the specific perceptions and practices of green pedagogies employed by teachers in various educational contexts. While it highlights existing gaps in teacher training and the relationship between environmental literacy and teaching practices, it does not directly explore how these factors impact student eco-literacy. The emphasis on general trends and studies may also overlook the nuanced micro-level dynamics within classrooms. This study is significant as it fills these gaps by examining teachers' perceptions of green pedagogies, ultimately providing a nuanced understanding of their effectiveness in fostering eco-literacy. Additionally, this research aligns with global initiatives, such as the United Nations' Sustainable Development Goals, which emphasize the need for education systems to equip students with competencies for sustainable development. Insights gained could inform targeted professional development and educational policies, enhancing the integration of sustainability in teaching practices and promoting a more environmentally literate student population.

Theoretical framework: Transformative Learning Theory

Transformative Learning Theory, developed by Jack Mezirow in 1991, emphasizes the process of critical reflection as a means to foster personal and social change. It posits that learners can achieve transformative shifts in their

perspectives through questioning and reassessing their beliefs and assumptions. This theory outlines a cycle of ten stages, starting with a disorienting dilemma that prompts reflection (Mezirow, 1991). Individuals can develop a more inclusive and open worldview by engaging in dialogue, fostering critical thinking, and exploring new frameworks. The ultimate goal is to empower learners to take informed actions and contribute positively to their communities and society (Mezirow, 1991).

Transformative learning theory has been applied to understand attitudes and behaviors toward environmental issues and sustainability. Studies have shown that learning can lead to individual sustainability actions, though societal-level impacts are rare (Moyer & Sinclair, 2020). Instrumental learning provides the necessary skills and knowledge for action, while communicative learning and personal transformation are also observed (Moyer & Sinclair, 2020; Diduck et al., 2012). The theory has been used to examine learning outcomes and processes in natural resource and environmental management, including reflection, rational discourse, and applying new frames of reference (Diduck et al., 2012). In education for sustainable development, transformative learning has emerged as a field of inquiry, contributing to the design and implementation of educational interventions and assessments (Aboytes & Barth, 2020).

In the current study, the transformative learning theory provides a suitable framework for examining how teachers' understanding of green pedagogies can transform their teaching practices and their perceptions of their effectiveness in fostering eco-literacy among students. By adopting a transformative perspective, this study recognizes that teachers' beliefs and assumptions about the environment and sustainability may shape their teaching strategies and approaches.

Overall, the theory provides a suitable framework for understanding how teachers' perceptions and practices related to green pedagogies can be transformed to promote eco-literacy among students. It recognizes the potential for personal and professional transformation through critical reflection.

Research methodology

This study adopts an interpretivism research philosophy (William, 2024a) to explore teachers' perceptions and practices of green pedagogies in fostering student eco-literacy. Interpretivism allows for a deeper understanding of the subjective experiences and meanings that teachers ascribe to their engagement with sustainability education within diverse cultural and educational contexts. This paper uses the studies of Morrison (2018) and Kidman and Casinader (2019) as references for exploring teachers' perceptions and practices of green pedagogies in fostering eco-literacy. The target population comprises 90 university teachers from Africa, Europe, and Asia, representing various disciplines, including social sciences, engineering and technology, humanities, and health sciences. A convenience sampling approach was utilized to recruit participants who have implemented or taught concepts related to green pedagogies.

Data was collected using an online self-administered questionnaire that incorporated closed-ended and open-ended questions. The questionnaire was designed to capture quantitative and qualitative data, with sections dedicated to teachers' definitions of green pedagogies, implementation strategies, and perceived effectiveness in fostering eco-literacy. Closed-ended questions facilitated statistical analysis, whereas open-ended questions allowed for nuanced insights into educators' practices and experiences. Thematic analysis (William, 2024b) is conducted on the qualitative responses using NVivo 14 software to identify key themes and patterns. Table 1 below presents the sample's features. Table 2 represents teachers' perceptions of whether or not incorporating green pedagogies is essential for effective teaching.

Table 1. Profile of the participants.

Attribute	Frequency	Percentage (%)
Teaching region		
Africa	10	11.11
Asia	70	77.78
Europe	10	11.11
Teaching subject		
Social sciences (Psychology, Sociology, Anthropology, Political Science, Economics, Geography, History)	40	44.44
Humanities (Literature, Languages, Philosophy, Arts)	30	33.33
Technology and Engineering (Information Technology, Computer Science, Engineering, Robotics)	10	11.11
Health Sciences (Medicine, Nursing, Pharmacy)	10	11.11
Teaching experience		
Less than 5 years	50	55.56
5-10 years	10	11.11
10-15 years	20	22.22
More than 15 years	10	11.11

Table 2. Perceptions of teachers regarding green pedagogies as essential for effective teaching.

Teachers' perceptions	Frequency	Percentage (%)
Strongly disagree	10	11.11
Disagree	0	
Neutral	40	44.44
Agree	30	33.33
Strongly agree	10	11.11
Total	90	100

Data analysis and interpretations

To enhance clarity, some participant responses are presented in quotation format, followed directly by analytical commentary that interprets the significance of each response about the study's research questions.

Perceptions of green pedagogies

The analysis reveals five key themes: the definition and understanding of green pedagogies, their practical implementation in teaching, fostering active citizenship and responsibility, creating a supportive learning environment, and their perceived effectiveness. Respondents emphasize the importance of integrating sustainability into educational practices, utilizing eco-friendly materials, and creating relatable learning contexts that enhance student engagement. Teachers view green pedagogies as essential for promoting environmental awareness and nurturing responsible, eco-conscious citizens equipped to tackle contemporary environmental challenges.

Definition and understanding of green pedagogies

Respondents demonstrated a clear and shared understanding of green pedagogies focused on environmental education and sustainability. Many participants articulated that these pedagogies aim to instil environmental awareness in students. For instance, one respondent stated, "*A teaching approach that educates our young generation on environmental sustainability, highlighting the educational objective of fostering a sense of responsibility for the environment*." Another described green pedagogies as "*teaching in a way that focuses on caring for the environment*," further reinforcing the idea that the core of this approach is nurturing an understanding of ecological challenges. This collective emphasis on sustainability indicates that teachers view green pedagogies as essential to cultivating eco-literate students.

Practical implementation in teaching

The practical application of green pedagogies emerged as a significant theme, with respondents noting how these approaches enhance the learning experience. One teacher mentioned the integration of real-world contexts: "*They make language learning more relatable to students,*" indicating that green pedagogies help students apply their knowledge in meaningful ways. Moreover, respondents emphasized the importance of using eco-friendly materials, with one stating, "*This includes using eco-friendly materials and encouraging students to think about how their actions affect the planet*." It illustrates that the choice of resources is critical in implementing green pedagogies and demonstrates how they can directly engage students in discussions about sustainability.

Fostering active citizenship and responsibility

Teachers also highlighted the role of green pedagogies in promoting active citizenship and fostering a sense of environmental responsibility among students. One participant noted, "*All practices aimed at encouraging active citizenship among students in terms of sustainable development*," suggesting that these pedagogies are not merely academic but are designed to empower students to contribute positively to their communities. This sentiment reflects a broader belief that green pedagogies should equip students with the knowledge and skills to address environmental issues actively. Such perspectives indicate that teachers perceive their role as imparting knowledge and cultivating responsible and engaged citizens who care for the Earth.

Emotional and environmental context

Respondents also highlighted the emotional impact of green pedagogies. One teacher remarked on the benefits of creating a supportive atmosphere, stating it is like a "*breath of fresh air and comforting environment.*" This quote suggests that green pedagogies can contribute to a positive emotional climate in the classroom, enhancing students' overall learning experiences. Such environments may inspire creativity and open-mindedness, allowing students to engage more deeply with sustainability topics and fostering a greater appreciation for the natural world.

The effectiveness of green pedagogies

Finally, teachers are generally optimistic about green pedagogies' effectiveness in fostering eco-literacy. While specifics on successful outcomes were not extensively detailed, the overarching sentiment expressed by respondents indicates a belief in the value of these pedagogies. One respondent claimed that green pedagogies "*help students learn about nature, understand environmental issues, and promote eco-friendly habits,*" which underscores the effectiveness of this approach in developing knowledge and responsible behaviors toward the environment. This outlook reveals the potential that educators see in using green pedagogies to prepare students for the environmental challenges they will likely face.

Practices and strategies

The analysis reveals three key themes related to incorporating environmental education in teaching practices: integrating environmental themes, creative strategies for student engagement, and measuring student learning. Respondents illustrate varying levels of commitment to embedding sustainability into their curricula, utilizing hands-on activities and innovative pedagogical methods. Strategies such as outdoor exploration and project-based learning are highlighted as effective means to captivate students' interest and foster a deeper connection to environmental issues. However, the approaches to assessing student understanding and engagement vary, signaling the need for more precise metrics in evaluating eco-literacy within educational frameworks.

Incorporation of environmental themes in teaching practices
The responses indicate a varied engagement with environmental themes in teaching practices, reflecting a spectrum of experiences from full integration to limited inclusion. Several respondents actively incorporate environmental themes into their instruction, exemplified by a participant who shared, "*I incorporate environmental*

themes by including lessons on sustainability, using eco-friendly materials, and encouraging students to think about their impact on the planet." It highlights a proactive approach to environmental education, emphasizing the importance of hands-on activities like recycling projects and nature studies. However, one respondent candidly acknowledged a lack of integration, stating, "*So far, I have not included any environmental themes into my teaching practices*," illustrating that not all educators feel equipped to weave environmental themes into their curricula consistently. Overall, the theme reflects a recognition of the need for sustainability in education, as well as the varying levels of implementation among educators.

Creative strategies for engaging students

Respondents provided diverse creative strategies for engaging students in environmental education, showcasing an array of pedagogical methods. Common approaches included project-based learning, outdoor exploration, and simulation games. One respondent mentioned that "*using simulation games where students manage virtual ecosystems*" allows students to see the consequences of different actions on the environment, highlighting the effectiveness of interactive learning methods. Another educator emphasized outdoor engagement— "*I take students on nature walks to observe local wildlife and plants*"—demonstrating an effective way to connect students with their local environment. Additionally, multimedia such as "*videos, images, PPT, worksheets, and oral practice*" indicated a multifaceted approach to fostering engagement. This theme reveals that teachers are employing various innovative strategies to make environmental education relatable and compelling for their students, enhancing their learning experiences through active participation.

Measuring student learning and understanding

Responses concerning measuring student learning and understanding environmental concepts reveal both structured and anecdotal approaches. Some educators highlighted using formative assessments and performance rubrics to gauge students' grasp of environmental issues. One participant noted, "*Provide a rubric about environmental marks to see how far students achieve it*," indicating a systematic approach to evaluation. In contrast, other responses were more interpretive; for example, a respondent mentioned measuring understanding "*through related assessments alongside active participation in discussions about real-world applications of environmental concepts.*" However, a few teachers expressed uncertainty, as seen in the response, "*I have no idea about the measurements*," which points to a gap in assessment practices within this area. This theme illustrates educators' diverse methods of evaluating student learning, ranging from structured assessments to informal observations and discussions. It highlights the ongoing challenges in effectively measuring eco-literacy.

Challenges and opportunities

The analysis reveals four critical themes related to the implementation of green pedagogies in educational settings: the benefits and impact of green pedagogies, challenges in their implementation, opportunities for enhancing eco-literacy, and the role of administrative support. Respondents highlight the potential of green pedagogies to foster environmental awareness and engagement among students. However, they face challenges, including an exam-oriented culture and a lack of resources. Opportunities for enhancing eco-literacy lie in interdisciplinary approaches and community involvement. Respondents stressed the need for more robust administrative support to facilitate the effective integration of sustainability into the curriculum, ensuring that eco-literate, responsible citizens are nurtured.

Benefits and impact of green pedagogies

Respondents identify multiple benefits associated with implementing green pedagogies, notably increased students' environmental awareness and a sense of responsibility towards ecological issues. One educator emphasized that "*students are highly aware of the urgency to protect and preserve the environment,*" reflecting a beneficial shift in perspective. Additionally, these pedagogies can create engaging and relevant lessons, fostering a connection between environmental concepts and real-world applications. The potential for interdisciplinary lessons to connect ecological concepts with various subjects is also noted, indicating that green pedagogies can enrich the learning experience and promote a holistic understanding of environmental issues.

Challenges in implementation

Despite the benefits, several challenges accompany the adoption of green pedagogies. A prevalent issue mentioned by respondents is the exam-oriented culture prevalent among students, particularly in Chinese educational contexts, which often prioritizes standardized testing over environmental themes. One teacher noted, "*Green pedagogies are not exam-centric, and therefore, this approach may not be effective in helping Chinese students learn for examination purposes.*" Other challenges include a lack of training, inadequate resources, diverse student interests and language competencies, and the necessity of extra planning. Additionally, respondents pointed out difficulties in engaging students who may not be aware of or concerned about environmental issues, illustrating the complexity of implementing environmentally-focused teaching strategies within existing curricular frameworks.

Opportunities for enhancing eco-literacy

Respondents recognize several opportunities to enhance eco-literacy among students. Suggestions include organizing field trips, promoting the innovation of green technologies, and integrating environmental education into the curriculum. Educators advocate for a culture prioritizing environmental

awareness and sustainability within the school community. To further support these initiatives, respondents suggest improved training for teachers on green pedagogies and increased communication and resources to engage parents in the learning process. By fostering a cooperative effort between educators, students, and parents, there is potential to create a more robust environment for cultivating eco-literate individuals.

Administrative support for green pedagogies

Respondents highlight the importance of school administration in supporting the implementation of green pedagogies. Suggestions for administrative support include providing teacher training and development opportunities, preparing budgets for environmental activities like field trips, and shifting the focus from a strictly exam-oriented approach to one that emphasizes sustainability. Furthermore, fostering a school-wide culture that prioritizes environmental education and providing technological support and resources are critical steps in promoting the effective integration of green pedagogies into daily teaching practices. This theme underscores the need for a supportive institutional framework to enable teachers to implement innovative environmental strategies effectively.

Discussions

This section synthesizes the findings of this study within the broader context of existing literature on eco-literacy and green pedagogies. It delves into three key aspects: how the findings build upon prior research, deviations from established trends, and the study's novel contributions to the field. By analyzing teachers' perceptions and practices, this section illustrates the potential of green pedagogies to foster environmental awareness among students while addressing the challenges faced in their implementation. This discussion aims to highlight actionable insights for enhancing eco-literacy and supporting the effective integration of sustainability in educational frameworks.

Building on prior research findings

This study reinforces existing literature on the significance of eco-literacy in environmental education, elucidating how green pedagogies enhance student awareness and engagement with ecological issues. As Ginju (2020) highlighted, eco-literacy is crucial for fostering responsible, global citizens capable of making informed environmental decisions. The findings support previous assertions that integrating sustainability into curricula promotes positive behavioral changes among students, a sentiment echoed in the writings of Sharma (2023). Furthermore, the emphasis on practical applications and student-centered approaches aligns with findings in the literature that underscore the need for innovative pedagogical strategies—such as project-based and experiential learning—to facilitate deeper ecological understanding (Kadarisman & Pursitasari, 2023; Khasanah et al., 2024).

Deviation from anterior research trends

Contrary to earlier studies emphasizing severe ecological illiteracy among educators, this research reveals a more nuanced understanding of the current educational landscape. While challenges such as a predominantly exam-oriented culture and limited administrative support are recognized, educators in this study demonstrate a proactive inclination toward integrating environmental themes into their teaching. It contrasts with previous findings, which depicted a more static scenario where innovative pedagogies were rarely embraced (Cutter-Mackenzie & Smith, 2003). Additionally, this study highlights a shift towards collaborative community involvement—an aspect less emphasized in existing research. As pointed out, the reciprocal relationship between parents, educators, and students could enhance eco-literacy, marking a departure from traditional classroom boundaries in environmental education.

Novelty of the study

This study contributes novel insights into the perceptions and practices of green pedagogies, filling a critical gap in the literature by closely examining educators' viewpoints in a specific cultural context. The findings underscore the teachers' understanding of green pedagogies and their innovative strategies for integrating environmental education in practical, relatable ways. Moreover, the research advocates for multidimensional approaches to sustainability education by identifying key opportunities for enhancing eco-literacy—such as incorporating field trips and promoting green technologies. This holistic understanding of green pedagogies positions the study as a significant addition to environmental education research, emphasizing the need for comprehensive teacher training and broader curriculum reforms. The findings illuminate actionable paths forward, highlighting the imperative for administrative support to facilitate a robust educational framework that nurtures eco-literate individuals in a rapidly changing world.

In conclusion, this research critically reflects the current state of green pedagogies, offering a comprehensive overview of their benefits and challenges while proposing actionable insights for enhancing eco-literacy within educational settings. By bridging these gaps in the existing literature, this study lays the groundwork for further exploration and innovation in environmentally focused teaching practices.

Conclusion

This study investigates how teachers perceive and implement green pedagogies to foster eco-literacy among students within diverse educational contexts. Participants emphasized the importance of integrating sustainability into their teaching practices, employing hands-on activities and innovative strategies to engage students effectively. However, the study highlighted implementation challenges, such as an exam-oriented culture and limited resources, which hinder the broader adoption of eco-focused pedagogies.

Theoretical contributions

This study enriches the literature on green pedagogies by addressing the often-overlooked perspectives of teachers responsible for delivering environmental education. By applying transformative learning theory, the research highlights the potential for teachers' beliefs about sustainability to evolve through critical reflection, ultimately affecting their teaching practices. The findings reflect the dynamic interplay between theory and practice, suggesting that effective eco-literacy education requires a robust understanding of the pedagogical frameworks underpinning these initiatives, thereby bridging existing gaps in the theoretical discourse on environmental education.

Practical implications

The insights from this study bear significant implications for educational policy and practice. By identifying successful strategies for engaging students in environmental education, such as outdoor exploration and project-based learning, this research encourages schools to adopt more impactful green pedagogies in their curricula. Additionally, it underscores the need for targeted professional development programs that equip teachers with the skills and resources to integrate sustainability into their teaching effectively. Furthermore, strengthening administrative support for environmentally focused initiatives is essential to foster a school culture prioritizing eco-literacy and student engagement.

Limitations and prospective research opportunities

This study has limitations, including the reliance on self-reported data from a small, convenient sample of teachers, which may not fully represent broader educational contexts. Future research could expand the scope to include a more diverse range of educators across different educational settings and cultures, providing a more comprehensive understanding of green pedagogies. Additionally, examining the long-term impacts of these pedagogies on student outcomes would provide valuable insights into their effectiveness. Investigating specific interventions or training programs for teachers could also yield actionable recommendations for improving eco-literacy in educational institutions, ultimately enhancing the development of environmentally responsible citizens. Future studies could investigate specific case examples where green pedagogies have significantly changed student behavior and community engagement.

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Theorizing non-western ontologies towards a pedagogy of animist praxis

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Abstract

This paper explores the role theorizing non-western ontologies play in developing pedagogies that center on animist praxis as a valid and necessary approach to problematizing environmental challenges in the environmental sciences and humanities. The ongoing call for this transdisciplinary pedagogical approach continues to suggest that the challenge of the Anthropocene is an ontological challenge arising from modern humans' abstraction from a more-than-human planetary community – rooted in the substance ontology of Euro-Cartesian metaphysics. The central focus of this pedagogy seeks to understand how theoretical examination of and self-reflexive engagement with the metaphysics of animist ontologies dismantle the primacy of dominant Euro-Cartesian assumptions in the classroom about the nature of reality and nature-knowledge relationships that inform systemic practices of environmental control.

In privileging Indigenous and Earth-centered epistemologies, this paper suggests how a pedagogy based on animist and other relational ontologies can assist students in experiencing themselves as part of an ecological web that values transspecies agencies – examining how theorizing and critical reflection on animist understandings of personhood, kinship, and the ambiguity of ontological between species can radically alter students' approaches to environmental work and reshape their relationships with other species.

Introduction

The academy as a social setting is structured according to established worldviews and paradigms that inform a set of beliefs that guide the instruction and actions of individuals who subscribe to and participate in this social setting. "These beliefs include the way that we view reality (ontology), how we think about or know this reality (epistemology), our ethics and morals (axiology), and how we go about gaining more knowledge about reality (methodology)" (Wilson, 2008, p. 13). What role does interdisciplinary and transdisciplinary theorizing of non-western ontologies continue to play in developing pedagogies (within mainstream academia) that problematize environmental challenges in the environmental sciences and humanities utilizing animist praxis or practice?

Over two decades ago, Potawatomi botanist Robin Wall Kimmerer, following in the footsteps of scholars of Native Science such as Greg Cajete (2000), among others, called for a more pervasive incorporation of non-western worldviews and environmental practices such as Traditional Ecological Knowledge (TEK) into mainstream science education and biology (Kimmerer, 2002). Since that time, departments such as SUNY College of Environmental Science and Forestry, where Kimmerer is director emeritus of the Center for Native Peoples and the Environment, the Traditional Ecological Knowledge Lab in the School of Forestry at Oregon State, alongside numerous other Environmental Studies Departments, Native American or Indian Studies Programs across the United States, (including other similar such programs in countries such as Canada and Australia) have fostered increasing interest among ecological and social science communities to include Traditional Ecological Knowledge systems (TEK) and Indigenous Knowledges (IK) in the study of the environmental and social impacts of contemporary ecological challenges like climate change (David-Chavez & Gavin, 2018; Wolf et al., 2024).

Despite the increase in interest to include Indigenous and other non-western knowledge systems and voices in scientific research and teaching institutions, many institutions continue to assume that scholars and scientists educated in classical interpretations of the natural sciences are sufficiently equipped to adopt a diversity of animist and or Indigenous epistemologies and to integrate the epistemologies of these ontological assumptions into their scholarly purview (Hird et al., 2023). Addressing this concern during a two-day workshop—entitled *Elevating Indigenous Knowledges in Ecology* hosted by Traditional Ecological Knowledge Section of the Ecological Society of America (ESA), Wolf et al. (2024) emphasize that notwithstanding the decades of transformation that has taken place in individual academic disciplines and schools of thought that without more comprehensive "holistic structural and cultural changes" (Wolf et al., 2024), enthusiasm to incorporate TEK and IK into environmental sciences risks perpetuating historical and ongoing exploitative academic perspectives and practices (Elkington, 2023).

Within the above context, this paper firstly serves as an ongoing decades-long conversation with educators (within the environmental sciences and humanities specifically) who continue to assess and reassess–how the philosophical foundations of particular forms of universalized western ontologies and ensuing pedagogies continue to form part of an extractivist knowledge economy (Tachine & Nicolazzo, 2023) that reinforces a market-driven logic in the scientific and social study of environmental and climate change (David-Chavez et al., 2024; West et al., 2020, 2021, 2024). Change that disproportionally impacts human and more-than-human communities that do not find this universalized worldview mutually compatible with their own (David-Chavez & Gavin, 2018). Wolf et al. (2024) have bracketed the critical underlying epistemological frameworks embedded in this universalized form of western science, as settler science, which continues to underpin the foundations of the academy of the west, or settler-colonial institutions. Sullivan and Hannis (2016) state that while this particular form of modern ontology, most commonly associated with the philosophical and scientific principles of Euro-Cartesianism–has become universalized– and is, in turn, universalizing, it is itself culturally and historically particular (including to the history of western philosophical thought), and therefore does not translate universally across cultural contexts (p. 6).

From this standpoint, educators seeking to institute holistic cultural and institutional change must continue integrating a broader and increasingly transdisciplinary and ecologically centered pedagogical approach to practice-based theorizing (Dawes, 2023; Tan et al., 2023) of the differences and pluralities of non-western ontological assumptions across departmental curricula. "From a cross-cultural perspective, cultural and historical differences generate plural ontologies: or, at least, a plurality of discourses regarding what entities are considered to exist and how they are knowable, as well as the attribution of moral considerability and status to these entities" (Sullivan & Hannis, 2016, p. 5). This plurality of discourse about ontological assumptions informs diverse communities' beliefs about themselves as part of material assemblages constituting a broader representation of ecological worlds.

Although not contemporarily novel, this discourse, which is cyclically emergent, requires continual construction and reevaluation as ongoing resulting perceptions continue to inform relational approaches to environmental problem-solving (West et al., 2024). In privileging Indigenous and Earth-centered epistemologies, philosophies, and science, this paper suggests that a pedagogy based on animist and other relational ontologies can assist students (future environmental activists, thinkers, and scientists) in experiencing themselves as part of an ecological web that values transspecies agencies. In light of these concerns and this ongoing debate, this paper seeks to briefly revisit the role of teaching animist ontologies from the perspective of praxis 1.) clarifying what is meant by western, and then second 2.) reviewing the merits of engaging with explicit and implicit theory across disciplines, and lastly 3.) exploring the limits of theorizing embodied lifeways and ecologies.

Written in North America from within the western academy as a site of exploration, the questions in this paper are conceptually inspired by recent theoretical and methodological developments in Post-Qualitative Research (St. Pierre, 2021), Critical Posthumanism (Braidotti, 2019; Ferrando, 2019), and New Materialism (Barad, 2007; DeLanda,

2016). This paper draws from Indigenous philosophies and recent scholarly work on Indigenous research principles and methodologies (Chilisa, 2019; Wilson, 2008; Kovach, 2012). Here, Indigenous refers to peoples and communities with longstanding and/or continuous connections to land, whose culture and spiritual practices are informed by and tied to that land (Shaw, Herman & Dobbs, 2006). Theoretically, this paper draws from the philosophies of social, cultural, and environmental anthropology that evolved out of the discipline's ethnographic engagement (amongst Indigenous communities) with animist cosmologies, resulting in the theoretical framework known as the "ontological turn" (Descola, 2013; Viveiros de Castro, 2015; Willerslev, 2007; Haalbraad & Pederson, 2017) or anthropology beyond-the-human (Kohn, 2013) that continues to inform the study of New Animism. Lastly, the author draws from direct observations of teaching in classical and interdisciplinary classroom settings within the academy.

Reality beyond the limits of the western scientific paradigm

The specific western philosophical tradition from which the now universalized western scientific paradigm emerged during the European Enlightenment, has been accused of a great many things – including the formulation and formation of a hubristic worldview that envisaged the metaphysical separation of mind from the body and soul (Carter, 2021). An ontological worldview whose supremacy is premised on the uniquely soul-bearing human culture existing outside of and transcendent from the mutuality of all other planetary cultures and beings (Sahlins, 2023).

Commonly identified as Cartesian ontology, this worldview "stripped living creatures of the presence of soul so as to make humans exceptional in these terms, creating pacified objects and automata of beyond-human others" (Sullivan, 2019). Dominant forms of first Catholic, Anglican, and then Protestant Christian theology and their symbiotic relationship to the evolution of empiricist natural philosophy (Gaukroger, 2001, 2006; Matthews, 2008) are similarly accused of reinforcing this worldview and of propagating an ideology of human positionality of dominion that has led to the widescale societal justification for the endless consumption of natural resources, including all parts of the geosphere and all forms of animate and inanimate life that exists upon and within it (Merchant, 2019).

> Since early modern philosophers and scientists envisioned the world as made out of nonexperiencing matter, it seemed clear that no natural (that is, material) process could possibly give rise to human minds/souls. The only alternative, they thought, was to assume that souls were created supernaturally by divine fiat. Consequently, human minds came to be seen as essentially unrelated to the world of nature around us (Mesle, 2008, p. 9).

With the evolution of this particular formation of a new European worldview (Tarnas, 2010), where the being of the human mind/soul is unrelated to the world of "nature", came the bifurcation of nature, where the divinely infused transcendental nature of the human is set aside from the mundane and earthly immanence of the rest of creation (Sahlins, 2023, p. 11). The problem, according to philosopher of science, Isabelle Stengers, however, does not concern the mind but rather the theories that we have chosen to privilege that determine that nature is bifurcated (Stengers, 2011, p. 58). Theories that, despite the plurality of the evolution of Europe's cultural history–and this history's associated metaphysics have become embedded in the most basic western academic assumptions that form the foundation of many of our academic disciplines concerning the nature of reality as defined in the environmental sciences and humanities (Kocku, 2022).

> Modernist philosophy of science implies a bifurcation of nature into objects having primary and secondary qualities. However, if nature really is bifurcated, no living organism would be possible, since being an organism means being the sort of thing whose primary and secondary qualities - if they did exist - are endlessly blurred…what sort of metaphysics should be devised that would pay full justice to the concrete and obstinate existence of organisms? (Stengers, 2011, p. xiii)

When we limit our understanding of the nature of being to what has become a universalized worldview of Cartesian ontology, we limit our understanding of reality to a culturally particular worldview that erases most other worldviews. Recognizing Cartesianism's ongoing prominence and influences on environmental and scientific disciplines does not preclude the recognition of Europe's intellectual heritage of resistance to ontological dualism primarily through social theory and the evolution of the environmental humanities, which at various points in the history of modernity have been heavily influenced by Indigenous philosophies, epistemologies and cosmologies (Graeber & Wengrow, 2021).

My reading of Euro-continental schools of social theory— including philosophy, history, and anthropology— is that they tended, at least initially, to focus on addressing human cultural and social concerns. Thinkers like Gilles Deleuze, Michel Foucault, Giorgio Agamben, and Antonio Negri, many of whom were positively or negatively influenced by Marxist theory (Laurence, 2016), focused much of their early work on human society's relationship to structures of power. These thinkers included concerns for the environment that relate to resource accumulation and labor production with a Marxist bent.

With the interdisciplinary convergence of sociology, anthropology, and science, western scholars like Bruno Latour, Michal Callon, Pugliese, Tim Ingold, Jason Moore, Isabelle Stengers, and Anna Tsing, amongst others, showcased the environment for its own sake. The flourishing of continental, Australian, and North American-based feminist studies, specifically eco-feminism, helped bring social theory and ecological critique together, moving the scientific study of ecology and environment into an even deeper relationship with the humanities. Feminist scholars like Judith Butler, Carolyne Merchant, Donna Haraway, Catherine Keller, Freya Mathews, and Val Plumwood,

to name a few, contributed significantly to what would come to be known as the collective field of environmental humanities, whose influence over time has extended to the environmental sciences.

The environmental humanities encompass an array of disciplines that preceded and helped define it. These disciplines include environmental history, environmental philosophy, eco-theology, eco-criticism, environmental ethics, and eco-psychology (Merchant, 2019). Significant scholars within environmental philosophy include notables such as Bron Taylor, Michael Zimmerman, Murray Bookchin, and Gary Snyder. As it has grown in influence and sophistication, the environmental humanities (and its influence on environmental science) have drawn upon the works of many who preceded the advent of the field itself, including figures such as the historian Lynne White Jr.; the philosopher Holmes Rolston; and environmental writers such as John Muir, Rachel Carson, Aldo Leopold and the founder of deep ecology Arne Naess.

Parallel to the flourishing of the above, the work of Alfred North Whitehead and the Deleuzoguattarian project (Deleuze & Guattari, 1987, 1996) reinvigorated academic discussions on process thought and process-relational ontology in England, North America, Australia, and Europe, respectively. Whitehead's process thought allowed postmodern Euro-American thinkers to reinvent their cosmologies, theologies, and epistemologies, while the Deleuzoguattarian project can be seen as having reinvigorated cosmological understandings of postmodern metaphysics (Griffin, 2008). Whitehead and Deleuze each engaged in a reimagining of how the metaphysical process of western thought and its material and nonmaterial modes of becoming interrelated. These two philosophers, emblematic of diverse yet connected positions that western philosophy can represent, demonstrate the complexity of the intellectual lineage of the western philosophical tradition and that tradition's ability to engage in an alternate perspective of ontology. As a mathematician, Whitehead was a philosophical empiricist concerned with thinking through the spatiotemporal processes of nature as defined by and denied by a particular history of western philosophy. Whitehead believed that "we habitually observe by the method of difference" (Whitehead, 1979, p. 4). Despite the long intellectual heritage of resistance within the environmental humanities to dualistic Cartesian ontologies, these ontologies' persistent prominence in the academic discipline and practice of mainstream environmental science remains at odds with animist and Indigenous worldviews (Hird et al., 2023).

The ontological turn: Engaging with explicit theory

The above discussion of the ongoing prominence of Cartesian ontology in scientific disciplines, despite Euro-American philosophy's ontological bend toward ontological extension or plurality, reintroduces the question of the role of theorizing non-western philosophies and ontologies to inform a different approach to environmental praxis. How do we, as Harvey (2018, p.35) and Morrison (2013) suggest, build on the teachings and ontological assumptions of western-non-western post-Cartesian scholarly practices – to support a praxis of human-non-human relationality in which environmental scientists, researchers, activists, and scholars recognize not only the rights of nature but also the role of alive, more-than-human agencies in shaping the future of climate adaptation and environmental decision-making beyond-the-human.

> Ontological assumptions denote what entities can exist, into what categories they can be sorted, and by what practices and methods they can be known (i.e., epistemology)...It suggests the parallel existence of different ways of understanding how reality is constructed, how the world and its entities can be known, and what constitutes appropriate ethical praxis in relation to these entities (Sullivan, 2016, p. 157).

Even as the hard sciences evolve towards a greater understanding of material complexity (Dodds, 2012; DeLanda, 2013), scholars have recently argued that the Cartesian worldview continues to, directly and indirectly, inform a single dominant reality about the nature of biological materiality that assumes that earthly matter lacks animism (soul), autonomy, and agency when problematizing environmental challenges (Hird et al., 2023). In contrast, in the ontology of an Indigenous worldview, there may be multiple realities, each of which comes into existence by acting on relationships with those realities. "This idea could be further expanded to say that reality is relationships or sets of relationships. Thus, there is no one definite reality but rather different sets of relationships that make up an Indigenous ontology" (Wilson, 2008, p. 73). Thus, if the dominant or even lingering belief about the nature of reality in environmental studies assumes a narrow scope of ontologies based on the bifurcation of ecological relations between species, humans, and other forms of materiality, then this assumption will continue to inform extractive research practices and methods that lack relationality in cross-cultural and other research settings.

The transdisciplinary theorization of animist praxis informed by decades of evolving theoretical frameworks put forward by Indigenous and Euro-American scholars in Anthropology, New Materialism, Posthumanism, and Feminist Studies continues to counter an academic culture of monolithic ontology, even if it has yet to be holistically integrated into the academy as a whole. Scholarship whose epistemological foundations focus on the relations between entities continues to hold considerable potential to reinvigorate and eventually transform many if not all, academic disciplines in a more pervasive manner (Astor-Aguilera & Harvey, 2018, p. 3).

> Allowing for ontological difference permits us to explore alternative modes of thinking by recognizing affordances to everything that surrounds us – be that animals, plants, the weather, water, rocks, as well as the unseen – both because most of us may also treat "objects" as "subjects" and, often in more deliberate ways, because many non-Western peoples relate to the world as such (Astor-Aguilera & Harvey, 2018, p. 6).

Anthropology, and more explicitly, environmental anthropology, including the rapidly evolving practice of multispecies ethnography (Ameli, 2022) within the context of post-colonial and decolonial scholarship, continues to experience an increasing move towards a broader spectrum of ontological considerations through the theoretical framework of animism "as researchers have dug more deeply into divergences regarding the assumed nature of reality, as revealed by differences in how environmental phenomena are framed and thereby constructed culturally" (Sullivan, 2016, p. 156).

As with nineteenth-century anthropology, the academic concept of animism evolved more generally from a Eurocentric evolutionist perspective (Tylor, 1920). A perspective replete with Cartesian assumptions about the soul and the essence of natural phenomena. Much of early anthropologies attempts to understand how non-western peoples and cultures relate to their worlds imposed (and continues to impose) Cartesian binaries (Astor-Aguilera & Harvey, 2018, p. 3).

Through Hallowell's study of Ojibwa ontology (Hallowell, 1960), the study of animism evolved to question how ecological awareness and engagement inform more-than-human ontological personhood (Forbes, 2021), a question more recently expanded upon by Ingold (2000) and Low (2017) among others who assume an 'ecological phenomenological' approach to animism. Hallowell's theorization of personhood beyond-the-human contributed to the understanding that the study of social organization should not be constrained to human relations but should include the connections of all animate beings, leading to the emergence of New Animism in the 1990s (Costa & Fausto, 2010, p. 90).

Via the dual paradigms of animism and philosophical perspectivism, the work of Philippe Descola and Eduardo Viveiros de Castro among Lower Amazonian peoples (Castro among the Achuar and Descola the Awarete) significantly contributed to the theoretical and philosophical evolution of New Animism and the ontological turn (Costa & Fausto, 2010). Intellectually indebted to Lévi-Straussian structuralism, Descola emphasizes "the aspect of human-non-human continuity by virtue of a shared 'interior' spirit or soul," while Viveiros de Castro is concerned with "discontinuity through different 'exterior' bodies which ensure that species see each other as different from one another" (Guenther, 2015, p. 280). Both paradigms focus on the ontological continuity between humans, animals, and the preternatural, where "in Descola's vision, the animist world is constitutive of species-societies that are isomorphic with human societies" (David-Bird, 2018, p. 28) and Castro explicitly stating that animism is "an ontology which postulates the social character of relations between humans and non-humans: the space between nature and society is itself social" (Viveiros de Castro, 2015, p. 473). With the emergence of New Animism as an explicit theoretical framework for engaging with the cosmologies of animist societies, animism morphs from being an epistemology or way of knowing to a way of being or ontology (Costa & Fausto, 2010, p. 94) that informs a praxis that reinforces that "reality is relationships" (Wilson, 2008, p. 73), that reality is social. "Put simply, animist ontologies assume the alive sentience of other-than-human natures, affirm the possibility of agency enacted by 'non-human' entities, and tend to adjust human relationships with these entities accordingly" (Sullivan, 2016, p. 159).

Astor-Aguilera and Harvey emphasize that despite the ontological turn being a social theoretical construct that essentially emerged from within the broader academy as a heuristic tool, the "turn toward emphasizing ontology in the study of non-western (or alternatively modern) peoples and knowledges" (Astor-Aguilera & Harvey, 2018, p. 3) has provided scholars with an expanded method to engage with cross-cultural differences and realities – valuable to scholars' and researchers' problematization of the impacts of present-day environmental challenges on peoples and species alike. Chris Low's recent work (Power et al., 2016) supports Ingold's notion of an ontology based on perceptual engagements with constituents of a dwelt-in world (Ingold, 2000). Low, in my understanding, advocates that a hunter-gatherer ontology, for example, is informed by somatic symbolic engagement with their environment. This allows us to reimagine a more embodied and inclusive approach to the historical development of human consciousness. Low's argument deemphasizes a human-centered approach to the development of consciousness, emphasizing instead the evolution of the human as part of the conscious ecology of Earth. Low argues that the premise of a sudden 'human revolution' of consciousness creates a superficial division between humans and the rest of the ecological and biological world (Low, 2017, p. 226).

Even with the advances made in the disciplines mentioned above, explicitly examined and taught, the theories of New Animism (and New Materialism to some degree) once treated as "curious belief systems" or theories (Astor-Aguilera & Harvey, 2018, p. 35), still lack cross-disciplinary integration as relational societal frameworks that have concrete bearing on the interaction between humans and their surrounding ecologies. And despite the progress made in the philosophy of science (Barad, 2007; Latour, 1993) and the study of critical posthumanism (Braidotti, 2019), animistic theory often remains relegated to Anthropology, Religious Studies, Animal Studies or Native Studies departments with some scholars arguing that there remain several significant challenges to the integration of animism with science or empirical naturalism with particular reference to the difference in which animism and science treat nature (Van Eyghen, 2023). Lastly, even with the flourishing of the study of animistic theory within these independent departments, the explicit instruction of relational animism across disciplines within the environmental humanities has yet to be thoughtfully incorporated into the broader spectrum of ecological studies outside specialized transdisciplinary fields of study. Again, this does not preclude the work being done in individual universities and colleges across the Global North and the Global South, the analysis of which would be better treated in a separate paper.

In parallel, and perhaps as an overlapping process, the growing recognition of the importance of Indigenous Knowledge (IK) to environmental studies provides alternate opportunities for theorizing plural ontologies, notwithstanding the present barriers that still exist to

integrating IK in environmental curriculum and research projects (Elkington, 2023). Like any theory, the animism of the ontological turn can, in a similar way to the scientific study of nature, become an ideated abstraction in the classroom, where students' first-hand exposure to these lifeways is often limited. Sullivan and Hannis (2016), in supporting the academic consideration of relational ontologies in the study of biodiversity, conservation, and natural resource management, suggest that in the absence of direct experience, one way to avoid such an abstraction is to continue to learn from the direct experiences of others, which for one, can be informed (across disciplines) by critical reflection on contemporary cross-species ethnography alongside experiences from other methodological forms of direct community engagement (Ameli, 2022).

In specific reference to environmental ethics, Sullivan and Hannis (2016) suggest that by reflecting on the direct experience gained from ethnography, environmental anthropology offers interdisciplinary students, scholars, and scientists in environmental studies "a deeper understanding of how people might live in specific relational contexts with different kinds of agency-asserting entities, only some of whom are human" (p. 22). The western academy has undoubtedly seen increased integration of explicit animistic theory within interdisciplinary educational institutions, and yet it lacks holistic and wide-scale integration across the environmental humanities, which raises the question of the function of implicit theory and its role in fostering relational animist praxis across academic disciplines and institutions.

Implicit theory: Towards a pedagogy of animist praxis through storytelling

Developing a pedagogy of animist praxis implies that we are not only instructing students about multiple ways of relating to the world but are, instead, also demonstrating the principles embedded in relational ontology as a valid framework with which students can engage and approach the world. In classical educational settings where the study of (or demonstration of) ethnographic detail across disciplines may not be available to students undertaking environmental studies, Sullivan and Hannis's (2016, p. 22) suggestion to learn directly from the experiences of others can still be applied through the instruction of implicit relational and animist theory utilizing different educational tools. Here, the mediums of narrative, storytelling, and oral traditions are well suited for instructing implicit relational and animist theory and are congruent with the relational principles of an animist and Indigenous praxis. Nêhiyaw and Saulteaux scholar Kovach explains that

> Stories hold within them knowledges while simultaneously signifying relationships. In the oral tradition, stories can never be decontextualized from the teller. They are active agents within a relational world, pivotal in gaining insight into a phenomenon. Oral stories are born of connections within the world and are thus recounted relationally. They tie us with our past and provide a basis for continuity with future generations (Kovach, 2012, p. 94).

Bantu scholar Chilisa further elaborates that languages, folktales, and stories embody the Indigenous knowledge (Chilisa, 2019, p. 92) of animist praxis and that stories are a tool for enabling scholars (and students) to "triangulate postcolonial Indigenous values, belief systems, and community and family histories with other sources of knowledge" (Chilisa, 2019, p. 194). Chilisa's statements here are further enhanced by Wilson's articulation that stories serve the purpose of allowing the listener to arrive at their own conclusions and to integrate life lessons from their particular and personal viewpoints (Wilson, 2008, p. 17). Guenther, in discussing the role of story and myth in the animistic cosmology of the San Bushmen of southern Africa, writes that "myth, through its linkages with and relevance to people's real-life existence, becomes an implicit aspect of this existence, and contributes to shaping how they live, experience, and understand their lives" (Guenther, 2017, p. 8). Biesele further highlights that for southern African hunter-gatherer societies, survival is as much dependent "on functioning as a creative, intercommunicating collective" (Biesele, 2023, p. 16) as on resource sharing and that the principles of sharing resources are continuously reinforced by communal artistic activities, where storytelling serves as a tool for creating a world of unique agreement and social cohesion (Biesele, 2023, pp. 16-17) among human and more-than-human kin in place—governing and reinforcing collective morals and ethics that inform relationships (Biesele, 1993). Wilson reiterates that relationality is the central overlapping or connected aspect of an Indigenous ontology and epistemology, "relationships do not merely shape reality, they are reality" (Wilson, 2008, p. 73). Stories about and storytelling by more-than-human affirming agencies help elucidate a reality of relationality that extends beyond human social relations.

Stories help to make sense of and reinforce relationships in places that are at the heart of animistic and Indigenous ontologies. Giving a direct voice to the relational lifeways embedded in Indigenous and other place-based stories can be an approachable and relatable demonstration of animist praxis that is less abstract and, at the same time, supportive and demonstrative of relational animistic theory. Stories, in various artistic formats, with a particular reference to the visual medium and the use of film in the classroom, allow educators to introduce students to relational animistic principles that not only facilitate a process of fostering ontological paradigms beyond Cartesianism, but further allow them to imagine the co-creation of futures beyond our current condition (Strauß, 2023). Integrating and teaching, for example, animistic and Indigenous understandings of kinship – based on reciprocity with the more-than-human world – to students for whom such understandings are entirely foreign requires a literal demonstration of relationship to place that is challenging to achieve using explicit theory in texts alone.

How do we demonstrate to students, as Sahlins (2013) suggests, to experience and see more-than-human kin as "mutual" beings who participate in each other's lives through the plurality of being? How do educators demonstrate in the classroom an ontology of "being immersed from the start, like other creatures, in an active, practical, and perceptual engagement with constituents

of the dwelt-in world" (Ingold, 2000, p. 42)? We adhere to the suggestion that we give voice to the direct experiences of peoples and communities for whom an ontology of dwelling is a lived reality (Sullivan & Hannis, 2016), while as Wolf et al. (2024) suggest working towards an academic reality that integrates Indigenous Knowledges (IK) as a central paradigm to ecological sciences institutionally and culturally. Environmental activist and filmmaker Craig Foster, in referencing the Indigenous concept of two-eyed seeing, first introduced by Mi'kmaq Elders, Albert, and Murdena Marshall, where Indigenous perspectives and western perspectives are held together (Wright et al., 2019), suggests that it is necessary, in our contemporary moment, to engage in what he recently referred to as three-eyed seeing. A process where storytelling becomes an active agent with science and Indigenous knowledge in communicating a way of being in relationship with the more-than-human world that is not currently accessible to large groups of people and students raised and educated within western societies (Oberhosel, 2024).

The above does not obfuscate existing academic advancements in this direction nor suggests that the academy is void of such practices. Instead, it argues for a more pervasive integration of such tools and methods across disciplinary frameworks, particularly concerning the intersection of environmental humanities and the environmental sciences.

Conclusions on the limits of theorizing embodied lifeways

Animist embodied lifeways are, first and foremost, embedded in a deep relationship to place, embodied over time from one generation to another, where ancient knowledge is "grounded in the experiences of self-in-relationship to place" (Styres, 2018, p. 25). This highlights the most apparent limits of theorization in that theorization is incapable of substituting embodied and phenomenological processes gained over thousands of years. However, the limits of theorization can also define its purpose: creating space for a paradigm shift or broadening intellectual possibilities that support more embodied futures, supporting the development of what Narvaez calls ecological relational consciousness (2024). An awareness where we understand that an "acknowledgement of our dependence upon nonhuman worlds contribute to our understanding of ourselves" (Sullivan & Hannis, 2016, p. 24).

This author's limited observations within the classroom at both an undergraduate and graduate level within classical and interdisciplinary academic settings reveal that despite increased access to information and social mobility, students are frequently culturally and intellectually isolated while repeatedly being encouraged to engage in siloed learning as a strategy for navigating academia. This educational strategy encourages students to filter out rather than embrace a plurality of paradigms and ontologies that lead them back to problem-solving through the worldview of Cartesian binaries. So where, then, do we begin or go from here?

The starting point is to return to the question of what worldviews and ontological paradigms we are privileging in the classroom and how these directly translate into either a pedagogical praxis of bifurcation or a pedagogical praxis of interrelation between beings. As educators, we must begin with the assumptions in our higher education system.

Secondly, it is insufficient to assume or discover that these assumptions are based on Euro-Cartesian dualism and turn this into a philosophical practice of assigning blame to justify the status quo. It is instead critical to continue to recognize that much of the academy and secondary education continues to be at fault for placing one culturally particular or universalized paradigm hierarchically above all others–positioning this paradigm as the benchmark by which to assess and understand the entirety of the universe (Tachine & Nicolazzo, 2023). It is equally insufficient to call on environmental studies to include Indigenous scientific perspectives or to ask Indigenous researchers to engage in two-eyed seeing when we, within the western academy and scientific institutions, have not integrated an equivalent approach to scientific and environmental inquiry ourselves–demonstrated by the collapse of a recent collaborative study between Indigenous communities in North America and U.S. National Academies of Sciences, Engineering, and Medicine (NASEM) (Ortega & Mervis, 2024). Just as for an Indigenous scholar, where blending western scientific approaches with Indigenous scientific knowledge can be experienced as a contradictory process, so too, students within the western academy who have not been taught how to embrace relational or animistic research principles will encounter contradiction in the field when asked to use the tools of western science, to engage with TEK and IK.

Thirdly, educators who are not Indigenous must continue to support and give voice to Indigenous scholars and the stories of Indigenous-led science and research projects, including projects that support the successful blending of western science, TEK, and IK in problematizing contemporary environmental challenges (David-Chavez, 2024).

Lastly, educators in environmental studies must continue to increase the integration of practical outdoor and land-based education designed and led by Indigenous communities, successfully demonstrated for decades (Kimmerer, 2002), for whom an animist praxis forms part of their lived environmental strategy—a praxis based on a reality informed by reciprocal relations to the more-than-human world. "Many indigenous communities globally…seem to conceive of an expanded zone of moral considerability, reciprocity and collaboration that includes entities beyond-the-human, as these are embedded and constituted in specific and shifting relational settings" (Sullivan & Hannis, 2016, p. 6).

Decolonizing environmental studies in the neoliberal era of western academia is, by design, a paradox and can, for many educators, scholars, and students alike, feel contrary to their reasons for being in academia in the first place. It is important to remember, though, as Tachine and Nicolazzo remind us, that academia "both reinforces existing systems and has the potential to serve as a site of refusal" (Tachine & Nicolazzo, 2023, p. 26). Embracing a pedagogy of animist praxis through the theorization of plural ontologies

and learning from the lived ontological experiences and cosmologies of non-western peoples and societies turns the classroom into a site of refusal of the universalization of one very particular and culturally specific ontological paradigm and worldview. The academy can also serve as a site of creation and regeneration to support a praxis of human-non-human relationality in which environmental scientists, researchers, activists, and scholars recognize not only the rights of nature but also the role of alive, more-than-human agencies in shaping the future of climate adaptation and environmental decision-making beyond-the-human.

In conclusion, a move towards a pedagogy based on animist praxis and other relational ontologies can open possibilities for students to experience themselves as part of an ecological web that values transspecies relationality.

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Realization of Gross National Happiness-inspired green education in Bhutan

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Abstract

Green education as mentioned in Thakur S. Powdyel's *My Green School: An Outline* (2014) was developed to support democratic Bhutan's initiative 'Educating for Gross National Happiness' (EGNH), pinned on the nature-culture axis. The initiative motivated the educational institutions to imbue their teaching-learning environment with the values of Gross National Happiness (GNH). However, in terms of holistic development in modern education, the concept requires an integrated understanding beyond the explicit meaning of green, which primarily denotes nature and the environment. The eight dimensions of green school, denoted by the term 'Sherig Mandala' and designed in a concentric sense, hold a critical significance. Besides dealing with the idea of education through the natural environment, the concept also has a major claim on an individual's life and learning on a moral level, integrating the physical and psychosocial ambience. It attempts to establish that the process of learning is the key to understanding the principles of life.

With the core value of education being jeopardized in modern times, the paper attempts to ascertain the meaning and purpose of learning for a holistic life. The inherent meanings of the elements of greenery such as natural, social, cultural, intellectual, academic, aesthetic, spiritual and moral were examined to comprehend their philosophical intent. The significance of the concept was examined not in isolation but in correlation with the nine domains of Bhutan's developmental philosophy known as GNH. Further, the paper has also affirmed that the conceptualization of 'Green School' in Bhutan is quite different from other countries around the world because it focuses not on the buildings and infrastructure, but on the behaviour and the core inner aspects that each child requires. This is to emphasize the fact that only the nobility of mind, heart and hands would empower the learners.

Introduction

Green education is today, increasingly being accepted as an important crusader in bringing about a paradigm shift in the way the world perceives man's connection with nature. In educational parlance, green education is simultaneously called environmental education which aims toward a critical pedagogical approach to schooling people on environmental issues, ecological concepts, and sustainable practices which could have long-lasting ramifications if they are not addressed early and in the right way. "The goal of green education is to empower individuals with the knowledge and skills to make informed decisions that positively impact the environment. On the other hand, greening education focuses on incorporating sustainable and eco-friendly practices within educational institutions themselves" (Said et al., 2023). Green education goes beyond traditional classroom teaching and learning.

The objective of green school endeavours in an educational institution is to ensure that the education delivered not only encompasses knowledge but also the essential competency and values for a sustainable development of the community. To achieve this aim, the school governance must forge community partnerships that engage with the local stakeholders to drive home the point of environmental protection which in turn impacts the community's social, economic and cultural components. Green education unravels the spirit of oneness in nature and human life. Practitioners of green education who share their learning and experiences can compare this with other projects in the region. For instance, the green school in Bali, Indonesia is defined as a natural, holistic, student-centred learning environment that empowers students to be creative and innovative as green leaders. According to MoE (2011b), in Bhutan, the concept of 'Green School' includes not only the teaching and learning institution but also the village communities. Such a praxis will spread the need to develop attitudes and behaviours that will support partner communities and even countries to establish sustainable methods of conducting businesses. This can result in a paradigm shift in the ethics associated with teaching environmentally sustainable models of practices and behaviour in schools and developing environmental sustainability in the community.

Background

The term 'Green School' has equivalent names around the world, such as 'Enviro-schools' in New Zealand, 'Green Schools' in China, Hong Kong and Israel, 'Eco-schools' in Canada, 'Green Flag Schools in Sweden and 'Sustainable Schools' in Australia and the United Kingdom (Gough, 2019). Gough also informs that these countries have created sustainable green school buildings that provide a conducive learning environment for teachers as well as students. The Green Schools programme aims to give educators and students ownership of the issues needing resolution and a sense of empowerment over the environmental challenges they face (United Nations Educational, Scientific, and Cultural Organization, 2014).

Drakpa and Dorji (2013) found out that in countries like Ireland, the scheme is used to promote and acknowledge long-term, whole-school action for the environment. It is to be noted that these nations use the model of a green school to disseminate environmental education; thus, Yangdon (2019) asserts that in most of the countries other than Bhutan the motive of 'Green School' remains the same that is to garner the importance of environmental awareness with its focus on learning environment only. However, the conceptualization of a 'Green School' in Bhutan, is quite different from other countries around the world because it focuses not on the buildings but on the behaviour and the core inner aspects that each child requires. Bhutan considers 'Green School' as an all-encompassing and empowering model ranging from physical to moral dimensions fostering an integrated system of learning that children deserve. It is believed that such a concept would help learners to grow into a well-rounded individual into fullness realizing the nobility of mind, heart and hands. The concept will be further validated in the paper by analysing the integrated wholesome values present in the eight elements of a 'Green School'.

The Eastern world believes that education facilitates self-discovery which results in an individual becoming aware of his or her potential with conviction and virtuous disposition. Bhutan's distinctive development trajectory under the guidance of its historical and current kings mirrors its approach to educational development. For over a thousand years, Buddhist monastic education was the primary form of schooling in Bhutan that believed education was only aimed at dispelling ignorance and seeking knowledge. In contrast, secular education that emerged in the latter half of the twentieth century began to see education as a means to an end, specifically geared toward job market readiness. The Green School model unites the contrasting features of monastic and modern education, blending values and skills in a cohesive manner. Thus, the eight elements included as the key dimensions of a Green School are identified as the cornerstone of education.

Discussion

The Green School for Green Bhutan programme evolved under the aegis of the Educating for Gross National Happiness (EGNH) initiative to help reach the goal of Gross National Happiness (GNH) (Powdyel, 2014). Bhutan's development philosophy of Gross National Happiness over Gross National Income is mindful of happiness and wellbeing to an extent that GNH guides its policies, curriculum, decision-making and societal goals. Ultimately, happiness is a matter of perception; a state of mind; a fact that is fully acknowledged by Buddhism and other world faiths. In 2010, Bhutan's Ministry of Education put forth a widespread reform program named Educating for Gross National Happiness which was to be achieved by supporting Green Schools for Green Bhutan, and consequently, schools across Bhutan instituted the programme. Education being a critical factor in the four pillars and nine domains of GNH, the cardinal elements of the model proposed for Bhutan's education system in association with the core ideas of the nation's Gross National Happiness philosophy highlight

the strategies involved for the wholesome development of a child in schools. Gyeltshen (2016), an educator in his doctoral thesis titled, 'Contemplative practices and learning: A holistic approach to education in Bhutan' defines 'holistic education' as a system that considers the affective dimension of learning as much as the cognitive dimension. While cognitive learning takes care of knowledge and skills for workforce development, affective learning promotes socio-emotional skills, spirituality and social-cultural values. In this direction, the end goal of both Green School and GNH are to produce wholesome individuals by linking both the affective and cognitive dimensions. The nine domains of GNH intend to produce individuals with community vitality and concern for nature, uphold culture and tradition, and judiciously use resources for a harmonious society. Along these lines, Green School aspires to facilitate holistic education that would build the much needed humanistic and moral values in individuals since childhood.

'Sherig Mandala', literally meaning 'Education Circle' contains the elements of a Green School arranged in concentric layers. The dimensions move inward from the periphery to the core starting with natural greenery and gradually in a phasic pattern, moving towards the moral greenery emphasizing deep learning and the fact that morality is the fundamental element of Bhutan's education system. Though natural greenery helps individuals to sustain on the physical level with its conducive environment, moral greenery is what the education fraternity needs today when the standard of education has become debatable. Metaphorically, the term 'green school' indicates both the external and internal environments and in Bhutan, a green school refers to the eight different greeneries viz., environmental, academic, intellectual, moral, aesthetic, social, cultural, and spiritual balance, which are deemed necessary for the organic growth of every student in the school (MoE, 2012). The eight green dimensions do not just educate children to love, care, respect, and conserve natural resources as information-oriented learning. It also aids to realize the interconnectedness between the environment and inner self. Unlike the modern education system, wherein the 3Rs namely reading, writing and arithmetic delivered in the classroom focus only on the cognitive aspect of education and not on the whole person, the eight elements of a Green School will help to modify the behaviour towards anything and everything surrounding him / her that makes up the whole.

The concept of 'Green School' suggests that 'Green' institutions refer to the physical aspect of the surroundings, the general layout, the ambience and the objects that make the exterior of the school a part of the vital components of learning. The color 'green' symbolizes nature which is life-giving. Powdyel further adds:

> Such an environment is welcoming to the eyes and the mind. It lifts the heart and sharpens the sensibilities of the viewer. Learners feel invited and welcomed. This human–environment bond enriches the experience of living and learning. This mutual support system sustains life and living. The colour and character of school change with the seasons and delight the givers and the receivers of nature's gifts (Powdyel, 2014, p. 14).

A green school fosters and advances a very active involvement both by parents and the community. "Along with several studies in terms of reflections on Gross National Happiness in the education context and globalization, as well as the context of development, Powdyel's Green School describes all the fundamentals, as well as many other crucial aspects related to greenery concepts in the entire school, as a whole-green-school approach for future education" (Hoang & Lin, 2024, p. 1). Sithey et al. (2015) believe that Gross National Happiness advances health as per the guidelines of the World Health Organization (WHO) charter. It can do so on a large scale, and in doing so, it highlights the interconnectedness of the environment, sustainability, governance, and social factors. The core message of *My Green School* is often applauded as a milestone contribution in global education.

According to the MoE (2015), a green school approach entails "The use of the whole school behaviour starting with school management and administration, morning assembly, classroom teaching, co-curricular activities, formal and non-formal teacher-student interactions, school-community relationships and all the other dimensions of school behaviours. However, it is even more important for teachers and principals to collectively realize… the sacred onus to make this possible through whatever specific innovative strategies that work best in their schools" (MoE, 2015, p. 121). Following the implementation of the EGNH through building Green Schools for Green Bhutan, "several schools have reported visible and substantial improvements in terms of physical ambience, mindfulness, students' understanding of and regard for culture and nature" (MoE, 2012, pp. 3–4). Powdyel believes that it helps to improve both academic performance and behaviour, and significantly mitigate disciplinary issues. The end goals of both 'Educating for GNH' and the concept of 'Green School' are common, that is to make learners aware of their own self and make contemporary education an all-inclusive phenomenon.

In the schools of Bhutan, the applied aspects of the green domains are integrated into the curriculum. For example, in science and social studies, topics on 'Our environment', 'Waste Management', and 'Green Plants' are part of the teaching and learning for classes four to six. It is also compulsory for the classes, from pre-primary to sixth grade to have a minimum of five potted plants in the classroom. As part of the Social Forestry Day on 2nd June every year, Green Education implements tree plantation; on the World Environment Day, school students and the members of the community unite to carry out a mass cleaning campaign. Plantation of flowering and ornamental trees, along with saplings of cherry blossoms and Jakaranda plants that are collected from the neighbouring towns ensure ecological vitality (D. Lhaden, personal communication, 6 November, 2024). A focus group discussion was held with the management team and teachers of two schools located in the vicinity of Kanglung in Eastern Bhutan, namely Kanglung Primary School (KPS) and Jampeling Central School administered by the Ministry of Education and Skill Development (MoESD). In both these schools, certain 'green' practices are commonly held. Monday is a green day that says no to plastic, and it is mandatory for the students to carry greens in their lunch pack. The same policy is adopted by the school mess in the

Central School which provides meals for the students. A junk food penalty is levied if students bring junk food to the school premises. Such practices blend natural greenery with academic greenery to create a complementary text and context-based learning environment.

Similarly, there are activities that strengthen the values of GNH in terms of the physical, social, cultural, mental and spiritual health of both students and staff, thereby contributing to the idea of holistic education. Under the guidance of the Bhutan Scout Association, schools organize Scout programmes to develop life skills and problem-solving abilities in students. During the current year, Jampeling Central School organized a two-day outdoor camping activity for 113 students of classes VII, IX and XI respectively, escorted by five teachers. The objective of this outdoor activity was to help students experience nature, away from academic pressure, and learn basic survival skills including cooking. Following the directives of MoESD, the schools host the annual Games Carnival that includes competitions to help students unwind from academic pressure while fostering teamwork, sportsmanship, and fitness. Cultural events and variety shows featuring songs and dances in Hindi, Nepali, English, and Bhutan's national language, Dzongkha, celebrate diversity and vitalize the community (Chhimi, personal communication, 18 November, 2024).

Mentoring students is a routine activity with a bid to boost academic performance and welfare besides ensuring their mental well-being. To further strengthen the psychological well-being of the students and staff, mindfulness meditation and the Bhutanese traditional practice known as *Sorig Zhiney Lijong*, a practice akin to Yoga encompassing breathing and physical exercises, are offered in the campus every Saturday for two hours by trained practitioners. This sort of training sharpens the focus of the students and assists them in maintaining a balanced approach in life. The schools conduct an annual religious ceremony called *Rimdro* to pray for the welfare of sentient beings. During the pooja, both students and parents collectively contribute their services to fulfil the social and cultural components of the green school paradigm on this auspicious occasion. Members from the Central Monastic body are deputed to visit the school and deliver talks on values, ethics, culture and tradition which attend to the moral aspect. The school management also invites monks from the local monastic body known as *Kanglung Shedra* to give spiritual talks to the students. The students also form groups to perform songs and dances during the three-day local festive celebrations like *Tsechus* and *Drupchens*, which are as much a social event as they are religious, representing the communal cohesion, cultural ethos and the spiritual teachings of gurus in Buddhism displayed through mask dance performances. (Gyeltshen, personal communication, Nov.18, 2024). The masks and costumes used in the *Cham* dances and ceremonies are handcrafted to represent various deities, demons and animals from Buddhist mythology that tell symbolic stories and impart moral lessons about life's impermanence. By declaring local holidays during the celebration, it is ensured that Bhutanese families of old and young attend community functions and religious programs that help them stay rooted. In every sense, this vibrant festivity offers a colorful insight into the sense of unity for the youngsters, making them embrace their heritage and religious beliefs with national pride.

The above-mentioned practical initiatives have motivated the educational institutions to imbue their teaching-learning environment with the values of GNH. The doctrines of GNH were intrinsically infused in the school curriculum at all levels. According to Hayward and Coleman (2010), there is an emphasis on an organic understanding of ecological consciousness, a holistic insight into the Earth, reverence for ancient wisdom, and commitment to caring for nature. Such an integrated approach achieved through the eight dimensions of greenery applicable to a Green School has been listed by Powdyel as follows:

1. Environmental greenery is the ability to discover and honour our vital link with all life-forms around us and beyond us and that sustain us.

2. Intellectual greenery is the positive disposition to new ideas, knowledge, and information; openness of mind to seek and value new discoveries and insights and examine their merit.

3. Academic greenery is the ability to discover and to value the great ideas that define and give vitality to the many academic disciplines that we study in schools.

4. Social greenery is the ability to build relationships, goodwill, and positive energy and release these to the society around us and beyond us.

5. Cultural greenery is the appreciation of who we are and what makes us who we are, our values, sensibilities and worldview.

6. Spiritual greenery is an acceptance of the need for a higher, nobler, and sublime object to realize greater fullness and completion for our limited and unfulfilled lives.

7. Aesthetic greenery is the ability to extend the range of our sensibility to appreciate objects and ideas that elevate and edify our life beyond the mundane.

8. Moral greenery is the ability to distinguish between categories of values that give us our special character as the human of the species.

These eight components of a Green School also resonate with the primary goal of achieving happiness and the national objective of Gross National Happiness by covering the essential domains such as psychological well-being, health, education, culture, good governance, ecological diversity, resilience, and living standards. Together, they groom and nurture students.

The schools of Bhutan in general and the two specific examples considered for this study align their vision and mission with the domains of GNH philosophy and its ultimatum to achieve the happiness index. To live by

the maxim, 'a sound mind in a sound body', the Central School appoints a Health and Well-being coordinator to monitor children's health, attend to the boarding students during their illness and escort them to health centres and hospitals when necessary. International days are celebrated to promote good practices such as handwashing, menstrual hygiene, and BMI monitoring. Educational programs on nutrition and the prevention of non-communicable diseases raise student awareness. Reports are then submitted to MoESD.

In the domain of education, teachings on Buddhist philosophy and ethics are integrated to foster a culture of respect and moral integrity in the younger generation. It is believed that education is a holistic approach to nurturing the mind and spirit in accordance with Buddhist principles. As a result, Buddhism influences Bhutanese education by teaching values such as compassion, empathy, community service, respect for nature and all living beings that extend beyond academic knowledge to inculcate good human qualities. The value of respect ingrained in the culture and tradition of the Bhutanese not only defines their identity but also promotes cooperation, communal efforts to live sustainably and reduces conflicts over human and natural resources. The core Bhutanese values of *Tha-Dam-Tse* and *Lay-Ju-Dey* aim at the preservation of their unique culture and tradition and their contribution to nation-building. "Tha-Dam-Tse refers to loyalty, integrity, and honouring sacred commitments to others or the nation, emphasizing sincerity and respect in fulfilling one's duties. The *dam-tse* between the king and the people, parents and children, teachers and students, superiors and subordinates, and so on, is deeply rooted in the bloodline of the Bhutanese" (Phuntsho, 2024).

The value system is infused with Bhutan's cultural manifesto referred to as *Tsa wa Sum* or love, loyalty and dedication to His Majesty the King, the country and the people, "thereby urging every Bhutanese individual to actively contribute to this common goal of national and ideological importance." (Aris & Hutt, 1994, p. 153). The law of causal effect, guided by the principle that actions are not without consequences, is emphasized by *Lay-Ju-Dey*, who has governed the thoughts, speech and deeds of the monarchs. These values are a crucial part of the free education system to lay the moral and ethical foundation in the younger minds with the goal of building a strong character in Bhutanese students. The value-based and skill-oriented education enables the Bhutanese student community to become 'locally rooted and globally competent' to realize the vision of His Majesty the King, thus making them invaluable future citizens of the GNH nation. To develop the skills and creativity of the students, the management team of the Central School shared information about the club activities held for students. The club programs in the school, ranging from traditional to modern-day activities, include traditional as well as contemporary art and painting classes, *Cham* or Mask dance practice, tailoring, multimedia, vlogging, choreography and student-run salons, with student coordinators for UNESCO and Home Science forums. In addition to co-curricular and extracurricular activities, literary activities like debate, essay and story writing, storytelling and drama competitions are conducted to empower the students to participate and acquire the skills that would help them gear toward wholesome development and value-laden education. (U. Wangchuk, personal communication, 18 November, 2024).

One of the domains of GNH includes making students realize the value of time, and teachers put in consistent efforts towards this. In the digital world of today, the school works actively to curb time spent on devices and doom scrolling of students on social media. Solutions are being worked upon to restrain this issue among day scholars and boarders, and ad hoc checks are conducted even at midnight by wardens of hostels. There is also a focus on good governance which is amply demonstrated using a voting machine (EVM) for the selection of student leaders. Accountability in work and finances, establishing transparency and judicious use of resources are all considered as good governance. An example of this is taking their feedback when creating the menu for the students' mess. Accountability extends to the area of His Majesty's Kidu (donation), wherein the recipients of this donation are reminded of their responsibilities as recipients of this generosity. Community support is visible during times of crisis. Whenever there is a grievance in the family of teachers and students, they collectively visit the family to render them emotional support and make nominal contributions to help the family. (T. Yangki, personal communication, 18 November, 2024). Thus, the rules and regulations of the schools of Bhutan infused with GNH principles and Green School initiatives build the students' character.

The dimensions of greenery are in close alignment with the relevant domains of GNH. According to the self-assessment tools for the Green School domain, the first claim of a 'Green School' insists that students coming to school should discover their relationship with planet Earth, and by doing so, they would learn the value of honouring and appreciating nature and their physical environment. The dual purpose of a Green School is both conserving and learning with nature. The second important claim of 'Green School' is the social greenery. When boys and girls come to school they do not come as an individual but with their families and society. Therefore, schools must be a place where children celebrate diversity and trust each other. The creation of such positive energies gives young men and women a holistic outlook on life and society. Unfortunately, education today does not touch the deep core of learners in relation to their sense of belongingness, solidarity and fellowship with other human beings. Despite achieving high marks in examinations, students often end up isolated and alienated from society and culture. Thus, the objective of 'Green School' is to prepare young boys and girls to realize that they are part of a society, and they belong to a culture. This is how cultural greenery helps students discover their roots rather than becoming rootless and estranged.

Education in 'Green School' believes that ideas are important, so intellectual greenery helps children keep their minds open to new knowledge and new ideas. When children have understood the essence of natural, social, cultural and intellectual greenery, they would be able to absorb learning from books. This is called the academic greenery (Powdyel, 2014). Powdyel also underscores the fact that education should protect the integrity and uniqueness of the learner by reminding the children of their inherent talents and

potential. Hence, it is important to create space for children to identify their talents. Therefore, there should be room for arts, music, sports and moments when children can go out and listen to sounds, smell beautiful fragrances and understand what beautiful nature has given us. this is the aesthetic greenery that each child must learn to appreciate. Like aesthetic greenery, spiritual greenery brings a sense of fulfilment as it helps children associate them with something greater, better and holier. Tangible spiritual greenery discovered in the schools were the prayer, value talks, explanation of the prayer, value slogans and thoughts of the day, as well as mind training offered in selected schools. This fact affirms that spiritual greenery is the binding component of the other seven elements for effective implementation. The critical element of moral greenery teaches children to distinguish between what is right and wrong, thus making each child ethical and mindful.

Serving as a conduit for knowledge, the green school is instrumental in arming children with the intellectual, emotional, social, and moral resources required for their evolution. By promoting environmental sustainability, a Green School builds a society that values the planet while equipping students with eco-literacy that provides the skills, information, and ethics necessary to deal with environmental challenges, and work towards a future that does not degrade the environment for future generations. Instruction from the school level would help to inculcate a positive attitude from a young age and foster a need to preserve the ecosystem. This will manifest in myriad ways such as adopting better ways of conserving energy, waste reduction and management, water conservation, and making informed decisions on product purchases. Such habits can spur people to participate in the pursuit of actions that seek to motivate sustainability, propose policy changes to safeguard sustainable practices, encourage businesses that are conscious of their carbon footprint, and work to disseminate information on environment-friendly actions and methods. This will forge an interdependent structure between the environment, society and the government.

To emphasize the fact that children should be learning meaningful lessons for their holistic growth and development, the Ministry of Education has framed the school self-assessment rating tools in which the Green School domain receives major attention among the other parameters of rating tools. The Green School domain is further sub-categorized into physical and psycho-social ambience (MoE, 2011b) with the aim to educate children about the future and make them conscious of their actions and thoughts by addressing the eight elements of a Green School and the nine domains of Gross National Happiness. Tables 1 and 2 describe the tools that ensure a conducive teaching-learning environment where all children in the school receive equal and fair treatment with attention to their basic needs, assurance of safety on the premises and monitoring of everyone's personal health, hygiene, and growth.

The tools under the physical ambience build a learning ecosystem that is safe and secure, clean and litter-free, attractive and peaceful. Such an exciting and stimulating environment would make children feel invited, welcomed and happy to come to school. Each of the indicators helps to nurture the learners in a wholesome manner as they contain inclusive values. However, to transform schools into a holistic place of learning, the role of teachers assumes a critical significance. Teachers need to rekindle in the minds and hearts of learners an increased awareness about the strengths of values the indicators inherently possess. For example, it is the duty of the teachers to ensure that children learn the 'dignity of labour' while they tend to their little flower and vegetable garden. Without value inculcation, any extracurricular activity will only be viewed as a mere external activity to win the competition or to be just fulfilled for the sake of it. Drakpa and Dorji (2013) claim that Green Schools are basically concerned about love, care, conservation and respect for nature, with the noble intention that the values derived from the tools are wholesome and all-inclusive. Therefore, a Green School is more than the physical environment wherein the academic and intellectual climate of the school provides learners with skills and attitudes to become responsible citizens and contribute to the progressive welfare of their society.

The school's psychosocial atmosphere includes aspects of students' well-being, respecting individual differences, and encouraging participation. The indicators help learners become mindful and conscious about self and others. For example, individual attention is provided, and students from disadvantaged families are supported with basic requirements such as school uniforms, tuition fees, and stationery items. Such support helps underprivileged students to continue with their studies. Thus, the tools under the psycho-social ambience of Green School domain would help teachers strengthen the students' minds, fortify their hearts and vitalize their thoughts. Thus, the school

Table 1. Physical ambience.

	Indicators
1	The classroom is clean, safe and conducive for interactive teaching/learning activities.
2	The school has adequate and clean toilets separately for girls and boys.
3	The school has safe and sufficient drinking water with functioning taps.
4	The school is litter free with proper waste management practices.
5	The school adopts and advocates a 'No Plastic' policy in school and community.
6	The school has a well-maintained flower garden, hedges and plants in all relevant places.
7	The school promotes organic farming and local products through school agricultural programs.
8	The school encourages healthy food habits. For example, nutrition guides displayed on walls, to avoid food wastes, junk food.
9	The school practices strong conservation ethics (saving electricity, water, paper use)
10	The school promotes and demonstrates knowledge on eco-literacy like climate change, resource conservation, impact of pollution and consumerism.
11	The school uses outdoor for enriching teaching and learning (field trips, local wisdom)
12	The school adopts water sources, streams, sections of rivers and forest and provides sustained care, cleanliness and preservation.
13	The school harvests rainwater.
14	The school practices reduce, reuse, recycle and refuse.
15	The school environment is free of graffiti.
16	The school ensures timely maintenance of school buildings and other infrastructure to provide a safe environment.
17	The school has recreational places.
18	The students are clean, tidy and healthy.

(MoE, 2011a, p. 26).

Table 2. Psycho-social ambience.

	Indicators
1	The school has safe, caring and supportive environment (e.g. absence of abuses, bullies, corporal punishment, humiliation and harassment)
2	The principal and staff talk with learners outside the class and school.
3	School promotes mind training and mindfulness practices as a normal part of school life.
4	The school has remedial programs and services to help all students succeed.
5	The school practices a variety of positive discipline techniques.
6	The school conducts counselling programs and services with protocols for referrals.
7	The school has life skills provided to students.
8	Each student has a proper health record maintained by the class teacher/warden/matron/PE teacher.
9	All children feel cared for and supported.
10	Teachers and students feel that they are succeeding.

(MoE, 2011a, p. 27).

management and teachers are instrumental in fulfiling the requirements under the psycho-social ambience of Green School. Although modern education basically aims to enable learners to cope with scientific and technological knowledge, the Green School model of education can help to redefine these skills. By combining the values of both monastic and modern education, Green School acts as a point of convergence. Instead of solving the problems and filling the voids left by modern education, the model prepares individuals with the moral strength required to deal with unexpected challenges and contemporary crises. The values contained in the eight cardinal elements of a Green School develop the moral strength of children and youth to build resilience against such challenges.

The concept of 'green' in Green School transcends mere color or ecological concerns; it reflects a green philosophy that shapes every facet of the students' experiences. As with the case of the eight green dimensions of a Green School, the nine domains of GNH also groom learners to be imaginative, alert, insightful, and proficient enough to address various challenges so as to uphold the long-established traditional values of Bhutan as a nation. If education is aligned with standardized tests, children may not fully understand the real-life impact of their actions. Instead, they learn best from topics that are discussed and thought about in relation to their immediate experiences.

There has been heightened extant discourse in academia and industry about sustainability agendas within higher education (Tan et al., 2023, pp.316). The application of greening education was included in the pedagogical practices of the module titled 'Ecocriticism' offered for the students of MA in English at Yonphula Centenary College under the Royal University of Bhutan. The module explored the relationship between literature and the physical environment by studying the interactions between human beings and nature from two perspectives, namely, 'nature as celebratory and minatory'. (DPD, 2017). In keeping with green education principles, this module familiarized students with ecology, community involvement, sustainable lifestyles, environmental mindfulness, and the tenets of earth democracy. Students were also exposed to several literary works representing the natural world and ecocentric perspectives. For example, the subject matter called 'Green voices' included both the Western and Eastern perspectives of human-nature interaction ranging from Thoreau's Walden and Momaday's House Made of Dawn to Mahasweta Devi's activism and Gulzar's Green poems. In the context of Bhutan, the essential reading list includes the keynote speech delivered by the former Prime Minister of Bhutan, Jigme Y Thinley in the College of Bio resources and Agriculture at National Taiwan University during April 2014. The speech titled 'Earth's vitality and the power of happiness: A call for organic farming' made a huge impact on the masters' students of YCC. The idea was implemented as part of their project assignment by creating a greenhouse between the campus and the students' hostel. Students of the fourth cohort planted and nurtured a variety of local vegetables like greens, peas, cabbage, cauliflower, beans, carrot and mint leaves using organic farming practices, and shared the yield.

As part of a social commitment project, students from various cohorts explored ecological practices such as waste and water management, recycling, conservation of nature by creating an eco-park, and the sustainable use of natural resources and organic farming. By addressing the sustainable ecological issues of everyday life, students developed a scientific outlook and used an ecocentric lens to understand the relationship between nature and culture. An educational field trip was organized to expose students to Bhutan's ecologically sustainable practices under the project titled, 'Understanding sustainable practices in the traditional industries of Bumthang valley.' Over the course of four days, students visited jam production units in Bumthang to analyse the use of local products in the food processing industry of Bhutan, and then toured a beekeeping farm to explore the beekeeping and honey making industry to understand the ecological importance to gain insights of bees aiding to sustain the environment. Finally, they visited the Yathra textile production units to observe the traditional textile production process and to learn about the deep connection between Bhutan's handloom culture, ecology and local resources. During these visits, students documented their discoveries, challenges and opportunities along with photographs. These findings were the basis of their project symposium which involved submitting a report and delivering a presentation. It is to be noted that an individual's perceptions of, and orientations towards, sustainability and related socio-environmental concerns impact how they perceive the concept, its contributing effects and potential solutions to address concerns, including attributions of responsibilities (Tan et al., 2023, pp.316). Thus, the purpose of the study tour was to investigate how locally available resources can be used in livelihood systems without affecting the ecosystem. Further, the project aimed to broaden the understanding of students extensively in the following areas: Handloom and traditional resources in Bhutan, Food habits in Bhutan and its ecological value, Buddhism, women and ecology in Bhutan, Biodiversity conservation and terrace farming in Bhutan and Ecologically sustainable practices of tribal communities in Bhutan. Overall, the objective of situational analysis by way of project-based learning was to explore possible strategies regarding how mini-industries manufacture products with locally available raw materials, and how these products and practices adapt to local environmental needs.

GNH and Green School go hand in hand by accommodating both skills and values in the learner with its different dimensions and domains. Both the concepts, besides focusing on the holistic development of an individual, also seek to ensure the preservation of the traditional Bhutanese values and culture. In fact, the former Education Minister of Bhutan, Thakur S. Powdyel initiated the Green Schools program to support the noble program 'Educating for GNH' to secure and strengthen the vital interest of the nation and the well-being of people. The timely and far-sighted approach of the visionary kings of Bhutan pronounced in its GNH philosophy also emphasizes the importance of education wherein all the fundamental characteristics of the green school implicitly contain the core ideas of GNH to pave the way for the nobility of action. The Green School model in Bhutan considers the well-being and happiness of others too while teaching how to live in agreement with nature. This goal is achievable if the concept and the meanings of the eight cardinal elements of a Green School are understood by the education fraternity. Such clarity will guide them to make a significant difference in the lives of the children under their care. The stakeholders such as the Bhutanese education curriculum developers must consider the tools pertaining to different grades and levels containing the holistic values of the Green School model in order to harness the benefit of this inclusive model. The model and the concept continue to be a work in progress while inspiring other institutions around the world.

Conclusion

The aim of a Green School is to provide a system of holistic education that encompasses humanitarian values, which are the need of the hour. The idea transcends physical greenery by making students aware of the importance of protecting biodiversity and encouraging them to live in ways that support environmental harmony. Should schools commit to the Green School concept with enthusiasm, it would go a long way to enrich the quality of life for Bhutanese children by ensuring the curriculum addresses the nine domains of Gross National Happiness: psychological well-being, health, education, culture, time use, good governance, community vitality, ecological diversity, resilience, and living standards. This would indeed make their lives more meaningful. Ultimately, the combined effort of both concepts would go a long way in making an individual morally and mindfully happy. The Bhutanese education system should preserve and sustain the Green School model because it will equip children with problem-solving skills, making them role models equipped with interpersonal skills and critical and effective thinking. All stakeholders in education community members, parents, school employees, and students should be prompted to be more engaged with the values of the eight green elements, and its objectives for the efficient process of learning to ascertain the real meaning and purpose of education. T. S. Powdyel too makes a plea and expresses his desires through his book 'My Green School: An Outline' that all the schools and institutions across the country in Bhutan should inculcate and imbibe the values of a 'Green School' with the hope that the students would release the values to the organizations and the society they enter upon graduation. This approach will both honour Bhutan's cultural identity and significantly contribute to the development of proficient and skilled human resources.

Abbreviations and operational definitions

Gross National Happiness (GNH): Gross National Happiness was propounded by the fourth king of Bhutan, His Majesty King Jigme Singye Wangchuk immediately after his enthronement as a king in 1972. It was conceived as the guiding philosophy of Bhutan's development as a unique nation. The theory proposes that, though materialistic development is important for a nation to thrive, the mental and the psychological stability of its people is not conditioned by materialistic expansion (Thinley, 2005).

Educating for Gross National Happiness (Educating for GNH): 'Educating for Gross National Happiness' is a nationwide reform initiative of the Bhutanese education system that was conceived in 2009 by the Ministry of Education which is hailed as an offshoot of Gross National Happiness. This reform initiative brought changes in the education curriculum with GNH-infused values and principles (Ministry of Education [MoE], 2011a).

Ministry of Education (MoE): The Ministry of Education is an agency under the Royal Government of Bhutan that looks after the education system in Bhutan. It plans and formulates policies and principles to enhance educational quality in line with the principles of Gross National Happiness.

Sherig Mandala: 'Sherig' is the Dzongkha (Bhutan's national language) translation of the word 'education'. Hornby (1989) describes a mandala as a geometric design that is round which is symbolic of spiritual attainment. The word originated from Sanskrit which means 'circle'. 'Sherig Mandala' is used as the graphic depiction on which the eight elements of green school are represented in an integrated manner (Powdyel, 2014).

Green School: 'Green school' is a learning model developed by the Ministry of Education in 2011 to support the educational reform program called Educating for Gross National Happiness (Powdyel, 2014). The concept of green school as a slogan, 'Green School for Green Bhutan' aimed to engage learners in a holistic kind of learning through the different elements of greenery.

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Exploring green pedagogy for eco-centric praxis-based learning in higher education

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Abstract

In the wake of climate change affecting all aspects of global sustainable development, the imperative for greening education as a tool to help address its impacts has become increasingly pressing. Facing this challenge requires global adoption of more sustainable practices, coordination of efforts, and recognizing the pivotal role that education must play. Green pedagogy can help foster a sense of agency among individuals to acquire the skills and the right attitude to catalyse the transition towards a greener future. For an eco-centric praxis-based education system to be applicable, the interconnectedness of climate change should be recognized, and a holistic perspective should be adopted. This paper proposes a systems-based approach to eco-pedagogy and the greening of curricula. Systems thinking recognizes the interconnected and interdependent relationships that exist within an emergent ecosystem. This approach can also aid an understanding of eco-pedagogy that supports and integrates an interdisciplinary conceptualization of pedagogical approaches. To effectively engage with green pedagogy, both the inherent possibilities and challenges of an eco-centric praxis-based education must be explored.

In doing so, we argue that to improve the quality and the delivery of education responses to climate crisis, the integration of *project-based, learner centred, experiential learning, reflective/critical learning, problem-based,* and *collaborative learning* pedagogies can empower learners to become agents of change and contribute effectively to a more sustainable future. The proposed study aims to provide guidance on how to develop relevant, research-based curricula, increase educators' preparation and enhance institutional capacity to provide greening education and engage with a more eco-centric praxis-based education system. By elucidating best practices, this paper seeks to contribute to the advancement of applicability of green pedagogy in higher education and its role in building Education for Sustainable Development (ESD) competence among learners developing an eco-centric consciousness.

Introduction

This research inquiry stems from the academic struggle and challenges faced by many educators and educational institutions in integrating an eco-centric praxis-based education system to address climate change affecting all aspects of global sustainable development (GSD). Climate change affects all aspects of GSD, with its repercussions threatening the survival of humans, terrestrial and aquatic creatures. Addressing these challenges calls for an urgent profound shift in behaviour and requires global adoption of more sustainable practices, international coordination of efforts, and recognizing the pivotal role of education at all levels. Even though Education for Sustainable Development (ESD) has been promoted as part of the global agenda in Sustainable Development Goal (SDG), aiming to equip learners with the knowledge, skills, and values to contribute to the sustainable development of societies (UNESCO, 2021), the complexity of the climate crisis calls for a more holistic approach. Green pedagogy can cultivate a sense of agency among learners to acquire the skills and the right attitude to catalyse the transition towards a greener future.

Therefore, in the context of our study we employ a systems thinking approach in developing a conceptual framework for greening the curricula in the higher education system. Firstly, we argue that to improve the quality and the delivery of education responses to climate crisis, the integration of systems thinking in teaching, systems thinking in learning, and systems thinking as holism in education should be promoted. Secondly, we analyse the integration of various pedagogies such as learner-centred, experiential learning, place-based, project based, problem based, critical and collaborative pedagogy to emphasize holism of the education system. Thirdly, we examine the necessity of developing an eco-centric consciousness by examining eco-spiritual pedagogy which will enhance gross national happiness and transcend any dualities establishing interconnectedness between self and the environment. Detailing a dynamic education system, we illustrate green education as a form of holism promoting transdisciplinary education.

Background

Prior to the emergence of state-controlled education systems, learning tended to be localized to communities' needs and practices (Green, 1990; Tyack, 1974). Tyack (1974) has tied the centralization and standardization of education to industrialization, and the requirements of an industrial society to train efficient and disciplined labourers who could perform work in a structured, linear manner and within an established hierarchy. The industrialization of knowledge is also intrinsically tied to the colonial project and its control of epistemology. Colonization disrupted local education systems and replaced them with Eurocentric models to perpetuate cultural hegemony, serve the economic interests of the colonizer, and produce a workforce that would be dependent on the colonizing power (Altbach & Kelly, 1978). Dey (2023) notes that to Indigenous communities around the globe prior to colonization, "nature was never alienated from the developmental patterns of human civilization" (p. 2). Knowledge arose organically from the ways in which humans interacted with the natural world around them, from knowledge of how materials could be changed to make clothing and how different herbs interacted to treat illness, to how crops could best be rotated and how the destructive impact of wildfires on local biodiversity could be minimized. Colonialism has disempowered Indigenous knowledge systems through its systemic relocation of communities from their traditional lands, its domination of cultural practices, and the exploitation of the same natural resources that were previously involved in Indigenous knowledge production. Dey (2023) has described this as a plundering of Indigenous knowledge and practice. As the colonizing Eurocentric viewpoint then inserts itself as the provider of knowledge and solutions, it effectively expropriates the extant knowledge system. Like industrialization alienated the worker from their labour, the colonial project alienated the human from the natural world.

Freire's (1970) critique of the traditional top-down teacher/learner 'banking model of education', where the teacher imparts state-approved discourse as knowledge and the learner is the tabula rasa that receives said knowledge, makes connection to how the modern system of education reflects, reinforces, and maintains the enduring oppressive dichotomy of colonizer/colonized. Bernier (2018) also explains that the pervasive linear construction of thinking in education "perpetuates the idea that knowledge and life happen in isolation" (p.4). Orr (2011) has critiqued modern liberal education for its devotion to increasing specialization, contributing to the siloing of knowledge and fragmented, narrow fields of study. Institutions continue to operate disciplinary silos and utilize didactic pedagogies that stand opposed to sustainability's need for transdisciplinary and holistic learning. These academic silos typically perpetuate due to the logistical difficulties in merging academic practices within traditional structures (Hilger & Keil, 2021). Although the benefits of transdisciplinary approaches are widely acknowledged, implementing these approaches in education has been slow (da Rocha et al., 2020). The continued adherence to Cartesian reductionism in liberal education has slowed efforts to modernize learning in step with the ecological changes that have rapidly taken place on the planet and the urgency to reformulate to non-linear modes of thinking and living. Therefore, the enhancement of climate literacy is essential.

Why Green Education?

Orr (2004) argues that the value of education should be assessed based on the criteria of human decency and survival. Now, two decades later, seeking an education system that teaches students to live more responsibly is more important than ever. Climate literacy is essential for empowering learners to make informed decisions and be more engaged in sustainable practices. Kwauk and Casey (2022) state that the complexity of climate issues is beyond the confines of subject areas, and it is only by engaging in cognitive, socio-emotional, and behavioural skills that more actionable understanding of climate change can occur. This approach is also in line with the guiding principles of ESD. Young people are calling for climate change education to be included in various subjects. According to UNESCO (2023),

climate change education is mainly delivered within natural sciences (50%), and only 25% of young people reported it to be integrated in other subjects. Interestingly, as the age bracket of the respondents increased, the likelihood of climate change being taught as a stand-alone subject decreased (UNESCO, 2023).

A green holistic education model can integrate disciplines with adaptive strategies that can mitigate the effects of climate change through training resilience-building and critical thinking skills (UNESCO, 2023). Green education is helpful in addressing eco-anxiety as well. Clayton (2020) shares how prevalent the chronic fear of environmental doom is. Through agency and action, learners can mitigate their feelings of helplessness and feel better equipped to contribute (UNESCO, 2022). Green holistic education also promotes equity and justice. Familiarizing students about the socio-economic and historical factors that have been contributing to the climate crisis, can prepare students to demand and advocate for more equitable, and inclusive policies (Youth4Climate, 2021). For the interconnectedness of climate action, nature, and social progress to be reinforced, a systematic change in education models is a necessity.

Defining systems thinking

Systems thinking emphasizes interconnectedness and interdependence within a complex network of relationships (Capra & Luisi, 2014). This necessitates looking at the entirety of the system, where there are emergent properties that are not evident from component parts alone. This can be elucidated through the maxim: "the totality is not, as it were, a mere heap, but the whole is something besides the parts" (Aristotle, 1924). Systems are also dynamic and adaptable, operating through feedback mechanisms that can change the behaviour of the overall system.

Capra (1996) has identified holism, relationships, processes, and the individual construction of reality as the paradigm shift in thinking that occurs in applying systems-based thinking to the world. Within a system, Meadows (2008) elucidated the notion of leverage points, where smaller-scale changes might facilitate a larger, overarching change to the system. She identifies rules as a high leverage point, holding significant power over the entire system. Within education, these rules might relate to where the funding for education comes from, who has the decision-making power, or even the purpose of education itself. For example, if the purpose of education is to train young people to join the workforce and participate in the economy, the rest of the system may respond through the commercialization of education, focusing on academic programs with the closest links to industry and emphasis on the development of networking skills. On the other hand, if the purpose of education is the social and cognitive development of the whole individual, the rest of the system may align towards that through integration between disciplines, teacher-learner relationships founded on an ethics of care, and emphasis on developing collaborative skills. Hence, deeper aspects of the system impact how the entire system functions and unfolds over time.

Like knowledge and life can no longer be viewed from a Cartesian reductionism, education itself needs a paradigm shift where educators, learners, curricula, and pedagogies operate as an interconnected network. While this means that learners need to be given the tools to identify systems, understand systems, and apply this knowledge in novel ways to understand larger relationships of systems, it also means that educators must likewise develop this skillset to appropriately translate the concepts alongside learners. However, research into systems thinking has primarily focused on the students' systems thinking competence, rather than teachers' systems thinking competence (York et al., 2019). This demonstrates a misalignment in priority as systems thinking has nonetheless been identified as a key competence of teachers within the ESD framework (UNECE, 2012).

We will begin by examining systems thinking as a holistic framework that can enhance an understanding of green education by targeting competencies in several dimensions: Firstly, informing curriculum design and professional development; secondly, integrating learning that engages systems thinking in the classroom; and thirdly, thinking of eco-centric education as part of a whole system that considers institutional and social structures.

Systems thinking teaching competence

Andreoni and Ruiz Vargas (2020) have noted several challenges in the incorporation of eco-centric learning into the curriculum for the furthering of the SDGs. Among these challenges are the need for sustainability education to include the development of a wide variety of creative, problem solving, and holistic skills in learners, as well as the entrenched dependence on operating in disciplinary silos as opposed to a transdisciplinary building of curricula. Even when disciplines intersect, courses are at times institutionally offered only as electives and not as a core part of the curriculum, such as business ethics, or law and sustainability courses within a business curriculum (Bagley et al., 2020).

To address these challenges and emancipate curricula from their silos, we need to look at how educators can become better equipped to understand holism and systems pedagogy themselves. Systems thinking has been proposed as a methodology that can improve the development of curricula by its potential to tilt the scales toward a deeper ecology (Spain, 2019). Gilisen et al. (2020) suggest that teachers need to be provided with the tools to instruct students in systems thinking, but that there is currently a dearth of clear guidance from institutions on how to effectively utilize systems thinking in the classroom. Owens et al. (2023) have also raised the issue of instructor agency and ability to enact sustainability teaching in the classroom. Participating in eco-pedagogy workshops has had positive effects in terms of improving teacher participants' higher-order thinking skills and organization of eco-pedagogical concepts, alongside being recognized by participants as important to their development as teaching professionals (Asli et al., 2024). To convey systems thinking to students, teachers must therefore be equipped to develop the skills to think in a systems-based way and understand systems

as a pedagogical approach. The use of systems thinking in teacher education has been found to enhance pedagogical content knowledge (PCK) through the integration of multiple technologies (Niess & Gillow-Wiles, 2017). Yet, the acquisition of PCK by student-teachers seems to be more effective when a technical course has didactical elements compared to when it does not (Rosenkränzer et al., 2017), signifying a need for at least a partly instructional rather than wholly heuristic approach to teacher education in understanding systems as a pedagogy.

It is important to note that one potential barrier to multidisciplinary teaching in higher education is instructors' reluctance to speak in areas outside of their expertise. For instance, an instructor teaching a case in a tort law class where a vulnerable community has filed a lawsuit against a toxic polluter may resist incorporating a discussion of colonialism, extractivism, and ecological apartheid if they see these as areas outside their expertise, even though they may be pertinent issues to a full multidisciplinary contextualization of the harm caused. In looking at the discipline of business where educators may avoid deeper explorations of ethics, Bagley et al. (2020) thus propose collaborating across disciplines to create instructional materials and engaging in team-teaching to deliver a course that intersects disciplinary knowledge. Team-teaching also contributes to heightened engagement and a construction of knowledge from multiple perspectives, involving students and several teachers, rather than mono-teaching from the convergent perspective of a single educator (Gono & de Moraes, 2023).

A transdisciplinary curriculum design for an eco-centric education that connects and cross-connects across disciplines requires thinking that understands holism. Providing training supports for educators and fostering their own ability to think in terms of systems is essential to building a curriculum that leverages pedagogical approaches that empower educators to facilitate these skills in learners.

Systems thinking learner competence

Understanding sustainable development necessitates an understanding of the dynamic relationship between the natural world, the social world, and the economic world. Yet, a review by Amorós Molina et al. (2023) has found that higher-income countries tended to prioritize more formal pedagogical approaches and pedagogies when incorporating SDGs into their curriculum, whereas lower-income countries preferred more engagement with pedagogies that leverage real-world applications of the SDGs. This reinforces the notion that the Western and Eurocentric educational sphere has decoupled itself from the natural world. Under ESD, UNESCO (2014) has identified the comprehension of complex systems and decision-making abilities to act as important competencies for learners to acquire. Rieckmann's (2018) review of key competencies for learners in sustainability has also identified the critical role of systems thinking. The possibility of systems thinking to enhance educational outcomes for students has already been noted in multiple disciplines, including chemistry (Pazicni & Flynn, 2019; York et al., 2019), biology (Gilissen et al., 2020; Riess & Mischo, 2010; Verhoeff et al., 2018), engineering (Mehalik et al., 2008), business (Marcos-Sánchez et al., 2022), and emergent technologies (Fowler et al., 2019). Applying systems thinking in the classroom has empowered students to observe and analyse real-world problems and provide solutions. Pedagogies that involve a bottom-up approach where learners can engage with authentic scenarios are linked to the development of the ability to solve problems and understand relationships between systems (Andreoni & Ruiz Vargas, 2020). If higher education is to green its curricula and develop an eco-centric ethos, this process also cannot begin when students enter higher education, and it ought to instead consider a learner's entire educational trajectory. In one case, by integrating systems thinking through a project-based pedagogy, teachers facilitated second-grade students addressing an ecological issue of a state-wide drought (Curwen et al., 2018). In engaging with non-linear and interdisciplinary cognition, second-grade students were not only able to propose solutions but were also able to identify key points of leverage within the system where a minor action can result in a significant change to the system. Curwen et al. (2018) found students were also able to creatively think of ways to motivate others to also act upon identified leverage points. This engaged not only their own autonomy but promoted the autonomy of others to act as agents of change. In such a case, students take disciplinary knowledge about a system and bridge it to new disciplines to complete a project. Likewise, the students bridge their understanding of a system to a real-world observable scenario. This is not taking place in a tailored way but rather is occurring by asking students to organically engage with the whole system. Mehalik et al. (2008) showed that students who designed a system performed better when tested on central concepts than those who constructed a system by following a scripted set of steps. Engaging in hands-on learning and being involved in the whole system as a learner appear to be important for establishing systems thinking as a learner competence.

Studies of higher education students have also shown success when real-world applications are introduced. A study by Demssie et al. (2023) found that combining integrated learning pedagogies with real-world, collaborative applications demonstrated improvements in systems thinking competence. In its application in the classroom, systems thinking can also enhance a learner's sense of self-efficacy (Maina & González, 2016; Spain, 2019). The learner has the potential and the tools to become the co-pilot of knowledge, rather than the assumed blank slate upon which discourse is imparted. Winter-Simat et al. (2017) discuss whole systems thinking as a way of engaging students on a multidisciplinary level, visualizing their path through different disciplines as a web. This stands in sharp contrast to the way that academic and career options are often presented to learners as a fork in the road, where they often must make life-long decisions between STEM and the liberal arts.

Systems thinking education competence

Eco-centric education can be imagined as an interconnected system arising emergently from component parts that are not completely isolated means of knowledge production. Educators, students, curricula, and pedagogies interact dynamically and in a network of relationships that has leverage points and feedback loops regulating its behaviour. Rieckmann (2018) has emphasized the importance of a whole-institution approach to ESD. Systems have been acknowledged to also be constituent parts of a larger system (Meadows, 2008). An individual becomes part of their classroom system, which is part of the system of their institution, which exists within a provincial or state-regulated system of education. These systems within systems act like a Matryoshka doll, nested inside one another. In this way, education can be conceptualized as a system nested within the macro-level cultural, political, economic, and social forces that direct knowledge production. These forces have historically been advanced by imperialist epistemology.

Yet, an eco-centric education seeks to create a new model for a socially just, biophilic, and sustainable world. Tan et al. (2023) have suggested that governmental policies that promote eco-pedagogy for sustainability will require collaboration between stakeholders within educational institutions to facilitate the adoption and integration of such policies. Further, for educational institutions to fulfil the role of change agents, the internal system of eco-centric education would need to also provide feedback outward, effecting an epistemological decolonization of the neoliberal cultural, political, economic, and social structural forces. Owens et al. (2023) have identified confronting these prevailing sources of power in education and in the overarching system as fundamental to accessing the tools necessary to change how sustainability is taught. Unlike the Matryoshka doll, the inner system of education must in turn also provide feedback to the larger social, economic, and ecological system that defines sustainability. Hence, systems thinking as a matter of educational competence in eco-centric education necessitates looking beyond linear, top-down, unilateral relationships and instead to how all systems and levels of systems interact with and affect each other, both horizontally and vertically within a systems web. We can thus think of the holistic systems framework to eco-centric education as emphasizing teacher competence in systems thinking, student competence in systems thinking, and institutional and societal competence in systems thinking.

Through facilitating the integration of eco-awareness into curricula, the professional development and acquisition of PCK by teachers, empowering students and learners to connect academic learning to real-world problems, systems thinking provides a framework for understanding how an eco-centric education could be implemented. Examining whole systems allows us to understand how eco-centric education itself functions as a system and is also situated within broader societal forces.

In the next sections, we discuss the integration of praxis-based pedagogies to provide guidance on best practices for empowering learners to become agents for sustainable change and explore the development of an eco-centric consciousness that transcends dualism. These serve as important aspects of conceptualizing systems thinking in relation to eco-centric education as emphasizing holism.

Table 1. Systems thinking competencies and identified dimensions.

Competence for Eco-Centric Education	Identified Dimensions
1) *Systems Thinking Teaching*	Curriculum building Professional development Pedagogical content knowledge
2) *Systems Thinking Learning*	Conceptualizing systems Bridging across disciplines Bridging to observable world
3) *Systems Thinking Education*	Whole systems

Integration of pedagogies

Over the past decades, educators have been striving to integrate transdisciplinary curricula to enable the students to become sustainability leaders which has revolutionized how educators teach and evaluate their students. Even though fostering skills that help students use their knowledge in the real world can be applicable to all topics, integrating pedagogies seem particularly relevant to environmental education and sustainability literacy as they equip students to synthesize information and apply knowledge to critically and collaboratively problem solve. Years of research show that an amalgamation of the pedagogies below can benefit climate change education:

Learner-centredness

This methodology focuses on learners' autonomy and active role in constructing knowledge, rather than being a passive receiver. The process begins with students' schemata and experiences, with educators acting as facilitators (Rieckmann, 2018). Studies value this approach, as students are entrusted with more responsibility for their learning which fosters critical thinking, and problem-solving skills and is also in line with inquiry-based learning. This approach prepares students to be proactive and promotes stewardship for the environment (Byrne, 2016).

Bremner (2021) conceptualizes Learner Centred Pedagogy (LCP) in six easy-to-adopt aspects. He believes active participation encourages learners to engage with both their peers and teachers through collaborative activities. Adapting to needs ensures that learning is tailored to students' prior knowledge and individual preferences. Autonomy fosters self-directed learning, where students take responsibility to develop lifelong learning skills. By focusing on providing meaningful content that is applicable to real-life situations, critical thinking and creativity can be emphasized. He also advocates for power-sharing to promote a more democratic classroom environment. Lastly, he views learning as a continuous process that can be enhanced by incorporating self and peer assessments.

Active/participatory/experiential learning

Experiential learning is inspired by Dewey's (1930) philosophy of "education is experience" and "learning by doing". Hands-on experiences can bridge the gap between knowledge and action (Brundiers et al., 2010). Experiential learning involves concrete experience, reflective observation, abstract conceptualization, and active experimentation (Kolb, 1984). Huang (2001) identified the learning characteristics and ability traits of Kolb's model and suggested methods for the adoption of this learning cycle. He suggested hands-on experiences such as experiments or interviews alongside demonstrations to emphasize engagement, and small group discussions paired with thoughtful exploration and shared experiences to promote reflective learning. He proposes literature reviews and classifications to support understanding of abstract concepts, and small group problem-solving applied to real-life situations to emphasize active experimentation (Huang, 2001, as cited in Yu, 2024). This combination of methods and examples underscores the effectiveness of Kolb's model in fostering a comprehensive learning experience.

Place-based and project-based learning

Place-based education is a realistic form of education with the potential to tap into multiple disciplines while extending outside the classroom and linking learners with society (Elbaz, 2023). As students get actively involved in planning, project-based and place-based pedagogies can develop pro-sustainability skills in learners (Cincera et al., 2019). Research suggests that these approaches can immensely improve pro-sustainability learning outcomes (Khadka et al., 2020). Vander Ark et al.'s (2020) research also found how the 6 principles of place-based learning (community as classroom, learner-centred, inquiry-based, local to global, design thinking, and interdisciplinary) align well with the principles of learning sciences (cognition, motivation, identity, individual variability).

Though some may argue that the interconnectedness of the world is causing the notion of locality to lose significance, Stevenson (2008) finds this notion to be an oxymoron and proposes that place-based and critical pedagogies can productively complement each other.

Critical pedagogy

The causes, effects, and solutions to climate change go beyond particular disciplines. Oberman and Sainz (2021) believe in education that supports students in considering both scientific and social aspects of decision makings. They believe critical thinking to be the cornerstone skill in green education as it enables students to analyse evidence, explore links, and evaluate solutions. Hofman (2015), and Chiba et al. (2021) advocate that with exposure to different perspectives, critical pedagogy has the potential to change students' way of thinking which can lead to reflective actions, and consequently global changes. This pedagogy aims to critique the status quo and demands change.

Problem-based learning

This approach encourages independent learning and deeper critical thinking by applying knowledge to authentic scenarios (Savin-Baden, 2020). By organizing learning around problems, encouraging formulating the right questions, and involving learners in real-world problems, students become better equipped to tackle environmental issues (Karpudewan & Roth, 2018).

Collaborative learning

The transformative aspect of education for sustainable development can only be strengthened by the participation of different stakeholders and social engagement (Schnitzler, 2019). This approach requires a learning environment in which community members can devise solutions to achieve common goals collaboratively. A study conducted by Namaziandost et al. (2024) illustrates that working with peers in a collaborative and team approach leads to enhanced academic enjoyment and better academic performance. In this study, building relationships with peers improved motivation and contributed to a positive learning environment.

Application in higher education

Many universities have already integrated learner-centred pedagogies to some degree, and there is an increasing desire to adopt pedagogical approaches that provide students with learning opportunities outside of the traditional classroom model to promote SDGs. Some universities have turned to technology-based tools like Riipen to connect learners with business partners on the platform, including a partnership with ECO Canada (Riipen, 2024). This can promote students' ability to work in teams and provided them with career preparedness skills (Palatnik & Blaber, 2021). The University of Toronto's Sandbox partners students with organizations that are facing a persistent challenge and are looking for innovative solutions. For instance, one project involved students from the disciplines of environmental chemistry, geography, and writing to work together for a project by the Toronto District School Board to raise awareness of bicycling or walking to the university as a more sustainable option that driving or even taking transit (University of Toronto, 2024). The Global Immersion Guarantee program in education at Monash University, Australia, connects students from diverse backgrounds with community leaders to address local issues (Monash University, 2024). In such collaborative and project-based learning, students work across disciplines and are exposed to various stakeholders to complete concrete tasks. In a sustainability context, Living Labs have been identified as engaging with both experiential learning and collaborative learning processes (van der Wee et al., 2024). The University of Waterloo's Sustainability Living Lab applies problem-based and experiential learning by providing students with the opportunity to address real-world engineering challenges in a way that also promotes sustainability, such as designing solutions to a potential flooding issue on campus caused by the existing storm water drainage system (University of Waterloo, 2024). The

University of British Columbia (UBC) has a Green Labs Program that allows students to engage with experiential, problem-based, and collaborative learning in greening research spaces and laboratories (University of British Columbia, 2024a). One successful Green Labs project had fourth-year UBC mechanical engineering students tasked with creating a shredding machine to solve a foam recycling problem for the Museum of Anthropology (University of British Columbia, 2024b). Van der Wee et al. (2024) have identified that institutions approach the opportunities provided by Living Labs as dual places of learning where students are presented with both "*authentic learning environments and engagement with the real-world*" (p. 262).

Additionally, a study on place-conscious pedagogy by Fraser (2016) focused on the experience of students enrolled in a course on "place matters". The results indicated a strong inclination towards engaging with alternative learning environments. Engaging with diverse spaces and places creates a conscious ecological dimension to a holistic development. Another study examined the outcomes of the Green Ambassador course at Holon Institute of Technology (HIT). HIT's initiative of Green Ambassador is an illustration of how this institution is empowering young adults as conscious beings to safeguard our planet. On completion of the program, the participants demonstrated enhanced environmental literacy and awareness promoting sustainable practices (Friman et al., 2024). The Green Ambassador program focuses on "eco-friendly projects, nature excursions and collaborative strategies" (Friman et al., 2024, p. 3) in the community.

The integration of the aforementioned pedagogies places learners as self-determining and empowered agents of change. Along with amalgamating these pedagogical approaches into curricula, developing eco-conscious beings as a part of greening the curriculum is crucial for reinforcing eco-conscious awareness.

Eco-centric consciousness

As an endeavour to cultivate and explore green pedagogy for eco-centric praxis-based learning in higher education, establishing a holistic perspective is crucial. To leverage the systems thinking approach, integrating student-empowering pedagogies can be further enhanced by developing eco-centric or ecological consciousness as an attempt for greening the curricula.

Ecological consciousness is a deeper awareness of self as an entangled being with the environment. Along with the integration of project-based, experiential, reflective/critical, problem-based, and collaborative learning, creating a relationship with the environment needs to be formulated through a cultural transfiguration. Due to a fast-paced digital world, the pursuit of being a spiritual educator as a part of a systems-based approach of greening the curricula, provides a trajectory to deconstruct self and realize one's potential to the fullest. To corroborate an eco-centric consciousness amongst learners, enhancing their self-agency will lead to a continuous process of recognizing self as an interconnected being with the environment. As the youth is the future generation, educators must work in sync with them and establish a collective effort to ingrain a sense of environmental consciousness (Saputri, 2018).

Environmental consciousness reflects humans' relationship with nature which constitutes an intertwined contemplation of cognitive, ethical, and emotional aspects (Panov, 2013). Therefore, to further enhance sustainable development education, we examine the role of eco-consciousness attainment through the following suggestive model:

Figure 1. Framework for developing eco-centric consciousness.

Eco-spiritual pedagogy

Adapting a spiritual pedagogy is to focus on 'self-making' and 'self-creating'. According to Tagore (1906), decoding spirituality in education can be illustrated as establishing a non-hierarchal, flat structure with collaboration. (Recognizing self as an entangled being with the ecosystem intertwines eco-pedagogy and spiritual intelligence, providing a dimension for eco-spiritual pedagogical practices. To address the changing effects of GSD, fostering a sense of agency among individuals is to harmonize self with the environment. This harmonization with self and the environment requires an amalgamation of ecological and spiritual values (Dhungana & Neupene, 2021). Eco-spiritual pedagogy as a part of greening the curricula is an initiative to provide learners a trajectory to promote eco-consciousness, which is to recognize self as a co-existent entity interweaved with all phenomenal beings.

We classify some of the praxis-based learning aspects of eco-spiritual pedagogy into the following dimensions:

Engaging with ecotherapy approaches

For spiritual evolvement of self, one of the major components is to blur the boundaries between self and the environment. Ecotherapy, also known as nature-based learning, is a restorative approach which focuses on using outdoor spaces for people's wellness (Corazon et al., 2018). It is a systematic approach of healing self and the earth, including spirituality in education. As ecotherapy is an umbrella term for healing and growing by interacting with nature (Clinebell, 1996), for the purpose of greening the curricula, we analyse this approach by encouraging educational institutes to utilize outdoor spaces for learning. This can be developed by physically using outdoor spaces or by promoting more

experiential learning, or project-based approaches.

Additionally, educators may encourage activities such as gardening and nature walks. Nature walks can lessen stress and can be a remedy to calm oneself amidst nature. Nature activities are a great source for relaxation providing a positive connection with the ecosystem. Therefore, ecotherapy includes developing self in the lap of nature. For an educative praxis, ecotherapy can be interpreted as an intertwined aspect of healing ourselves (educators and the learners) by healing the earth. As a process, it will help the endangered human species to minimize or subsist productively the unparallel challenge of saving the earth for today and for future generations (Clinebell, 1996). Further, it may lessen the increasing climate anxiousness amongst youth. Therefore, eco-centric education must consider nature as a co-educator because nature can be utilized for therapeutic educative purposes (Pedretti-Burls, 2007). Some of these projects may focus on physical, psychological, social, and cultural well-being, developing a sense of freedom in outdoor spaces. Pedretti-Burls (2007) highlights that the therapeutic approach of nature may enhance human well-being at the following three levels:

- Physical well-being: enhance mobility and build stamina
- Psychological well-being: enhance concentration, focus memory, reduce anxiety
- Social well-being: enhance social skills and relationship awareness

Adapting biophilia hypothesis

Along with ecotherapy approaches in education, we further highlight the theoretical model of the Biophilia hypothesis. The Biophilia hypothesis, propounded by Wilson (1984), highlights that the innate nature of humans is to co-exist with the environment. This hypothesis provides a theoretical and pragmatic approach to support the co-existence of humans and nature. Additionally, it highlights the importance of nature for both the survival and well-being of humans. Kellert and Calabrese (2015) further build on the Biophilia principle by categorizing environmentalism into three components:

Firstly, Kellert and Calabrese (2015) underline the essentiality of being directly present in nature. Secondly, the indirect experiences of nature could be created by focusing on activities such as photography, paintings, or various other artworks, which depict nature or utilize eco-friendly natural products. Thirdly, they highlight the importance of human perception, related to cognitive responses such as human experiences of various spaces and places that help to recognize cultural and ecological reverences.

Correspondingly, to enhance eco-spiritual consciousness as a part of eco-pedagogy, Kellert and Calabrese's (2015) model on the Biophilia principle can be applied in the educative model. Firstly, to establish a direct connection with nature, classroom spaces need to be redefined. Secondly, to initiate indirect experiences with nature, students may be vicariously made to connect with the environment. Some of the examples include creating virtual labs, focusing on experiential learning, and projects such as visual essays, which may also deepen indigenous knowledge and cultures. Additionally, case studies may focus on sustainable development while fostering cultural relationship with local indigenous communities. While courses may have different topics, the integration of case studies based on environmental aspects may be encouraged. Thirdly, to stimulate our cognitive processes about the perceptions of nature, more outdoor activities, experiential learning, and field projects should be reinvigorated. More outdoor activities will establish memories for the learners in natural spaces. Educational institutions provide a platform for students to not only develop content knowledge but also provide a space for creating lifetime memories that become a crucial part of their educational journey. Therefore, the biophilia threefold principle or approach will provide a roadmap for its implementation.

Comprehensively, spirituality in education as elucidated by Souza et al. (2009) focuses on the spiritual dimensions of the human life journey as a continued process of 'becoming'. It includes fostering compassion, empathy, and developing one's identity by promoting "body, mind and spirit" evolvement. This approach of eco-spiritual pedagogy will create a holistic being who grows as a conscious entity, realizing the essentiality of creating meaning and interconnectedness with the ecosystem.

Thereby, a green curriculum does not limit its understanding to environmental studies but rather it widens its horizon to cultivate a holistic perspective creating eco-conscious beings. This will augment humans to enhance their capabilities to perceive the current situation of climate wakefulness and focus on a positive transitional future (Dhungana & Neupane, 2021).

Focusing on achieving Gross National Happiness (GNH)

Adapting an eco-spiritual pedagogy (eco-pedagogy + spiritual pedagogy) by focusing on ecotherapy and by embracing the Biophilia hypothesis, may form a trajectory to magnify happiness. Gross national happiness (GNH) is not a novel paradigm; rather, it is a concept which needs to be reinforced in the curricula. The country of Bhutan aims to foster education to achieve GNH for their citizens. One of the initiatives for achieving GNH is to emphasize greening the curricula. The missing dimension in human identity formation is the cultivation of happiness amongst the youth. To address the increasing eco-anxiety and digital anxiousness, the approach of adopting an eco-spiritual pedagogy will lead to stimulating GNH. Achieving GNH, will further augment the youth to transcend dualities by promoting interconnectedness of self and the ecosystem.

"Happiness is the meaning and purpose of life, the whole aim and end of human existence." (Aristotle, 1924, as cited in Diener & Kesebir, 2008, p.69). Therefore, Bhutan's initiative to achieve GNH elucidates its importance over Gross National Product (Hayward & Colman, 2010). Hayward and Colman (2010) illustrate that to achieve GNH, the country of Bhutan

focuses on sustainable development, promotion of culture and positive governance. These initiatives in the education sector highlight the importance of a curriculum infused with emphasis on critical thinking and creative thinking, along with developing ecological literacy. In addition to familiarizing learners with the content knowledge of the subject matter, a great deal of attention should be given to instilling values amongst learners. Bhutan's Ministry of Education (2012) launched a plan to enhance nation-wide happiness by focusing on greening the environment, intellect, aesthetic, academic, social, and cultural aspects. The complete blend of spirituality and content knowledge is illustrated by introducing meditation prior to the commencement of each class. This not only increases focus but also reduces anxiety amongst learners. Similarly, Brooks (2008) suggests that GNH in America may be enhanced by bridging the gap between social and cultural values.

Correspondingly, Tagore's (1961) educational mission of Visva–Bharati highlights the multifaceted development of self, which includes aesthetic, intellectual, physical, and spiritual development. Aesthetic development is to connect with art, music, and literature to enrich the soul. Intellectual development is inclusive of creating lifelong learners so that they may continue to enhance their knowledge with an organic sense of curiosity. Physical development focuses on games, sports, outdoor activities such as yoga, meditation, and immersing oneself with nature. Spiritual development provides a trajectory for self-liberation, finding peace and solace amidst self and nature. This four-dimensional educative praxis will encourage transformative pedagogies to illuminate self in the lap of nature (Lesar, 2015). Therefore, it will create a pathway for holistic education. Despite Tagore's first school commencement which dates to 1901, the pursuit of education to recognize self as an entangled entity with the universe remain relevant in today's digital era. He identified that the trajectory of education should cultivate and enhance the arts of life such as diverse forms of creative expressions (Lesser, 2015), while developing a conscious relationship with nature (Gupta, 2004) to create a sustainable future. To stimulate conscious experiences, learners should indulge in music, literature, dance, meditation, and other forms of experiential learning, which remain human attributes of self-reflection and self-expression in today's digitally enhanced era.

Transcending dualities and establishing interconnectedness

As we argue that education cannot be viewed from the Cartesian philosophical approach of reductionism and dualism, eco-spiritual pedagogy as a component of holism will augment the paradigm shift of education. Holistic development should be perceived from a non-dualistic attitude that promotes interconnectedness. Posthuman approaches also focus on human and non-human issues (Braidotti, 2016) and post-anthropocentric approaches displace humans from being the centre of the universe (Ferrando, 2019). Future research may explore these alongside the systems framework. Due to the current climate challenges, the interconnectedness of human life with non-human entities (Herzogenrath, 2009) should be encouraged to develop a keen sense of deeper ecological awareness. The eco-centric conscious being is one who transcends any dualities and establishes interconnections by developing a deeper awareness of self and its surroundings. The "ecologization" of education will support creating an environmental consciousness and a cultural transformation of educators and learners both personally and professionally. The philosophical transcendental approach of nature examines humanity, nature, and the universe as one single being contributing to sustainable development (Panov, 2013). Wilson (2002) raises concerns over the "Eremozoic age" which he calls the "age of loneliness". He highlights the importance of biodiversity without which humans may face immense psychological deficiency leading to loneliness and alienation. Overall, by forming an ethical ecological well-being, heightened awareness is experienced when learning is applied in real-world contexts (Herbert, 1996).

Eco-centric consciousness will thus further the greening of curricula. Transcendence of self may be achieved through eco-pedagogies and spiritual pedagogies in education. This philosophical discourse will actualize through educative measures where learners and educators collaboratively feel empowered to be lifelong learners. Egri (1999) thus proposes the implications of spiritual discourses at a global level. Ecological education as holism reconnects humans and nature, developing an eco-bonding (Pedretti-Burls, 2007). The eco-bonding will transcend any dualities between humans and nature which will further reduce eco-alienation. This spiritual enrichment will transcend self in nature, leading to a more responsible nourishing of nature (Clinebell, 1996).

Challenges

Education for sustainable development can significantly affect the pace at which countries are moving towards a more sustainable future. However, the adoption of holistic approaches and integration of these pedagogies has been slow.

Cebrián et al. (2021) state that often educators believe ESD to be more relevant to content rather than pedagogy and may lack confidence to adopt them in their teaching practices. This issue can be addressed in teacher education programs in which student-teachers develop curriculum with environmental considerations. Another challenge faced by instructors is the "perceived need to cover" content (Kober, 2015) which makes integrating holistic breadth of knowledge seem less feasible. Other logistical challenges can be classroom configurations, availability of resources (Byrne, 2016), large enrolments (Walker et al., 2008), and shorter time blocks which do not lend themselves well to rigorous, collaborative engagements.

These challenges, individually or collectively, can hinder the transformations of traditional teaching practices. Access to easy-to-adopt-and-adapt resources can pave the way for the integration of the innovative pedagogies by instructors. UNESCO's (2024) Greening Curriculum Guidance is a notable resource towards mainstreaming ESD in national curricula.
Additionally, challenges in adapting eco-spiritual pedagogies begin from the problematic nature of defining spirituality as an intrinsic value in the ecological system.

According to Chomsky, climate upheaval currently poses one of the biggest existential threats (Samphir, 2019). The eco-conscious beings, who are concerned about climate wakefulness are also unable to act due to ecological paralysis (Lertzman, 2015). Additionally, the "ecological guilt, grief and anxiety remains under-theorised" as it is less explored and defined (Bryan, 2020, p. 12). While the need to address these challenges is increasing, significant efforts must be established as a part of the education system. An aspiration to improvise and ecologize education may not be adequate. The willingness to engross in addressing the climate issues is often restricted by families or societies (Bryan, 2020). A collective effort may be necessary to bridge the aspiration, knowledge, and action plan or behavioural aspects. Learners must be encouraged to develop emotional responses towards the environment by embedding 'personal reflexivity', 'emotional clarity', and awareness to realize self as an identity which is enmeshed with the environment.

Conclusion

Applying a systems approach, the proposed conceptual framework of positioning education to focus on holistic development, reinforces the LCP approach. While being conscious of the limitations, we urge educators to enable eco-consciousness by focusing on eco-spiritual pedagogy praxis-based learning.

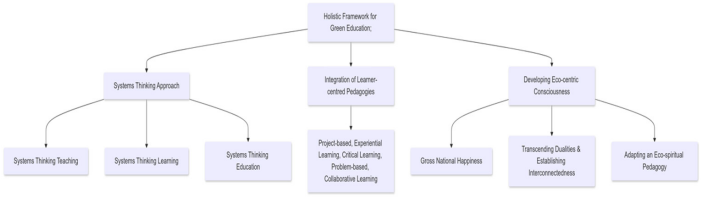

Figure 2. Holistic framework for Green Education.

To save our present, future selves, and the planet, education needs to be revamped with a systematic approach of rethinking human and environmental relationships. The exploration of green pedagogy for eco-centric praxis-based learning in higher education demands an urgent need for reform across existing educational structures. This paper highlights that despite the emerging recognition of the importance of sustainability in education, the integration of systems thinking, transdisciplinary curricula, and eco-centric learning remains inadequate. This inadequacy can be attributed to disciplinary silos, a lack of teacher preparedness, limited institutional support, ambiguity surrounding eco-spirituality, ecological paralysis, and societal reluctance to change. Collaborative efforts among educators, learners, and policymakers are critical in overcoming these hurdles. Bridging aspirations with actionable plans calls for a cultural shift that fosters emotional clarity and environmental advocacy among learners. It is only by breaking free of reductionist paradigms that a holistic education model which fosters sustainable development and ecological harmony can evolve.

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School children's attitudes toward green education: Validity and reliability of the revised 2-MEV scale in West Bengal, India

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Abstract

Schools are strongly encouraged to transition from traditional didactic teaching methods to smart education to enhance the overall learning experience for students. Over the past 40 years, technological advancements have led to significant breakthroughs in learning. One important initiative, known as green schooling, plays a crucial role in promoting sustainable development by equipping individuals with the necessary knowledge, skills, values, and perspectives to tackle environmental challenges and strive for a more sustainable future. So, here, the attitudes of school children towards green education (GE) are explored by examining environmental utilization (UT) and preservation (PR). This present study aimed to test the validity and reliability of the Revised 2-MEV Scale of Johnson & Manoli (2010) in the Indian context. With a sample size of 222 secondary students from West Bengal, India, this study followed descriptive statistics such as Mean, Median, and Test of normality, Kaiser-Meyer-Olkin (KMO) Test, Bartlett's Test of Sphericity (BTS), Confirmatory Factor Analysis (CFA) and Cronbach's Alpha using AMOS v21 and SPSS v23. The original scale with 16 items across two constructs was retained throughout the stringent validation process and resulted in a high-reliability score proving it apt for future usage to measure 16-18-year-old students' attitudes towards green education. The analysis of responses concerning Environmental UT and PR was two key dimensions, supported by sub-factors. The Goodness of Fit index (GoF) (CMIN/DF=1.654) confirms the appropriateness of the model. The revised 2 MEV scale is a valuable and reliable tool for assessing students' attitudes toward green education (GE) in West Bengal, India. Researchers, academics, and policymakers may use the scale to understand the attitude of 16-18 aged children towards green education. Stakeholders can utilize this scale to find existing gaps in understanding, raise awareness about environmental issues, and improve the quality of GE training.

Introduction

People are becoming increasingly aware of environmental issues due to the global ecological crisis, which encompasses climate change (Randler et al., 2024). A green school promotes environmentally conscious attitudes and behaviors among students and the school community, encouraging them to integrate these habits into their daily lives, both on campus and at home (Hidayat et al., 2023). The mainstream educational institutions in the post-COVID-19 era are increasingly recognizing the importance of nature-based and environmentally friendly pedagogical and curricular infrastructures (Dey, 2022, p. 16). The urgency of addressing environmental issues such as climate change, various forms of pollution, and resource depletion is becoming increasingly evident. A report by the Intergovernmental Panel on Climate Change (IPCC) highlights the need for immediate and sustained large-scale actions to tackle our global challenges (IPCC, 2021). According to Gough (2013) and Sterling and Orr (2001), green education (GE) plays a crucial role in this effort by equipping individuals with the knowledge and skills necessary to address environmental problems while promoting sustainable development. This study validated the revised scale of the attitudes of school children toward GE concerning Environmental UT and PR. GE aims to integrate environmental themes into school curricula, promoting student engagement in conservation efforts and instilling a sense of responsibility from a young age (Tilbury, 1995). According to Kollmuss and Agyeman (2002), early exposure to environmental education is essential, as it influences attitudes and behaviors that contribute to lifelong environmental sustainability. Children, who are in the process of developing their beliefs and behaviors, are ideal candidates for educational initiatives that promote environmental stewardship. Research by Constantin et al. (2024), indicates that GE programs in schools can effectively foster social responsibility, environmental awareness, and sustainable habits among students, positively influencing their views on environmental preservation and sustainability. A study conducted among students at senior secondary government schools in Indore, India, revealed diverse opinions on the teaching of green skills. Despite a low mean score and a high standard deviation, students were applying the green concepts they learned in vocational courses (Mahapatra & Ravichandran, 2023). Additionally, Choudhury (2014) found that secondary school students generally exhibited a positive attitude toward environmental conservation, highlighting the significance of fostering informed decision-makers and active participants through dedicated Green Education initiatives.

According to Llopiz-Guerra et al. (2024), GE programs in schools can significantly influence students' attitudes toward sustainability and environmental conservation. Most psychologists assume a framework of cognitive (i.e., facts, knowledge, or understanding), affective (emotion and feeling), and conative (action and behavior) components for the theoretical construct of attitude (e.g., Fishbein & Ajzen, 1974; Gray et al., 1985). According to Dunlap and Jones (2002) more focused on environmental concerns with Variables of socio-psychological. According to Schultz et al. (2004), a person's environmental attitude is made up of their beliefs, feelings, and behavioral intentions about topics or activities that have an impact on the environment. Bogner and Wiseman, (1999; 2002a; 2002b) established a scale for the entire European on UT and PR factors for ecological attitudes. Based on environmental/ecological attitude theory sets in two orthogonal (uncorrelated) factors- UR and PR (Wiseman & Bogner, 2003). According to Wiseman and Bogner (2003), an individual's position on two orthogonal dimensions associated with natural resources shapes their ecological values. Scale validation is important in this situation because, even though this scale has been used in many countries in various age groups, the researcher could not find a 2-MEV scale in the Indian setting. The researcher provided more evidence in the review section. Questionnaires are essential for identifying behavioral patterns and tracking attitude changes over time or across demographic groups (Randler et al., 2024). Our younger generation has a significant responsibility to promote and achieve the Sustainable Development Goals (SDGs), especially in the era of social media, where digital issues often take precedence over environmental concerns. The present study aims to establish the validity and reliability of the Revised 2-MEV (2-Major Environmental Values) Scale to investigate attitudes toward GE in the context of West Bengal, India.

Review of literature (RL)

According to Yadav et al. (2021), environmental issues have become more prevalent and severe because of growing industrial and human impacts on the environment. Güngör et al. (2022) reported that schoolchildren's awareness of the ecological footprint concept was primarily at a medium level (51.5%). According to research, environmental knowledge and attitudes begin to develop in early childhood, and positive attitudes and behavior toward the environment are significantly influenced by the environmental awareness acquired during this time (Ardoin & Bowers, 2020; Spiteri, 2020; Perez-Lopez et al., 2021). Environmental attitude depends on conservation behavior and environmental awareness. Environmental challenges, such as water poisoning and climate change, have received more attention since the United Nations 2015 released Agenda 2030 and its 17 Sustainable Development Goals (SDG) (Samejo et al., 2023; Borg et al., 2017). Fayyaz et al. (2023) stated that students should be aware of the importance of conserving the environment. Over time, there have been different questionnaires or scales developed globally to find environmental attitudes (Randler et al., 2024). Numerous scales are now in use to measure concepts that appear to be connected, but there needs to be more confirmation research (Bogner & Wiseman, 2006). Presently measuring environmental attitude (EA) is essential, but there are significant issues related to the absence of standardized measurement instruments (Randler et al., 2024; Hines et al., 1987, Dwyer et al., 2016). Here, a researcher adds on the strongly validated scales in RL like, Dunlap et al. (2000) used scales, including the New Ecological Paradigm (NEP) through the 2-MEV model for adolescents. Here, utilization is an anthropocentric dimension, that represents the use of natural resources, preservation, is a biocentric dimension that represents environmental preservation and conservation (Wiseman & Bogner, 2003; Kibbe et al., 2014). Preservation

stands for willingness to preserve the environment, and it is typically used to identify the selfless domain (Kibbe et al., 2014). Bogner and Wilhelm established the Environmental Scale, 2-MEV model, which consists of 69 items that can be used to measure environmental concern and actual behavior toward the environment (Bogner & Wilhelm, 1996; Johnson & Manoli, 2010). For the German-speaking populations, Bogner and Wiseman (1999) again developed a 2-MEV model to measure EA. Bogner and Wiseman (2006) validated the first version which was conducted with 11–18-year-old secondary school students with the help of good agreement with a model that included two higher-order factors, UTL (utilization) and PRE (preservation), along with the two fundamental variables (Bogner & Wiseman, 2006; Binngießer & Randler, 2015). A high preservation factor score suggests that the individual values the conservation and protection of ecological resources, implying an ecocentric attitude. PRE measures three primary factors: Intent of Support, Care with Resources, and Enjoyment of Nature and UTL consists of Human Dominance over Nature and Altering Nature (Randler et al., 2024). According to Randler et al. (2024)'s study to find out, in widespread validity across continents, more than 30 languages, and numerous countries, the 2-MEV model is robust across regions and cultures, including Tanzania (Nkaizirwa et al., 2022), New Zealand (Milfont & Duckitt, 2004), the USA (Johnson & Manoli, 2010), and Europe (Boeve-de Pauw & Van Petegem, 2018; Le Hebel et al., 2014). The present study also followed the same primary factor for preservation (PR) and utilization (UT) due to strong theoretical and empirical evidence. However, it is unavailable in the Indian setting, creating a research deficit for this kind of work as well. Several studies indicate 9-12 years old adolescents and expanded it to youths for the validity of this scale (Munoz et al., 2009; Oerke & Bogner, 2010; Johnson & Manoli, 2010; Schumm & Bogner, 2016; Schneiderhan-Opel & Bogner, 2020; de Almeida Barbosa et al., 2021; Randler et al., 2024).

All this evidence can be said to support that the 2-MEV model is suitable for measuring EA across this age group and verifying that it is culturally invariant. Therefore, the purpose of this study is to establish the validity and reliability of the Revised 2-MEV Scale to investigate attitudes of students in West Bengal, India, toward GE.

Inadequate scale of measurement for attitude in green education in India

Kapoor et al. (2021) stated that the goal of green education is to instil in learners an awareness of the environment, sustainability, and eco-friendly behavior. As such, a reliable assessment method that appropriately represents these views is needed. In India, measuring attitudes toward green education is becoming progressively important. However, the inadequate scales now in use make it difficult to fully capture the richness and multidimensionality of environmental attitudes. According to Sharma and Sharma (2023), validated scales frequently draw on Western-developed constructs that may not be entirely appropriate in the Indian context due to the country's unique cultural, social, and environmental elements that influence attitudes toward green education. Inadequate measures not only impede but also weaken efforts to customize educational interventions that can promote significant environmental change when we attempt to assess the efficacy of green education initiatives using Western standards (Sharma & Rao, 2024). While significant affective and behavioral components of environmental attitudes should not be disregarded, current measurement instruments frequently concentrate on cognitive dimensions of attitudes toward the environment, such as awareness and knowledge. Therefore, a thorough understanding of environmental attitudes necessitates the integration of these components, which are influenced by social values, cultural norms, and personal experiences (Grosseck et al., 2019). Despite the drawbacks, there are still issues in the field of green education research, particularly about attitude toward GE, with the availability of clear definitions and reliable measurement instruments in the present context. In the RL section, the researcher did not find any valid scale in the present study area. These obstacles make it challenging to investigate the prevalence of this type of disordered behavior, which in turn impedes crucial advancements in the field of addiction research (Choudhury et al., 2024). According to Kapoor et al. (2021), to assure environmental stewardship and sustainable development, it is critical to address the inadequateness of measurement scales in today's educational programs and green education advancements.

> Objective 1. To validity and reliability of the Revised 2-MEV Scale of Johnson, B., & Manoli, C. C. (2010) in the Indian context.

Methodology

The Comprehensive Model of Scale Development model was covered in the scale development process using a rigorous empirical method; see Kundu et al. (2024, p. 709). The researcher used purposive sampling to select 222 students from different higher secondary schools in West Bengal, India. The data were collected in rural and urban areas distributed throughout Western (Birbhum, Purulia, Bankura) and Southern part (South 24 Parganas) West Bengal, India. Collection of demographic data beyond the pupils' area (51.35% Rural and 48.65% Urban) and gender (46.4% Male and 53.6% Female) (Bogner & Wiseman, 2006). The data collection lasted for four months between April-July, 2024 and is prevented by all regulations. According to Tinsley and Tinsley (1987), a sample size of approximately 270, or 5-10 subjects per item, is recommended for factor analysis. Following this recommendation, a 16-item questionnaire was administered to 160 consenting participants who met these criteria. Additionally, DeVellis and Thorpe (2021) noted that a larger sample size is preferable for creating scales, as it helps reduce subject variability. Therefore, this sample size was considered acceptable and indicative of the study's significance. The questionnaires were distributed during regular school hours and completed in class using Google Forms for the higher secondary students. Data were gathered from a single questionnaire featuring a 5-point Likert scale, where responses ranged from "strongly agree" (1 point) to "strongly disagree" (5 points), with an undecided option included (Likert, 1932).

Inclusion and exclusion criteria

To ensure the study's relevance, 222 participants were carefully selected based on specific inclusion and exclusion criteria. The inclusion criteria required participants to be students in 11th and 12th grades attending government and private schools, with a requirement for regular school attendance. The exclusion criteria disqualified those who did not complete the questionnaire fully or filled it out incorrectly.

Statistical analysis

SPSS v.23 was used for all other statistical analyses. All participants who had data for the specified variables were kept in case of missing data. The researcher first used the Kaiser-Meyer-Olkin (KMO) test and Bartlett's Test of Sphericity (BTS) (Field, 2013) to begin data analysis. According to Hutcheson and Sofroniou (1999), testing the sampling adequacy whereas the latter tests the hypothesis that the correlation matrix implies (Tabachnick & Fidell, 1996). We performed an Exploratory Factor Analysis (EFA) with principal component extraction and varimax rotation to analyze this sample statistically (Thompson, 2004). An exploratory factor analysis was employed to establish the validity of the scale (Bhandarkar, 2009). The number of factors was determined by the author using two main criteria: a parallel analysis based on 16 variables (items) and 110 participants, and a reliability analysis using Cronbach's α. Items taken from the 2-MEV Scale (Johnson & Manoli, 2010) are enclosed in double quotes to address concerns about plagiarism, and the researcher did not reword any sentences because they were originally expressed. The parallel analysis was based on the scree plot and the eigenvalue greater than one criterion. To check whether the factor structure produced by the EFA procedure was compatible with the data, it was then examined again using Confirmatory Factor Analysis (CFA) on the second sample (n= 112).

Results and discussion

Exploratory factor analysis and scale optimization

Exploratory Factor Analysis (EFA) provided insights into patterns regarding the 2-MEV scale. As noted by Tabachnick and Fidell (1996), the dataset demonstrated a KMO measure of 0.751, indicating acceptable sampling adequacy for the analysis. Furthermore, a stronger KMO value of over 0.7 was observed for the 16 total items in Table 4, suggesting a high level of association between the factors and the items (Hair et al., 2010). Bartlett's Test of Sphericity (Table 2) yielded a significant result ($\chi 2 = 3819.657$, $p < 0.001$), further confirming the factorability of the data, as proposed by Field (2018). According to Guttman's rule and an examination of the scree plot (Figure 1) (Guttman, 1954), meaningful factors with eigenvalues greater than 1 were identified; however, no distinct factors were ultimately found (Kundu et al., 2024).

In Table 3, we present the factor loadings (λ), the exploratory factor analysis (EFA) results for the rotated component matrix, and the correlations between the five sub-factors

Table 1. The Original 16 item 2-MEV Scale (Johnson & Manoli, 2010).

PRESERVATION (PR)	
(Intent of support)	
1PIS	"If I ever have extra money, I will give some to help protect nature". (Johnson & Manoli, 2010; Baierl et al., 2021; Bogner & Wiseman, 1997; Randler et al., 2024)
2PIS	"I would help raise money to protect nature." (Johnson & Manoli, 2010; Randler et al., 2024)
3PIS	"I try to tell others that nature is important." (Johnson & Manoli, 2010; Randler et al., 2024)
Care with Resources	
1PCR	"To save energy in the winter, I make sure the heat in my room is not on too high." (Randler et al., 2024)
2PCR	"I always turn off the light when I do not need it anymore." (Randler et al., 2024)
3PCR	"I try to save water by taking shorter showers or by turning off the water when I brush my teeth." (Randler et al., 2024; Bogner & Wiseman, 2006; Bogner & Wiseman, 2004; Baierl et al., 2022; Bogner & Wiseman, 1997; Bogner & Wiseman, 2002; Schneiderhan-Opel & Bogner, 2021a; Schneiderhan-Opel & Bogner, 2021b; Raab & Bogner, 2021).
Enjoyment of nature	
1PEN	"I would like to sit by a pond and watch different trees." (Randler et al., 2024; Bogner & Wiseman, 2006; Bogner & Wiseman, 2004; Johnson & Manoli, 2010; Bogner & Wiseman, 1997; Bogner & Wiseman, 2002; Schneiderhan-Opel & Bogner, 2021a; Schneiderhan-Opel & Bogner, 2021b)
2PEN	"I like to go on trips to places like forests away from cities." (Randler et al., 2024)
3PEN	"I like the quiet of nature." (Randler et al., 2024; Bogner & Wiseman, 2004; Bogner & Wiseman, 1997; Bogner & Wiseman, 2002; Randler et al., 2024)
UTILIZATION (UT)	
(Altering nature)	
1UAN	"People have the right to change the environment (nature)." (Randler et al., 2024; Bogner & Wiseman, 2004).
2UAN	"I like a grass lawn more than a place where flowers grow on their own." (Randler et al., 2024)
3UAN	"To feed people, nature must be cleared to grow food." (Randler et al., 2024)
4UAN	Weeds should be killed because they take up space from plants we need. (Randler et al., 2024)
Dominance	
1UD	"Building new roads is so important that trees should be cut down." (Randler et al., 2024)
2UD	"Because mosquitoes live in swamps, we should drain the swamps and use the land for farming." (Randler et al., 2024)
3UD	"People are supposed to rule over the rest of nature." (Randler et al., 2024)

Table 2. KMO and Bartlett's Test.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.751
Bartlett's Test of Sphericity	Approx. Chi-Square	3819.657
	df	120
	Sig.	.000

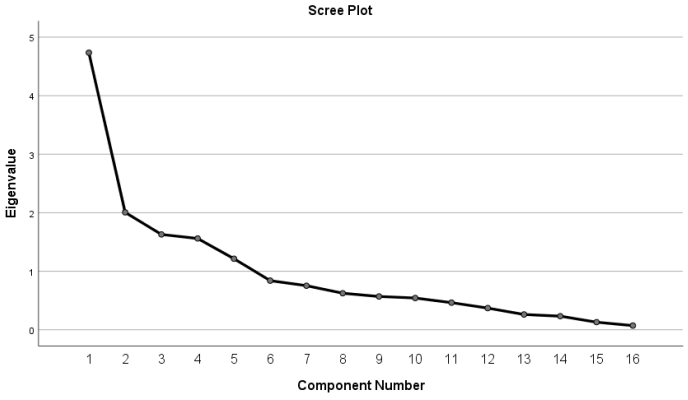

Figure 1. Scree Plot.

and their respective items. Due to the lack of a feature in SPSS to compute Average Variance Extracted (AVE) and Composite Reliability (CR) directly from the factor loadings, we performed the calculations manually utilizing the methods developed by Raykov (1997) (Kundu et al., 2024). The results indicate that the AVE values for the five constructs— "Intent of Support," "Care with Resources,"

"Enjoyment of Nature," "Altering Nature," and "Dominance"—are as follows: 0.58, 0.65, 0.57, 0.67, and 0.66, respectively. According to Fornell and Larcker (1981), an AVE of at least 0.50 is recommended. Since all the constructs exceeded this threshold, we conclude that they effectively measure the latent variables, thereby meeting the criteria for convergent validity. This provides further evidence for the authenticity and validity of the five factors.

Table 3. Factor Loading, AVE, CR, and Cronbach's alpha (α).

Factors	Items No.	Items Code	Factors Loadings (λ)	AVE#	CR##	Cronbach's alpha (α)
Intent of support	1	1PIS	.62	0.58	0.67	0.75
	2	2PIS	.75			
	3	3PIS	.79			
Care with Resources	4	1PCR	.77	0.65	0.71	0.79
	5	2PCR	.62			
	6	3PCR	.59			
Enjoyment of nature	7	1PEN	.72	0.57	0.67	0.81
	8	2PEN	.71			
	9	3PEN	.60			
Altering nature	10	1UAN	.87	0.67	0.61	0.76
	11	2UAN	.80			
	12	3UAN	.74			
	13	4UAN	.68			
Dominance	14	1UD	.83	0.63	0.64	0.72
	15	2UD	.79			
	16	3UD	.70			

Note(s): AVE# = $\sum(\lambda^2)/n$, where n = number of indicators or items under a contract CR## = $(\sum(\lambda^2)/[(\sum\lambda^2)+\sum(1-\lambda^2)]$ (formula invented by Raykov, 1997)

The CR values "Intent of support (0.67), Care with Resources (0.71), Enjoyment of nature (0.67), Altering nature (0.61), and Dominance (0.64)" are presented in Table 2 in a comparison way, along with the internal consistency. For the same factors, the corresponding Cronbach's alpha values are 0.75, 0.79, 0.81, 0.76, and 0.72, which is within acceptable norms. The necessary levels of reliability are present in all five constructions. Both are high and exceed the cutoff value of 0.07 in both instances. It concludes that each component is workable and dependable. Whether the results are computed manually or with SPSS, there is a noticeable low difference between them, which is also a positive indicator of strong reliability as per the rule of thumb (Kundu et al., 2024).

Determining the number of dimensions to retain for further analysis relies on the total variance explained. According to Kaiser and Caffrey (1965), the combined explanation of the data's total variance from the five components is 69.648%, as shown in Table 3. Specifically, the first component contributes 18.454% to the variation, the second component contributes 32.787%, the third contributes 46.280%, while the remaining components contribute gradually less. A more evenly distributed variance across the components, ranging from 18.456% to 10.560%, was achieved through the rotating sums of squared loadings. An Exploratory Factor Analysis (EFA) with a sample size of 110 was utilized, resulting in a Rotated Component Matrix for the subsequent analytical step. The underlying factor structure was rotated using Varimax with Kaiser normalization, and Principal Component Analysis (PCA) was employed as the extraction method (Ahmad et al., 2023). The rotation method implemented is orthogonal, based on the assumption that the elements are uncorrelated. This approach maximizes the variance of the squared loadings for each factor.

Table 4. Total variance explained.

Component	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings		
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	4.734	29.590	29.590	4.734	29.590	29.590	2.953	18.454	18.454
2	2.007	12.542	42.131	2.007	12.542	42.131	2.293	14.334	32.787
3	1.628	10.178	52.310	1.628	10.178	52.310	2.159	13.493	46.280
4	1.560	9.748	62.058	1.560	9.748	62.058	2.049	12.808	59.088
5	1.214	7.590	69.648	1.214	7.590	69.648	1.690	10.560	69.648
6	.839	5.245	74.893						
7	.753	4.705	79.598						
8	.624	3.902	83.500						
9	.569	3.557	87.057						
10	.542	3.389	90.446						
11	.463	2.895	93.342						
12	.370	2.313	95.655						
13	.261	1.634	97.289						
14	.232	1.451	98.740						
15	.130	.813	99.553						
16	.072	.447	100.000						

Extraction Method: Principal Component Analysis.

Table 5. Rotated Component Matrix.

Elements	Component 1	2	3	4	5
1PIS	.853				
2PIS	.836				
3PIS	.700				
1PCR		.928			
2PCR		.902			
3PCR		.922			
1PEN			.671		
2PEN			.745		
3PEN			.682		
1UAN				.699	
2UAN				.835	
3UAN				.787	
4UAN				.728	
1UD					.776
2UD					.731
3UD					.753

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

Verifying factor structure with Confirmatory Factor Analysis (CFA)

Following EFA with the second half of the sample, or 112 respondents (Tinsley & Tinsley, 1987), CFA was used to validate the constructs and their quantifiable indicators. By visualizing and fitting the model, CFA is used to validate the outcomes of the EFA. The final structural model between the five latent variables was assessed using empirical data following the completion of CFA (Dash & Paul, 2021).

Table 5 presents the analytical summary of the model generated using IBM SPSS Amos v21. The standardized factor loadings range from 0.60 to 0.77, as illustrated in Figure 2. The five-component structure identified by exploratory factor analysis (EFA) is confirmed by confirmatory factor analysis (CFA). Three elements correspond to four factors: "intent of support," "care with resources," "enjoyment of nature," and "dominance." Additionally, four elements correspond to one factor labeled "altering nature." The alignment between EFA and CFA results enhances the construct validity of the measurement (Choudhury et al., 2024).

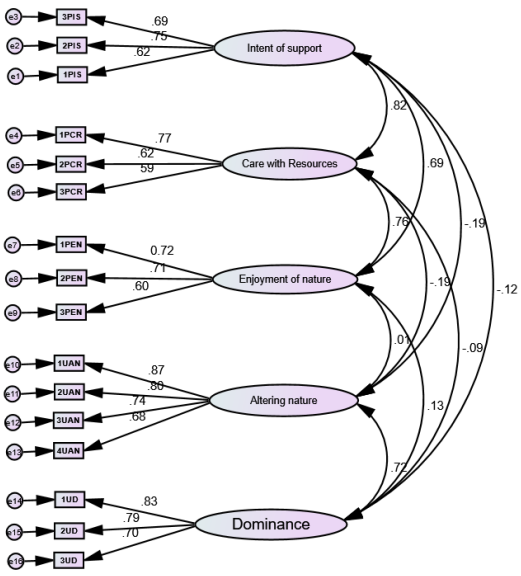

Figure 2. Factor structure of the model.

According to the indicators established by Hu and Bentler (1999), the CMIN/DF value is 1.654 (with a threshold limit of <3), and the chi-square p-value is 0.000 (<.05). The model also generated several goodness-of-fit indices: GFI = 0.923, AGFI = 0.803, CFI = 0.823, and NFI = 0.808, all of which exceed their respective threshold limits, indicating a good fit. The lower RMSEA value demonstrates how well the data fits the model, further supporting the appropriateness of the CFA measurement approach. Two indicators suggesting badness of fit are RMSEA = 0.026 (< 0.10) and SRMR = 0.042 (< 0.09), which further confirm that the model is appropriate.

Table 6. Summary of CFA Model fit.

Name of Category	*Model Fit indices*	*Threshold Limits*	*Value Attained*
Absolute fit Indices	X^2	p-value > 0.05	0.000
	RMSEA	>0.10 bad fit; 0.05-0.10 mediocre fit; and if <0.05 good fit	0.026
	SRMR	<0.09	0.042
	GFI	<0.90	0.823
Incremental Fit Indices	AGFI	>0.80	0.803
	PCFI	<0.80	.714
	CFI	>0.80 sometimes permissible; >0.90 traditional; and if >0.95 great	0.911
	TLI	>0.90	0.886
	NFI	>0.90	0.808
Parsimonious Fit	CMIN/ DF	<3 good; and if <5 sometimes permissible	1.654

Conclusion

Adolescent environmental attitudes in different European cultures have been examined using the 2-MEV scale since 1994, and it remains a valid assessment tool with a well-established theoretical foundation (Johnson & Manoli, 2010). Therefore, the current study aims to validate a scale for students' attitudes toward green education from various socioeconomic backgrounds in the context of West Bengal, India (Gorai et al., 2024). The author employed the same five components and the entire 16-item 2-MEV Scale from Johnson and Manoli (2010) to measure the GE attitudes of children ages 16–18. The scale has yielded robust findings that significantly contribute to our comprehension of the attitude towards green education through rigorous statistical analysis, such as EFA (refer Table 3), CFA (refer Table 6), and reliability testing. The 110 first subsample was used for EFA then the second subsample (112) was used for CFA, which falls within the acceptable limit of sample size (Tinsley & Tinsley, 1987). Table 3 indicated a commendable Cronbach's alpha for the internal consistency of the scale. CMIN/DF value of 1.654 and chi-square p-value of 0.000. Additional goodness indices that the model generated were GFI = 0.923, AGFI = 0.803, and CFI = 0.823, all of which indicate that the model is well-fitted and is over their corresponding threshold limits. In summary, the scale was subjected to strong evidence based on a systematic and comprehensive procedure. The 16-item 2-MEV revised scale is a valid and trustworthy instrument for evaluating higher secondary school students' attitudes concerning GE. The scale is appropriate for use in future research, even in various national and state contexts, as it has undergone many analyses to verify its validity and reliability. In addition to being a helpful tool for identifying gaps, this scale can aid researchers who want to better understand attitudes about GE in their future research. It may also help to increase awareness of environmental issues and enhance the quality of GE training after use.

Limitations

This research employed 222 respondents through purposive sampling, therefore investigating the attitudes toward green education on these measures may benefit from investigating a representative sample of Indian youth, ages 16 to 18.

Implications

This scale can be utilized because of its briefness and since it is intended to establish validity and reliability, but only in situations when environmental attitudes are not the primary focus of the research investigation, and the use of longer scales may be hampered by time restraints, compliance issues, or language barriers. Therefore, a modest study might focus on the five sub-factors under the above-mentioned preservation and utilization. The scale may be used by researchers, academics, and policymakers to understand the attitude of 16-18 aged children towards green education.

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Conflict of Interest

The authors declare that there is no conflict of interest.

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Capitalistic curricula and pedagogies: A comparative study of Indian knowledge systems in English textbooks of Central Board and Rajasthan Board Schools

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Abstract

English serves as a pivotal subject in Indian school curricula, offering students a platform to connect with diverse global and cultural perspectives. The National Education Policy (NEP) 2020 emphasizes revitalizing India's rich cultural heritage by integrating the Indian Knowledge System (IKS) into education. This study employs the Content Analysis method to critically examine the representation of IKS in English textbooks prescribed by the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE).

The findings reveal significant discrepancies in the extent and depth of IKS incorporation between the two boards, with CBSE textbooks demonstrating limited engagement compared to the more localized emphasis in RBSE curricula. These inconsistencies underscore the challenges of decolonizing education and the persistent dominance of capitalistic pedagogies that prioritize market-driven objectives over cultural and ecological sustainability.

The study advocates for the effective implementation of NEP 2020 recommendations through green curricular reforms that prioritize IKS integration, social justice, and sustainability. By aligning education with holistic and equitable frameworks, these reforms can empower students as agents of cultural preservation and ecological stewardship, fostering a globally connected yet culturally rooted education system.

Introduction

Role of higher education in driving transformation

Higher education institutions play a pivotal role in addressing societal challenges and fostering innovation. They serve as incubators for new ideas, frameworks, and practices, equipping future leaders with the skills and values necessary to contribute to sustainable development and societal growth. This transformative potential of higher education can be analyzed through several dimensions.

Higher education institutions are at the forefront of adopting and implementing policies like the National Education Policy 2020 (NEP 2020). NEP 2020 emphasizes a multidisciplinary approach, integrating Indian Knowledge Systems (IKS) and promoting sustainability and equity in education (Government of India, 2020). For instance, the introduction of eco-centric courses and curricula fosters an understanding of environmental conservation among students (Sharma & Singh, 2021). Such efforts align with the global agenda of Sustainable Development Goals (SDGs), particularly SDG 4, which advocates for inclusive and equitable quality education. It also includes the importance of AI in education. There are articles which stress the urgency for universities to integrate AI literacy within their curricula, not just as a technical subject, but intertwined with ethical decision-making and critical analysis.

Universities act as hubs of research that address pressing global issues, including climate change, cultural preservation, and technological advancement. According to Kumar (2019), higher education institutions have a responsibility to strengthen cultural identity by integrating indigenous literature and knowledge systems into their research and teaching practices. These research efforts not only preserve cultural heritage but also generate innovative solutions to contemporary challenges, creating a bridge between tradition and modernity.

Higher education cultivates leadership by embedding values of social responsibility and eco-consciousness into its programs. Initiatives like green campuses, as seen in universities in Bhutan (Dema, 2017), serve as examples of how institutions can lead by example. By integrating principles of Gross National Happiness into their pedagogy, these universities demonstrate the potential for education systems to balance economic, environmental, and social well-being.

Despite these opportunities, higher education in India faces structural challenges, such as inadequate funding, limited faculty training, and infrastructural deficits. Raina and Dey (2020) highlight the need for capacity-building programs for educators to facilitate the integration of indigenous knowledge and sustainability concepts into the curriculum. Moreover, the digital divide continues to hinder equitable access to quality education, particularly in rural areas (Mishra, 2020).

To maximize the potential of higher education in driving transformation, several measures can be undertaken:

- Enhancing faculty training programs to equip educators with the skills required to teach interdisciplinary and eco-centric courses (Batra, 2021).
- Strengthening public-private partnerships to address infrastructural and financial constraints (Giroux, 2004).
- Promoting international collaboration and knowledge-sharing initiatives to incorporate global best practices into local contexts (Norberg-Hodge, 1991).

Higher education institutions thus serve as critical agents of change, bridging policy aspirations with societal realities, but as Martin (2023) highlights, academics need to exercise the critical thinking they sell to their learners a little more deeply themselves. Through curricular reforms, research initiatives, and the cultivation of leadership, they have the potential to address global challenges while preserving cultural and environmental integrity.

Education is a transformative force that shapes societal values, beliefs, and the intellectual frameworks of future generations. In India, the National Education Policy (NEP) 2020 emphasizes revitalizing the country's cultural heritage by embedding the Indian Knowledge System (IKS) into mainstream education. This transformative vision aims to ensure that education does not merely serve as a vehicle for economic advancement but also as a medium to preserve and propagate India's rich cultural, ecological, and philosophical traditions. A key element in this process is the role of English as a compulsory subject in school curricula, particularly in systems governed by the Central Board of Secondary Education (CBSE) and state boards like the Rajasthan Board. English textbooks serve as a gateway for students to access global knowledge systems while simultaneously offering opportunities to reflect on and integrate indigenous traditions. However, the degree to which these textbooks succeed in incorporating IKS remains a critical area of investigation.

This research critically examines the integration of Indian Knowledge Systems within English textbooks used by CBSE and Rajasthan Board schools. By employing the Content Analysis method, this study focuses on the thematic representations, narratives, and pedagogical elements within these textbooks to assess their alignment with the NEP 2020's vision. The primary objectives are to identify discrepancies, highlight areas of omission, and understand how well these textbooks reflect the ethos of India's indigenous knowledge systems.

The historical context of this research is deeply rooted in the colonial legacy of education in India. Colonial powers systematically marginalized indigenous knowledge systems, replacing them with Euro-centric paradigms that prioritized capitalistic and industrial values over ecological sustainability and cultural inclusivity. This legacy has left an indelible mark on India's education system, creating a persistent imbalance where global knowledge dominates at the expense of indigenous traditions. While the NEP 2020 represents a

significant policy shift by advocating decolonized curricula, the challenge lies in translating this vision into practice, particularly within educational content such as textbooks.

The present study is timely, as it interrogates the practical implementation of the NEP 2020 recommendations. By comparing the representation of IKS in English textbooks from CBSE and Rajasthan Board schools, this research reveals the gaps and opportunities in curricular content. The findings are expected to shed light on how education systems in India can move beyond superficial inclusion to foster deeper integration of cultural, ecological, and philosophical elements of IKS.

This inquiry is not merely theoretical; it aligns with broader global efforts to create sustainable and equitable education systems. Examples like Bhutan's Green School System (Wangchuk, 2017), the Students' Educational and Cultural Movement of Ladakh (SECMOL), and Rajasthan's Barefoot College underscore how education can be re-imagined prioritizing social justice, sustainability, and cultural inclusivity. These models serve as benchmarks, offering valuable insights into how indigenous knowledge can be effectively embedded into educational practices.

Through this analysis, the study aims to make a meaningful contribution to the discourse on decolonizing education. It underscores the importance of challenging capitalistic and Euro-centric paradigms while advocating for education that is rooted in cultural heritage and ecological consciousness. By examining the potential of English textbooks to act as conduits for IKS, this research contributes to the larger vision of reimagining education as a tool for both cultural preservation and progressive global engagement.

Intent

The study seeks to explore the integration of the Indian Knowledge System (IKS) within the English textbooks of the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE). It aims to critically evaluate how these curricula align with the National Education Policy (NEP) 2020's vision of fostering cultural preservation, eco-centric values, and holistic education. By analyzing the representation of IKS in these textbooks, the research intends to identify the strengths, gaps, and inconsistencies in their content, thereby offering actionable recommendations for curriculum development that effectively bridges global learning standards with indigenous knowledge.

Rationale

The National Education Policy 2020 emphasizes the importance of integrating IKS into the education system to cultivate a generation of learners who are deeply connected to their cultural roots and committed to sustainable development. English, as a subject, serves as both a vehicle for global engagement and a platform for promoting local identities and traditions. This dual role makes English textbooks a critical focus area for examining how curricula reflect and uphold India's rich cultural and ecological heritage.

Despite this, there is a noticeable gap in research that systematically evaluates the extent and depth of IKS integration in English textbooks, especially across different educational boards in India. The CBSE and RBSE, representing national and regional frameworks, provide a valuable comparative lens for understanding how cultural diversity and ecological consciousness are embedded in educational materials. This study addresses this gap by providing a nuanced analysis of the content, with the goal of aligning textbook design more closely with the NEP's holistic vision.

Methodology

This study employs a qualitative content analysis methodology to examine the representation of cultural heritage, indigenous traditions, and eco-centric values in English textbooks from CBSE and RBSE for grades 9–12, a critical stage in secondary education. The analysis involves systematically reviewing these textbooks through a coding framework designed to classify content into predefined categories, including cultural narratives, ecological themes, and indigenous knowledge. A comparative analysis evaluates the thematic alignment of the content with the objectives of the National Education Policy (NEP) 2020, focusing on the depth, breadth, and contextual relevance of IKS representation across the two boards. Critical interpretations drawn from the data identify disparities, strengths, and areas for improvement in the integration of IKS. Based on these findings, the study offers practical recommendations for enhancing English curricula, drawing insights from global pedagogical models and the eco-centric principles advocated by NEP 2020.

Education is the cornerstone of societal development, shaping the values, beliefs, and knowledge systems that influence future generations. In India, the National Education Policy (NEP) 2020 has emphasized the importance of revitalizing India's rich cultural heritage through education, particularly by promoting the Indian Knowledge System (IKS) within various educational contexts. English, as a compulsory subject in school curricula governed by both the Central Board of Secondary Education (CBSE) and state boards like the Rajasthan Board, plays a critical role in broadening students' worldviews. It offers students the opportunity to connect with diverse cultures, traditions, and histories, both within India and globally. However, the extent to which English textbooks incorporate indigenous knowledge systems remains a significant area of investigation.

The study aims to explore the presence of Indian knowledge within English textbooks used in schools following the curricula of both the Central Board and the Rajasthan Board. By employing the Content Analysis method, this research examines how these textbooks reflect or neglect IKS, thereby assessing the potential role of indigenous knowledge in revitalizing the Indian education system, in alignment with the recommendations outlined in NEP 2020.

The historical imposition of Western education systems during the colonial era led to the marginalization of indigenous knowledge systems. European colonizers, despite their efforts to dismantle the eco-centric knowledge systems of indigenous communities, could not completely suppress these communities' epistemological and ontological foundations. Instead, these colonial powers transformed their insecurities into a global phenomenon, resulting in invisible empires of capitalism that continue to dominate educational practices today. These practices often prioritize profit and exclusivity at the expense of ecological sustainability and social justice (Bowers, 2001; Shiva, 1988).

The NEP 2020 represents a significant shift toward challenging these capitalistic frameworks by advocating for the integration of IKS into the mainstream education system (Government of India, 2020). However, the mere inclusion of indigenous knowledge in educational curricula is insufficient. As this content analysis of English textbooks reveals, there are notable discrepancies in the incorporation of IKS between the Central Board and Rajasthan Board curricula. These discrepancies underscore the persistent challenges of decolonizing education and the need for a more concerted effort to dismantle capitalistic curriculums and pedagogies that continue to dominate (Raina, 2019).

Alternative educational models offer valuable insights into how education can be reimagined to foster ecological sustainability and social equity. For instance, the Green School System in Bhutan, the SECMOL (Students' Educational and Cultural Movement of Ladakh) project, and the Barefoot College in Rajasthan serve as exemplary models of how education can prioritize sustainability, social justice, and holistic learning (Norberg-Hodge, 1991; Shiva, 2005). These models, though rooted in specific socio-cultural contexts, provide critical lessons for creating a more equitable and sustainable education system in India.

The effective implementation of NEP 2020's recommendations in future curricula has the potential to preserve and promote India's rich cultural and traditional values while contributing to the global movement toward decolonizing education (Kumar, 2021). By adopting green curricular and pedagogical approaches, educators can create learning environments that empower students to become active agents of positive change in their communities and the world. In this context, the comparative study of English textbooks used in CBSE and Rajasthan Board schools provides a critical lens to examine ongoing efforts to integrate IKS into the Indian education system and the broader implications for educational reform in the post-colonial, post-capitalistic era.

Literature review

The pie chart representing the distribution of the key themes in the literature review on the integration of the Indian Knowledge System (IKS) in the English curricula of CBSE and RBSE. The chart highlights various aspects, including the incorporation of IKS in educational policies, comparative studies on CBSE and RBSE curricula, analysis of NEP 2020 and IKS, global perspectives on alternative pedagogical models, and the challenges in implementing IKS in the

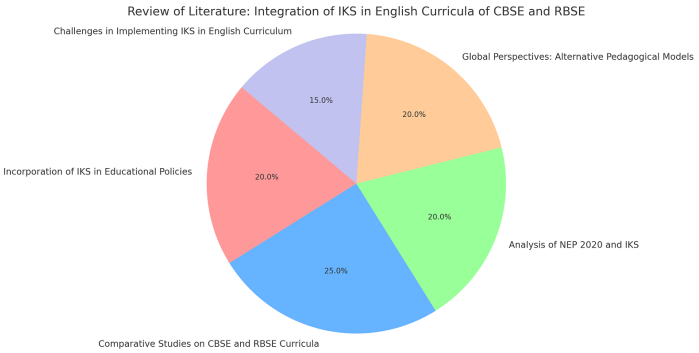

Figure 1. Review of literature.

English curriculum.

The integration of indigenous knowledge systems (IKS) into modern educational curricula has gained increasing attention, particularly in post-colonial societies like India. This literature review provides a comprehensive exploration of the historical marginalization of IKS, the influence of capitalism on education, and the transformative potential of integrating IKS into educational frameworks. It also highlights the role of NEP 2020, the relevance of eco-centric educational models, and the comparative analysis of English curricula from the Central Board of Secondary Education (CBSE) and Rajasthan Board of Secondary Education (RBSE). Historical marginalization of indigenous knowledge systems The colonial era in India witnessed a systematic suppression of indigenous knowledge systems as European powers imposed Western-centric educational frameworks. These frameworks prioritized scientific rationality, individualism, and linear progress while sidelining the eco-centric, community-oriented knowledge embedded in IKS (Shiva, 1988; Kumar, 2021). Colonial education systems served the interests of imperial powers, creating an administrative class aligned with colonial objectives rather than preserving indigenous epistemologies (Raina, 2019). Even after independence, the remnants of these colonial systems persisted, often reflecting Western epistemologies in curricula. Scholars such as Bowers (2001) and Shiva (2005) argue that modern education systems, driven by global capitalist ideologies, continue to marginalize IKS, favoring economic and technological advancement over cultural and ecological diversity.

The impact of capitalism on education

Capitalism has profoundly influenced education, framing it as a tool for economic mobility rather than a means for holistic development. Apple (2004) critiques capitalist educational frameworks for perpetuating inequalities by prioritizing market-driven outcomes. English, as a global language, exemplifies this dynamic, as its mastery is often linked to socioeconomic advancement. However, this emphasis often sidelines IKS, viewing it as less valuable in the global marketplace (Ramanathan, 2005). Shiva (2005) highlights that capitalist-driven education homogenizes knowledge, erasing diverse indigenous epistemologies. This commodification of education not only undermines cultural heritage but also diminishes the potential for creating

equitable, sustainable learning environments.

NEP 2020 and the revival of indigenous knowledge systems The National Education Policy (NEP) 2020 marks a paradigm shift in Indian education, emphasizing the need to incorporate IKS into mainstream curricula. This policy aims to decolonize education by integrating traditional knowledge systems across disciplines, including language education (Government of India, 2020). Kumar (2021) underscores that while NEP 2020's focus on IKS is promising, its successful implementation requires educators to develop context-sensitive pedagogical strategies. Batra (2021) argues that the integration of IKS into curricula should move beyond tokenism to foster holistic and inclusive education that aligns with ecological and cultural sustainability.

Eco-Centric educational models and global perspectives

Globally, alternative educational models offer valuable insights into integrating ecological and cultural values into curricula. Initiatives like Bhutan's Green School System (Wangchuk, 2017), the Students' Educational and Cultural Movement of Ladakh (SECMOL), and the Barefoot College in Rajasthan emphasize practical, community-based learning that promotes sustainability (Norberg-Hodge, 1991; Dema, 2017). These models challenge the dominance of capitalist education by prioritizing local knowledge, ecological balance, and social equity. For example, Bhutan's Green School System fosters environmental stewardship, while SECMOL and Barefoot College empower learners to address local challenges through community-oriented education. Internationally, movements like the *Māori Kōhanga Reo* in New Zealand and Hawaiian Pūnana Leo preschools further illustrate the global potential of integrating indigenous pedagogies into formal education (Dey, 2023).

Comparative analysis of CBSE and RBSE English curricula

A critical analysis of English textbooks from CBSE and RBSE provides insights into how IKS is incorporated into Indian education. Previous studies indicate that textbooks play a pivotal role in shaping students' understanding of cultural heritage and worldviews (Altbach, 1991). Content analysis reveals disparities in the representation of IKS between the CBSE and RBSE curricula. While CBSE textbooks often reflect a broader, globalized perspective, RBSE materials tend to include localized cultural elements. This divergence underscores the challenges of balancing standardization with the preservation of regional knowledge systems (Ramanathan, 2005).

Challenges in implementing IKS

The reviewed literature identifies several barriers to integrating IKS into education. These include entrenched colonial legacies, capitalist ideologies, and a lack of teacher training in IKS-based pedagogies (Batra, 2021). Effective implementation requires not only curricular reforms but also capacity building for educators to engage critically with indigenous knowledge.

The reviewed literature also highlights the historical marginalization of IKS, the pervasive influence of capitalism on education, and the opportunities presented by NEP 2020 to transform Indian education. By drawing on global examples of eco-centric educational models and analyzing the discrepancies between CBSE and RBSE curricula, this review underscores the need for a more inclusive and sustainable approach to education. The integration of IKS into curricula is not merely an act of preservation but a step toward creating an education system that values ecological sustainability, cultural diversity, and social equity.

Significance of the study

The growing frequency and intensity of climate and environmental disasters highlight a critical flaw in current approaches to sustainability: the reliance on top-down institutional policy-making and governmental initiatives that often fail to address the root causes of ecological degradation. This study, therefore, emerges as a crucial intervention in rethinking educational curricula and pedagogies to address these issues from the ground up. The importance of this research lies in its potential to disrupt the entrenched capitalistic frameworks that prioritize profit over environmental and societal well-being, which has historically led to disastrous consequences, such as the Bhopal gas tragedy and ongoing ecological exploitation in various parts of India and globally.

This study is particularly significant in the context of the National Education Policy (NEP) 2020, which emphasizes the revival and integration of the Indian Knowledge System (IKS) into the educational framework. By analyzing the presence (or lack thereof) of IKS in English textbooks used in schools governed by the Central Board of Secondary Education (CBSE) and the Rajasthan Board, this research seeks to illuminate the extent to which current educational practices align with the NEP's vision of fostering indigenous knowledge and sustainable practices.

The study also underscores the urgent need to dismantle capitalistic curricula that often perpetuate socio-economic inequities and environmental harm. By exploring alternative educational models—such as Bhutan's Green School System (Wangchuk, 2017), New Zealand's Kaupapa Māori education, and India's Happiness Curriculum (NCERT, 2020)—the research aims to highlight the potential of green pedagogical spaces in promoting sustainability, social justice, and holistic learning. These models demonstrate how education can be reimagined to not only include but actively promote eco-centric knowledge values, offering students practical, hands-on experiences that connect them directly with the natural environment.

The significance of this study also extends to its potential impact on policy and curriculum development. By providing a detailed comparative analysis of the incorporation of IKS in English textbooks, the research offers valuable insights for educators, policymakers, and curriculum developers who are working to implement the NEP-2020 recommendations. Curriculum designers can use these insights to create more effective, student-centered curriculum that incorporate

peer-based activities aimed at improving language skills, promoting growth mindsets, and increasing student engagement (Namaziandost et al., 2024). The findings could inform more effective strategies for integrating indigenous knowledge into mainstream education, thereby preserving and promoting India's rich cultural heritage while also contributing to global efforts to create more sustainable, equitable, and socially just educational systems.

In essence, this study is not just an academic inquiry but a call to action—urging a shift from capitalistic, profit-driven educational models to those that prioritize the well-being of both people and the planet. By advancing the conversation on how education can be a powerful tool for ecological and social transformation, this research contributes to the growing body of work that seeks to create a more just and sustainable future for all.

Scope of the research

The scope of this research encompasses a comprehensive analysis of the representation and integration of the Indian Knowledge System (IKS) within English textbooks used in schools affiliated with the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE). The study's primary focus is on the following key areas:

The research will conduct a detailed content analysis of English textbooks from both the CBSE and RBSE to identify the presence and depth of Indian knowledge, cultural heritage, and eco-centric values as emphasized by the National Education Policy (NEP) 2020. The study will compare how both boards incorporate IKS in their English curriculum, highlighting similarities, differences, and gaps in representation.

The research will assess the extent to which the current English curricula align with the NEP 2020's vision of reviving and integrating the Indian Knowledge System into mainstream education. The study will explore how the incorporation of IKS can contribute to fostering a deeper connection between students and India's rich cultural and ecological heritage.

The research will explore and analyze alternative educational models such as Bhutan's Green School System, New Zealand's Kaupapa Māori education, and India's Happiness Curriculum (NCERT, 2020). These models will be examined for their potential to inspire green curricular and pedagogical reforms in Indian education. The study will also consider the practical application of these models in the Indian context, particularly how they can be adapted to enhance the integration of IKS in English curricula.

By addressing these areas, the research seeks to contribute to a more informed understanding of how educational practices can be reformed to align with the goals of NEP 2020, promote cultural and ecological sustainability, and create a more equitable and just education system in India. The study's findings are expected to have significant implications for curriculum design, policy formulation, and the future direction of education in India. The research engages in a thorough content analysis of English textbooks from both the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE) to critically examine the inclusion and depth of Indian knowledge, cultural heritage, and eco-centric values as prescribed by the National Education Policy (NEP) 2020. This approach is not just a mere assessment of content, but a deeper exploration of how educational materials reflect and perpetuate cultural identity and environmental consciousness among students.

Significance of content analysis in educational research

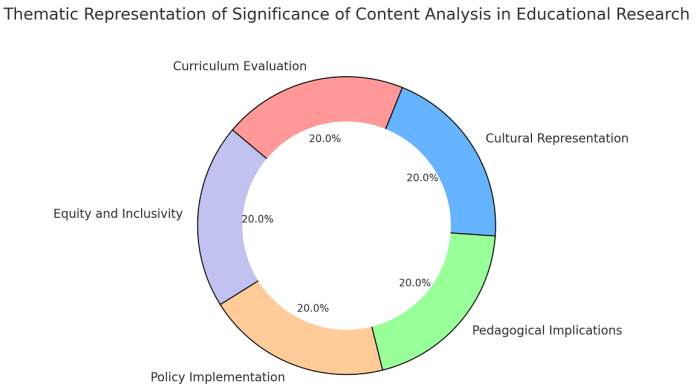

Figure 2. Thematic representation.

Content analysis is a valuable method in educational research that allows for the systematic examination of textual material. In this context, it serves as a tool to uncover underlying messages, ideologies, and values conveyed through educational content. By focusing on English textbooks, the research taps into a critical medium through which language, culture, and values are transmitted to students across India. As English is not only a subject but also a vehicle for broader educational objectives, analyzing its content provides insights into how the NEP 2020's goals are being implemented at the ground level.

The NEP 2020 emphasizes the integration of India's rich cultural heritage and indigenous knowledge systems into the curriculum. This is rooted in the understanding that education should not only impart technical and cognitive skills but also foster an appreciation for the country's cultural and historical legacy (NEP 2020). Through content analysis, this research investigates how English textbooks from CBSE and RBSE boards incorporate Indian literary traditions, historical narratives, and cultural symbols.

For example, the inclusion of classical texts such as the Ramayana and Mahabharata, or the works of poets like Kabir and Tagore, within English language curricula, is a direct reflection of NEP 2020's objectives. These texts do not just serve as literary studies but as conduits for passing down cultural values and moral lessons integral to the Indian ethos. Kumar (2019) argues that the integration of indigenous literature in school curricula not only enhances linguistic skills but also strengthens cultural identity and

continuity among students.

Eco-centric education is another cornerstone of the NEP 2020, which advocates for environmental consciousness and sustainable living practices to be woven into the fabric of education. This research investigates whether English textbooks convey eco-centric values through stories, essays, and poems that emphasize the importance of nature, environmental stewardship, and the interdependence between humans and the environment. An example of this can be seen in the inclusion of essays on environmental movements such as the Chipko Movement, which not only highlight historical events but also serve as a moral framework for students to understand the significance of ecological balance and activism. Research by Sharma and Singh (2021) highlights the critical role that educational content plays in shaping students' environmental awareness and attitudes, advocating for the inclusion of more eco-centric themes in school curricula.

The comparative nature of this research allows for an examination of the variances between CBSE and RBSE in terms of how these values are presented. The CBSE, with its national outlook, may emphasize a broader inclusion of pan-Indian cultural and ecological narratives, whereas the RBSE might focus more on regional cultural and environmental contexts specific to Rajasthan. Such a comparative approach is crucial as it reveals not only the alignment with national educational policies but also highlights the potential disparities that exist between different educational boards. This, in turn, can inform future policy adjustments to ensure a more uniform and inclusive educational experience across the country. A study by Mishra (2020) on the representation of regional and national identities in Indian educational materials suggests that discrepancies between different educational boards can lead to a fragmented understanding of national identity among students.

By conducting a detailed content analysis of English textbooks from CBSE and RBSE, this research seeks to uncover the depth and presence of Indian knowledge, cultural heritage, and eco-centric values within these educational materials. Such an analysis is essential in understanding how effectively the NEP 2020's goals are being realized in actual educational practice and what further steps might be necessary to ensure that Indian students receive an education that is both globally relevant and deeply rooted in their cultural and environmental heritage.

Comparative analysis of the Indian Knowledge System (IKS) in CBSE and RBSE English curricula

A bar chart representing the comparative analysis of the Indian Knowledge System (IKS) in CBSE and RBSE English curricula across four categories: IKS Representation, Cultural Heritage, Eco-Centric Values, and Alignment with NEP 2020. The chart highlights the differences and similarities in how these aspects are incorporated into the English curricula of both educational boards. The integration of Indian Knowledge Systems (IKS) within the English curricula of the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE) reveals

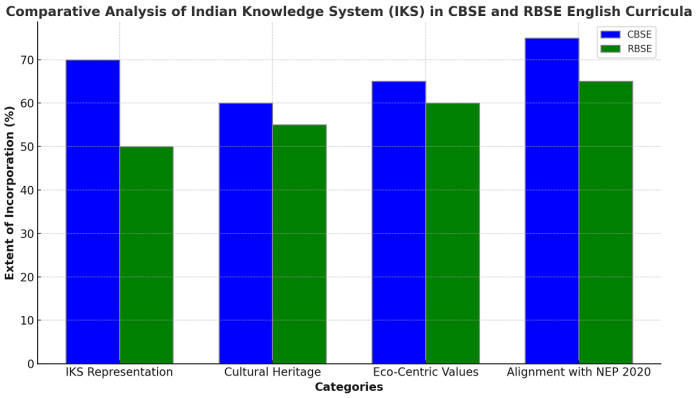

Figure 3. Comparative analysis of IKS in CBSE and RBSE.

significant insights into how each board approaches the representation of indigenous knowledge, cultural heritage, and eco-centric values, as emphasized by the National Education Policy (NEP) 2020. This comparative analysis highlights the similarities, differences, and gaps in representation within these curricula.

Both CBSE and RBSE have made efforts to integrate Indian cultural heritage and values within their English curricula, although the extent and depth vary. A common feature in both boards is the inclusion of texts that reflect India's rich literary tradition. For instance, both curricula feature works by Indian authors such as R.K. Narayan, Rabindranath Tagore, and Premchand, whose stories often portray Indian social norms, ethical values, and cultural practices.

Furthermore, both boards include passages and essays that discuss India's historical achievements and contributions to various fields such as science, mathematics, and philosophy. For example, essays on India's space achievements or the legacy of ancient Indian mathematicians like Aryabhata and Brahmagupta appear in textbooks from both boards, aligning with the NEP 2020's emphasis on showcasing India's intellectual heritage.

Despite these similarities, the depth and approach to incorporating IKS differ significantly between the two boards. The CBSE curriculum, for example, tends to adopt a more global perspective while integrating IKS, often juxtaposing Indian texts with global literature to provide students with a comparative understanding. This approach is evident in the inclusion of texts that pair Indian folklore with global fables, encouraging students to appreciate cultural diversity and universal themes. In contrast, the RBSE curriculum places a stronger emphasis on regional and local content, particularly focusing on Rajasthani culture and traditions. For example, RBSE textbooks may include folk tales from Rajasthan, discussions on the state's historical figures, and essays on local festivals and customs, thus offering students a more localized understanding of Indian culture.

However, this localized focus sometimes results in a narrower perspective, with RBSE textbooks potentially lacking the broader, pan-Indian view that CBSE texts provide. This difference is significant because while RBSE students gain a deep understanding of their immediate cultural surroundings, they may miss out on the broader

cultural narratives that are more prevalent in the CBSE curriculum. Both boards, despite their efforts, exhibit gaps in the representation of IKS, particularly in the context of eco-centric values and indigenous knowledge. The NEP 2020 emphasizes the need for education to incorporate sustainable practices and indigenous environmental knowledge, yet this is often underrepresented in the English curricula of both CBSE and RBSE.

For instance, while both boards include some environmental themes, these are often generic and lack a direct connection to India's indigenous knowledge systems. Topics such as the Chipko Movement or the Bishnoi community's environmental practices, which are critical to understanding India's eco-centric traditions, are either briefly mentioned or entirely absent. This gap suggests a missed opportunity to educate students on the vital role of indigenous practices in sustainable development, a core aspect of the NEP 2020.

Moreover, the representation of marginalized communities and their knowledge systems remains insufficient. Both curricula tend to focus on mainstream Indian culture, often neglecting the rich and diverse traditions of India's tribal and rural populations. This omission perpetuates a limited understanding of India's cultural and ecological diversity among students. A comparative look at specific textbooks can further illustrate these points. For instance, a CBSE English textbook for Class X might include an essay on Gandhi's philosophy of non-violence alongside a global text on Martin Luther King Jr.'s civil rights movement, thus framing Indian knowledge within a global context. In contrast, an RBSE textbook might feature a detailed account of the Marwar region's history, focusing on local heroes like Maharana Pratap, but might not include comparative global content.

While both curricula include environmental themes, the treatment of these topics often lacks depth. A chapter on environmental conservation in a CBSE textbook might discuss global climate change without delving into India's indigenous practices that contribute to sustainability, whereas an RBSE textbook might include a passage on the importance of preserving local flora and fauna but fail to connect these practices to broader environmental challenges.

The analysis reveals that while both CBSE and RBSE have incorporated elements of the Indian Knowledge System into their English curricula, there are notable differences in their approaches and significant gaps in representation. The CBSE curriculum offers a broader, more comparative perspective that connects Indian knowledge with global narratives, whereas the RBSE curriculum provides a more localized focus on Rajasthani culture. However, both curricula fall short of adequately representing eco-centric values and the diverse indigenous knowledge systems of India, highlighting a need for a more comprehensive integration of these elements in alignment with the NEP 2020.

The diagram representing the "Evaluation of Curriculum Alignment with NEP 2020." It outlines the process from analyzing CBSE and RBSE curricula, comparing the inclusion of Indian Knowledge Systems (IKS), evaluating alignment with NEP 2020 objectives, and concluding with recommendations.

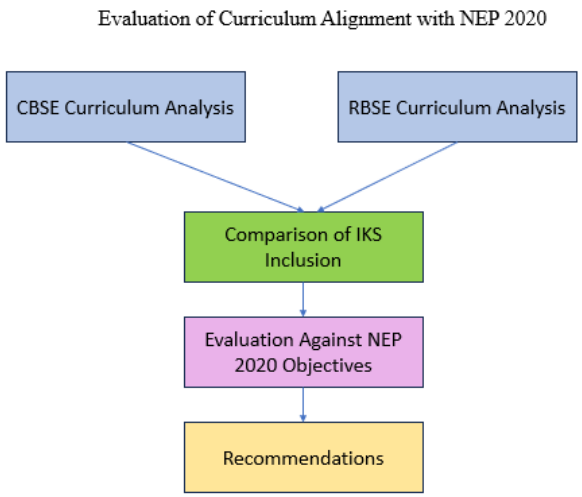

Figure 4. Evaluation of curriculum alignment with NEP 2020.

The National Education Policy (NEP) 2020 represents a significant shift in India's educational philosophy, emphasizing the need to revitalize and integrate the Indian Knowledge System (IKS) into mainstream education. This policy reflects an intention to move beyond the traditional Western-centric curriculum to one that acknowledges and celebrates India's rich cultural, philosophical, and ecological heritage. In this context, the research will critically evaluate the alignment of the current English curricula of the Central Board of Secondary Education (CBSE) and the Rajasthan Board of Secondary Education (RBSE) with the NEP 2020's vision.

Assessing curriculum alignment with NEP 2020

The NEP 2020 calls for a curriculum that not only includes Indian knowledge but also embeds it in ways that resonate with students, making it relevant and engaging. This involves a holistic approach that integrates traditional Indian wisdom across various disciplines, particularly in humanities subjects like English, where literature and language offer fertile ground for exploring cultural narratives. For instance, CBSE's English curriculum includes classic Indian texts like "Kabuliwala" by Rabindranath Tagore and "My Experiments with Truth" by Mahatma Gandhi. These texts reflect Indian socio-cultural contexts and ethical values, thus aligning with NEP 2020's call to integrate IKS. However, the presence of such texts in the RBSE curriculum is often limited to regional works, such as stories by Rajasthani authors, which, while culturally significant, may not fully reflect the pan-Indian knowledge system that the NEP envisions.

The NEP emphasizes environmental education, which includes the integration of India's traditional ecological knowledge. However, the incorporation of eco-centric values in both CBSE and RBSE English curricula remains sparse. The study will evaluate how topics related to India's

indigenous environmental practices, such as the Chipko Movement or the Bishnoi community's conservation efforts, are included or neglected in these curricula. For example, while the Chipko Movement might be mentioned in passing in a CBSE textbook, a detailed discussion linking it to current environmental issues, as the NEP advocates, may be missing.

The incorporation of IKS in the curriculum is not just about adding content; it is about fostering a deeper, more intrinsic connection between students and their heritage. The NEP 2020 envisions a curriculum that helps students develop a sense of pride and identity rooted in India's cultural and ecological heritage. The study will explore whether the current curricula facilitate this connection.

In many CBSE schools, the study of Indian authors and themes might be juxtaposed with global literature to provide a comparative perspective. This approach, while valuable, can sometimes dilute the focus on Indian knowledge. For example, a textbook might feature a chapter on the Vedic period alongside a discussion of the Renaissance, which may lead to an unequal emphasis on Western historical developments over Indian contributions. On the other hand, RBSE's focus on local history and culture can create a strong regional identity but may lack a broader connection to India's national heritage. The research will assess whether such curricula contribute to a fragmented understanding of India's cultural and ecological wealth, which the NEP 2020 seeks to address.

In conclusion, the research critically assessed how well the CBSE and RBSE English curricula align with the NEP 2020's goals of integrating IKS and fostering connections to India's cultural and ecological heritage. Through detailed content analysis, the study identifies the strengths and weaknesses of each board in achieving these educational objectives and provides recommendations for enhancing the representation of IKS in mainstream education.

The integration of Indigenous Knowledge Systems (IKS) into mainstream education, as envisioned by the National Education Policy (NEP) 2020, calls for a rethinking of traditional pedagogical approaches. To facilitate this integration, it is essential to explore alternative educational models that have successfully embedded indigenous knowledge and eco-centric values into their curricula. This section of the research examines pedagogical models from different parts of the world, such as Bhutan's Green School System (Wangchuk, 2017), New Zealand's Kaupapa Māori education, and India's Happiness Curriculum (NCERT, 2020), to assess their potential for inspiring green curricular and pedagogical reforms in Indian education.

Bhutan's Green School System (Wangchuk, 2017) is a pioneering model that emphasizes holistic education, integrating environmental sustainability, cultural preservation, and social well-being into the curriculum. This model is built on the philosophy of Gross National Happiness (GNH), which prioritizes the collective well-being of citizens over mere economic growth. The Green School System (Wangchuk, 2017) encourages students to connect with nature, understand their cultural roots, and develop a sense of responsibility towards their community and the environment.

In Bhutan, the curriculum is designed to foster a strong sense of environmental stewardship among students. For instance, students are involved in activities such as tree planting, waste management, and the study of local ecosystems. The curriculum also includes the study of traditional Bhutanese knowledge, such as indigenous agricultural practices and medicinal plants, which are deeply rooted in the country's cultural heritage.

The potential for adapting elements of Bhutan's Green School System to the Indian context lies in its emphasis on ecological consciousness and cultural preservation. For example, integrating similar practices into Indian schools could involve students in projects related to local environmental conservation, traditional farming techniques, or the study of regional flora and fauna. This approach could complement the NEP 2020's goal of embedding IKS into the curriculum, particularly in subjects like Environmental Science and Social Studies, but could also extend to English by including eco-centric themes in literature and writing assignments.

New Zealand's Kaupapa Māori education is a bicultural model that centers on Māori values, language, and knowledge systems. It aims to empower Māori students by providing an education that reflects their cultural identity and heritage. This model is based on principles of self-determination (tino rangatiratanga), the importance of language and culture (te reo Māori me ōna tikanga), and the collective responsibility of the community (whānau).

In Kaupapa Māori schools, the curriculum is designed to reflect Māori worldviews, with a strong emphasis on the language, history, and traditions of the Māori people. For example, students might study Māori legends (pūrākau) as part of their English or Social Studies curriculum, alongside the mainstream literature. The teaching methods also incorporate Māori pedagogical practices, such as collaborative learning (ako) and storytelling. The relevance of the Kaupapa Māori model to Indian education lies in its successful integration of indigenous knowledge into a national education system. India, with its rich tapestry of diverse cultures and languages, can draw inspiration from this model to develop curricula that reflect the unique cultural identities of different regions while promoting a sense of national unity. For instance, English curricula in India could include regional folklore, proverbs, and oral histories as part of language instruction, thereby preserving and promoting local knowledge systems.

The Happiness Curriculum, introduced in Delhi government schools, is a unique initiative aimed at fostering emotional well-being and holistic development among students. It focuses on mindfulness, emotional intelligence, and ethics, rather than academic achievement alone. The curriculum is designed to create a positive school environment where students learn to manage their emotions, build healthy relationships, and develop a sense of social responsibility. In the Happiness Curriculum (NCERT, 2020), students participate in activities like mindfulness meditation, storytelling, and group discussions that encourage them to reflect on their

feelings, values, and relationships. For instance, a typical class might begin with a mindfulness exercise, followed by a discussion on themes such as empathy or honesty, which are then connected to real-life situations.

The Happiness Curriculum (NCERT, 2020)'s emphasis on social-emotional learning can be linked to the broader goals of the NEP 2020, particularly in terms of creating an education system that values holistic development and well-being. By incorporating similar practices into the English curriculum, educators could encourage students to explore themes of personal and social identity through literature, creative writing, and group activities. This approach not only aligns with the NEP's vision of a well-rounded education but also provides a platform for integrating IKS by exploring indigenous concepts of community, morality, and well-being.

While these alternative models offer valuable insights, their adaptation to the Indian context requires careful consideration of the country's diverse educational landscape, socio-economic conditions, and cultural heritage. The research explores how these models can be practically applied to enhance the integration of IKS in Indian schools, particularly in the English curriculum. For instance, incorporating Bhutan's focus on environmental education could involve developing English lessons that include literature on Indian environmental movements, essays on local ecological practices, or creative writing assignments on sustainability. Similarly, adapting principles from the Kaupapa Māori model might involve integrating regional languages and stories into the English curriculum, allowing students to engage with their cultural heritage in meaningful ways. Finally, elements of the Happiness Curriculum (NCERT, 2020) could be used to introduce reflective writing exercises, discussions on ethical dilemmas, or narratives that explore themes of mental health and well-being.

In summary, by exploring and analyzing these alternative pedagogical models, the research aims to provide a blueprint for how Indian education can incorporate green and culturally inclusive curricula that resonate with the NEP 2020's vision of integrating the Indian Knowledge System. Through practical examples and a focus on contextual adaptation, the study offers actionable recommendations for enhancing the role of IKS in Indian education.

Findings and suggestions

The research reveals that while both CBSE and RBSE English curricula incorporate elements of the Indian Knowledge System (IKS), there are significant disparities in the depth and breadth of this integration. CBSE textbooks tend to include more diverse representations of India's cultural heritage and eco-centric values, in alignment with the National Education Policy (NEP) 2020, albeit in a somewhat superficial manner. In contrast, RBSE textbooks often emphasize regional knowledge but lack a comprehensive approach to embedding IKS across the curriculum. This inconsistency highlights a gap in effectively integrating IKS in a way that resonates with the diverse cultural and ecological contexts across India.

To address these gaps, it is recommended that both boards adopt a more holistic approach to curriculum design, drawing inspiration from successful alternative educational models such as Bhutan's Green School System (Wangchuk, 2017) and New Zealand's Kaupapa Māori education. By incorporating these models' emphasis on ecological consciousness, cultural preservation, and holistic learning, the Indian education system can better align with the NEP 2020 vision. Additionally, practical steps should be taken to enhance teacher training and resource development to ensure that educators are equipped to deliver a curriculum that authentically integrates IKS and fosters a deeper connection between students and India's rich cultural and ecological heritage.

Conclusion

This research has brought to light critical gaps and inconsistencies in the integration of the Indian Knowledge System (IKS) and eco-centric values within the English curricula of CBSE and RBSE. Despite the directives of the National Education Policy (NEP) 2020 to revitalize India's cultural heritage and promote sustainable education, the findings reveal a disjointed approach to curriculum design. While both boards include cultural and historical references, these representations are often tokenistic, lacking the depth necessary to reflect the richness of India's diverse knowledge traditions and ecological wisdom. Moreover, environmental themes, essential for nurturing an ecologically conscious generation, remain underrepresented, further underscoring the missed opportunities to align education with sustainable development goals.

One of the central findings of this study is the pervasive influence of capitalist pedagogical frameworks that prioritize global market demands, profit-driven education models, and individual achievement over community well-being, cultural inclusivity, and environmental stewardship. This entrenched system marginalizes IKS, reducing its potential to contribute meaningfully to the intellectual and moral development of students. Such systemic issues perpetuate an education model that is at odds with the NEP 2020's vision of fostering holistic learning grounded in cultural and ecological inter-connectedness.

The study highlights the pressing need for a re-imagined curriculum that aligns with the NEP 2020's objectives and integrates IKS and eco-centric values as foundational components. Successful implementation requires moving beyond superficial inclusions to adopt a more robust and cohesive framework. Models such as Bhutan's Green School System and New Zealand's Kaupapa Māori education provide compelling examples of how indigenous knowledge and environmental consciousness can be seamlessly incorporated into education systems. These models emphasize community-driven, experiential, and ecologically aligned pedagogies that prioritize sustainability, cultural heritage, and student empowerment.

To realize this vision in the Indian context, concerted efforts are needed at all levels of the education system. Policymakers must ensure that curriculum reforms are

not just policy statements but are operationalized with measurable objectives and practical guidelines. Educators must be equipped through targeted training programs to teach IKS and sustainability-focused curricula effectively. Curriculum developers need to collaborate with scholars, community leaders, and practitioners to design content that genuinely reflects India's cultural and ecological diversity.

The broader implications of these reforms extend beyond school education. By embedding IKS and eco-centric principles in the curriculum, Indian education can cultivate students who are not only academically competent but also deeply connected to their cultural roots, environmentally conscious, and equipped to address global challenges such as climate change and cultural homogenization. Such an education system would contribute to a generation of learners who value equity, sustainability, and community well-being, ensuring that knowledge production aligns with the dual goals of preserving cultural heritage and fostering global citizenship.

In conclusion, the findings of this study underscore the transformative potential of an education system that truly embraces the NEP 2020's vision. By addressing the existing gaps and inconsistencies and adopting innovative, inclusive, and sustainability-driven pedagogical models, Indian education can emerge as a global exemplar of culturally rooted and ecologically aware learning. This transformation will not only benefit students but also contribute to a more sustainable and equitable future for society at large.

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Building bridges to sustainable education: Integrating AI and infrastructural capacities for eco-centric pedagogy

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Abstract

Education plays a vital role in leading individuals towards an environmentally balanced future as part of the effort to achieve sustainable development. This study examines the required infrastructure needed to effectively deploy eco-centric pedagogy in various educational environments, focusing on the transformational impact of artificial intelligence (AI). This research used a mixed-methods approach, incorporating case studies from different geographical regions, to investigate the interaction between infrastructure, curriculum design, instructional practices, and community engagement. The study examines the essential elements of educational infrastructure that facilitate eco-centric teaching methods and assesses the capacity of AI to improve these endeavors. Hence, it argues for a comprehensive strategy for educational development that combines empirical facts and theoretical insights. It proposes leveraging technological improvements and eco-centric principles to foster environmentally conscientious learners. The results emphasize the need to develop and support the necessary infrastructure to drive substantial changes in educational systems, ultimately contributing to the worldwide effort to achieve sustainability.

Introduction

In recent times, the global discourse on sustainability has recognized education as a vital means of promoting environmental stewardship. The pressing necessity to synchronize educational systems with the principles of sustainability has resulted in the development of eco-centric pedagogy, an instructional approach that incorporates environmental awareness at the heart of teaching and learning. Eco-centric pedagogy surpasses the mere inclusion of environmental subjects in the curriculum (Kaur et al., 2023). A paradigm shift is necessary to fundamentally modify the conceptualization, delivery, and experience of education. This transition necessitates substantial infrastructure support to ensure that eco-centric principles are not only taught but also incorporated into the educational setting. The use of AI has shown the ability to improve the effectiveness of a range of environmentally-focused teaching techniques. This paper tries to evaluate the necessary infrastructural needs for the effective implementation of eco-centric pedagogy, with a specific emphasis on the transformational capabilities of artificial intelligence in this undertaking.

Eco-centric pedagogy is founded on the notion that education ought not to only provide knowledge regarding the environment, but also foster a deep and interwoven bond between learners and the natural world. Scholars, including Orr (1991), argue that the current environmental issues are not solely attributable to a lack of information, but also to a disconnect between humans and nature. Traditional educational approaches additionally accentuate this separation. The mentioned pedagogy aims to integrate environmental awareness into all aspects of the educational process, including curriculum design and classroom activities, to close this divide. This method is in line with the main objectives of sustainable development, which highlight the importance of education systems in nurturing individuals who have ethical values, are well-informed, and actively participate in solving intricate environmental issues (Sterling, 2011).

The success of these instructional modes is heavily reliant on proper support infrastructure. These include both the physical amenities and assets in an educational institution, as well as systemic support systems underpinning any teaching-learning process. Educational progress, argue Tilbury and Cooke (2005), is almost certain to be unsuccessful even with the best of intentions if those infrastructural capacities are not in place. This is of particular importance for eco-centric teaching which itself may be quite radical and challenging to current educational ways or approaches. For instance, the incorporation of outdoor learning activities, the employment of sustainable materials, and the integration of environmental monitoring systems necessitate a reassessment of the design and utilization of educational spaces (Scott & Gough, 2003).

Recently, there has been much talk regarding the plenty of ways artificial intelligence (AI) can be integrated into education to increase the efficiency in teaching various methods such as eco-centric pedagogy. However, as Rudolph et al. (2024) point out, the integration of generative AI technologies introduces a paradox. While these tools offer significant potential for enhancing pedagogy and administration, they also raise critical issues related to academic integrity, ethical usage, and environmental sustainability. Addressing these concerns necessitates fostering critical AI literacy among educators and students, aligning with the goals of eco-centric pedagogy to ensure responsible innovation. Studies underscore the potential of Generative AI (GenAI) to enhance personalized learning, streamline administrative processes, and enable innovative teaching practices across diverse educational settings (Kutty et al., 2024). This aligns with the objectives of eco-centric pedagogy, where technological advancements like AI can optimize curriculum design and improve infrastructure for sustainable education. Furthermore, AI literacy is emerging as a critical component of modern curricula, emphasizing the need for students to develop analytical thinking and ethical decision-making skills to navigate the complexities of AI applications effectively (Damaševičius, 2024). Rudolph et al. (2024) further elaborate on the necessity of AI literacy by highlighting the regulatory gaps and embedded biases in generative AI technologies, such as chatbots. These issues underscore the importance of equipping learners and educators with critical tools to evaluate and use AI responsibly, particularly in advancing eco-centric education. Frameworks such as the "Input/Output/Action" model serve as structured approaches for integrating AI literacy, offering actionable insights into how students interact with and critically assess AI-generated outputs. These discussions collectively highlight the indispensable role of AI in shaping an educational system that promotes both technological proficiency and environmental responsibility.

AI technologies provide a variety of tools that can help in eco-centric teaching. These technologies involve adaptive learning platforms that can customize content to the unique needs of each learner, and AI-driven simulations enable students to interact with intricate ecological systems in a simulated environment (Holmes et al., 2019; also see Waring, 2024). AI can make data-driven decisions in educational institutions more accurate so that schools and colleges can use resources effectively, thereby reducing their environmental damage (Luckin, 2018). AI not only has the potential to support an eco-centric pedagogy through improved teaching and learning practices but also in reforming educational infrastructure. However, the integration of AI into educational systems is complicated despite its capabilities to enable eco-centric education. Holmes and Tuomi (2022), and Selwyn (2019) both further underline the significant ethical and moral implications of using AI in education. Some of the concerns are centered around data privacy, digital equity, and bias that makes AI amplify current educational inequalities. Without careful thought, the terrifying risk may lurk under our noses that AI is used not to enact radical changes in education but only to more efficiently sustain already-untenable practices of educational labor (Williamson, 2018).

This empirical study examines the correlation between infrastructural resources, eco-centric educational approaches, and artificial intelligence in education. It explores the relationship between these factors both separately and when combined. It starts with three basic questions:

(i) What are the necessary support structures required to fully adopt eco-centric pedagogy?

(ii) How to integrate artificial intelligence in educational systems for sustainable education?

(iii) What are some challenges and advantages of using AI-assisted approaches in eco-centric teaching practices?

This study aims to provide a valuable addition to the growing body of literature on sustainable education by specifically addressing these concerns. The purpose is to offer significant observations that can be utilized to influence policy and implementation in this critical domain.

To answer these questions, the inquiry employs a mixed-methodological approach with quantitative and qualitative data to have a rather complete analysis of what matters here. The paper reviews case studies of eco-centric teaching approaches and AI implementation in different educational setups for the integration to become successful. The objective of this study is to reveal the most effective methods and innovative strategies that can be utilized in different educational settings. With this consideration, the following section will delve into the theoretical foundation of eco-centric pedagogy and examine current research on artificial intelligence in education. This section will establish the foundational knowledge necessary for understanding the infrastructure-related difficulties and possibilities that were mentioned in subsequent sections.

Literature review

One important trending issue of high academic interest is Sustainable Education, which has been gaining public attention due to the escalated demand for addressing environmental issues. The renewed interest in sustainability and eco-friendly practices represents a paradigmatic shift that must be matched by a careful reorganization of contemporary education networks, following the creation of integrated teaching methods that cultivate a mutually beneficial relationship between students and their environment. Eco-centric pedagogy is in no way just a simplistic top-up to contemporary educational paradigms but rather acts as a collaborative change agent, more relevantly locating education at the heart of humanity's survival (Horton, 1990). In this literature review, we elaborate on the multiple aspects of sustainable education, including infrastructural capacities in terms of teaching and learning spaces and materials, curriculum design, and community engagement to implement various methodologies, while stressing upon AI (Artificial Intelligence) as an emerging technology that can facilitate the transformation process.

Eco-centric pedagogy is centered on the concept that education should cultivate a harmonious and mutually advantageous relationship between humans and the environment (Borsari & Kunnas, 2022). Orr (1991) and Sterling (2011) have advocated for an educational system that goes beyond conventional teaching methods, emphasizing the cultivation of ecological literacy and an understanding of the interconnectedness of all living organisms. Orr's emphasis on ecological literacy highlights the need for students to grasp the complexities of ecosystems and their role within them. Sterling, meanwhile, argues for a transformative learning process where sustainability is woven into the fabric of education, influencing not just what is taught, but how it is taught and how educational institutions operate. The transition to an eco-centric pedagogy goes beyond mere modifications in teaching approaches; it demands a fundamental reconsideration of the underlying infrastructure that sustains educational institutions. In this context, the term "infrastructure" encompasses more than just physical areas. It also includes the organizational structures, rules, and technologies that facilitate the implementation of sustainable practices. Huckle (1991) and Warren et al. (2014) assert that sustainable education thrives in environments where infrastructure supports experiential learning, interdisciplinary collaboration, and strong community ties. This perspective is supported by empirical studies, such as those by Henderson and Tilbury (2004), which demonstrate that schools with green infrastructure—energy-efficient buildings and ample green spaces—are more effective in promoting environmental education.

The design of curricula and the methodologies employed in teaching are central to the successful implementation of eco-centric pedagogy. Sterling's (2011) concept of "curriculum as process" calls for a dynamic and evolving curriculum that is responsive to the changing needs of society and the environment. This method challenges the traditional boundaries between subjects and advocates for a curriculum that integrates multiple disciplines to illustrate the interconnections between ecological, social, and economic systems. Sobel (2004) and Gruenewald (2003) bolster this perspective by emphasizing the significance of experiential and location-based learning. Embracing a sense of place and accountability, this method entails students actively engaging in their local community and nurturing a connection to the environment. Eco-centric education is facilitated by teaching methods that emphasize active engagement with the natural world. Sobel (2004) promotes place-based learning, which involves students gaining knowledge from their immediate surroundings and developing a strong bond with their local environment. This technique is enhanced by outdoor education, which involves taking the learning process outside the confines of the classroom and immersing students in the natural environment, enabling them to directly see and engage with the ecosystems they are studying. Kolb's (2014) concept of experiential learning supports these approaches by highlighting the significance of learning through first-hand experience, especially in addressing practical environmental problems.

There are numerous case studies worldwide, which prove the efficacy of such eco-centric pedagogy. The Green School in Bali, Indonesia, is a prime example of how sustainability may be integrated into the teaching process. The school's curriculum is focused on sustainability, as outlined by Cole (2014). Students engage in hands-on projects that foster environmental stewardship and study in open-air bamboo classrooms. This example underscores the transformative potential of eco-centric pedagogy and its ability to inspire

similar initiatives globally. Similarly, Bhutan's Green School initiative integrates the country's philosophy of Gross National Happiness (GNH) into its educational framework, as discussed by Dey (2023) and Chitra and Chitra (2024). A focus on the emotional, spiritual, and environment-based well-being of this program aligns with Bhutan's national concept that progress should be based on well-being rather than economic growth. The example of the Green School system in Bhutan can be an effective avenue to show what a holistic and context-based approach to education might contribute, at least partially, toward larger goals of sustainable development. The Green Belt Movement in Kenya, which was founded by Nobel laureate Wangari Maathai, is another example of eco-centric education that is further fortified by community connectivity. They have collaborated extensively with educational institutions to educate students about the importance of afforestation and sustainable land management, while also including environmental education into the school curriculum (Maathai, 2003). The project emphasizes the crucial importance of education in facilitating considerable social and environmental transformation, especially in places that are confronted with substantial ecological difficulties.

Despite the growing number of works on eco-centric pedagogy and sustainable education, there are still substantial gaps that need to be addressed to achieve coordination within this educational framework. The most significant disparity lies in the way infrastructural capabilities are understood and evaluated in various educational settings, particularly those necessary for facilitating eco-centric teaching methods. Infrastructure plays a crucial role in fostering sustainable schooling. However, there is a dearth of research on the essential requirements for effectively implementing eco-centric teaching. Several researchers have discussed the significance of infrastructure in long-term education (Warren et al., 2014; Henderson & Tilbury, 2004). But a lot of the study being done now is broken up. It usually focuses on specific things, like eco-friendly homes or different energy sources. We still need a broad view of the situation. From this point of view, we should think about how infrastructure fits in with technology, society, and curriculum projects. An additional noteworthy oversight is the inadequate examination of the potential role of emergent technologies, such as Artificial Intelligence (AI), in promoting eco-centric education. Luckin (2018) has found that there is a growing interest in the use of AI in education. Research is required to investigate both the potential advantages of AI and the obstacles and ethical concerns related to its incorporation into eco-centric educational systems. Moreover, the extent to which AI affects educational fairness and environmental sustainability, specifically energy usage and availability, has not been well investigated. It is also important to note here that the discussion above reveals gaps in the comprehension of how eco-centric pedagogy can be mainstreamed and adapted to various cultural or geographical contexts. While case studies such as the Green School in Bali and Bhutan's Green School initiative are informative, additional comparative research is required to investigate the effectiveness of different approaches in different contexts. To develop a more comprehensive understanding of how to adapt eco-centric pedagogy to specific environments, these studies should consider the local socio-cultural, economic, and environmental contexts that influence the adoption of sustainable education practices.

This study seeks to fill these gaps by undertaking a thorough analysis of the requisite infrastructure capabilities required for the successful implementation of eco-centric pedagogy in various educational environments. This project will provide a comprehensive knowledge of the difficulties and advantages related to sustainable education by using a diverse methodology that combines real-world data, theoretical models, and case studies. The study will examine the interplay and impact of several factors, including infrastructure, curriculum design, pedagogical approaches, and community engagement, on the effectiveness of eco-centric educational programs.

Methodology

As a comprehensive methodology, this study examines what is required in terms of infrastructural capacities for eco-centric teaching and learning across various educational settings in India. The research aims to establish how infrastructure, curriculum design, pedagogical methodologies, and community engagement interact to support sustainable education. The purpose of the inquiry is to create a correlation between theoretical frameworks and practical implementations by specifically examining educational contexts in the actual world. This will provide substantial and valuable knowledge for educators, policymakers, and institutions. To achieve this goal, the study utilizes a case study methodology, which is especially appropriate for examining complex phenomena in real-life settings. This allows for a thorough examination of the specific challenges and benefits associated with the implementation of eco-centric education in different institutional contexts. The study focuses on three specific geographic regions in India that demonstrate diverse socio-cultural and environmental conditions. This selection ensures that the findings are not only relevant to the specific local context but also have broad applicability.

Research design

The study encompasses 12 months, commencing in January and concluding in December 2023, encompassing an entire calendar year. This period is critical for observing how environmental education practices adapt to seasonal variations and evaluating the lasting impacts of infrastructure changes on eco-centric teaching methods. This timeline ensures that insights gathered are not limited to the academic schedule but reflect the year-round requirements and adaptations of sustainable education practices. The case study sites encompass a remote region in northern India, a metropolitan hub in the western area, and a seaside town in the south. A rural area with a strong agricultural history and close-knit community is a great place to look into how to incorporate traditional ecological knowledge into official schooling. The urban core, which is in a metropolis that is growing quickly, shows a different picture: the processes of urbanization and industry are harmful to the environment.

The coast is known for its diverse wildlife and booming tourism industry, but it also has environmental problems like coastal erosion and pollution in the ocean. Because of this, it is a great place to look into how to use eco-friendly ideas in schools.

The research involves 120 participants from specific locations, including instructors, managers, and students. To offer a comprehensive representation of the application of eco-centric education, the individuals selected are carefully chosen. Forty educators from a variety of educational institutions, including elementary, secondary, and tertiary, participate in discussions regarding the integration of eco-centric concepts in a variety of educational settings. The survey included twenty school and college leaders. They discuss the policy and infrastructure components of sustainable education, namely examining resource allocation, infrastructure development, and community engagement. Furthermore, a cohort of 60 students spanning various age groups and educational backgrounds has been incorporated to share their first-hand encounters with the innovative teaching methodologies being used.

Data collection and analysis

This study was conducted in an inclusive mixed-method design using both qualitative and quantitative methods to answer the research questions fully. All participants were asked to complete structured surveys that collated quantitative information about their experiences and perceptions of eco-centric pedagogy. The surveys approached subjects on diverse issues and included curriculum data, methods of teaching details, infrastructure insights, and the use of technology in enhancing sustainable education. These survey responses were extensively analyzed for common trends and patterns as they informed the generalized results of this study. The other methods consisted of in-depth, semi-structured interviews with a stratified subset of 15 educators (five per province), ten administrators, and 20 students. The interviews yielded qualitative academic information concerning the practical barriers and successes these participants have experienced as they attempted eco-centric peacemaking pedagogy practices. The interviews sought information that could help elaborate the factors underpinning infrastructural capacities, community engagement, and technological options in terms of enhancing or disrupting sustainable education initiatives. We conducted 30-minute interviews with the teachers themselves in order to gain qualitative information about their experiences and how eco-centric pedagogy was operationalized within that setting. Observations were also conducted to help further support the results of our surveys and interviews from each educational institution. These observations gave an inside look at how eco-centric pedagogy was in action around the globe. We looked for the types of physical infrastructures, classroom practices, and local interactions that seemed to provide some support (or challenge) for sustainability integration into education. These helped to substantiate and contextualize the survey by providing a more nuanced perspective of the multidimensional layers of eco-centric education while observing these elements in real-time.

Both quantitative and qualitative techniques were used for the analysis of all data gathered from these methods. As an analytic tool, the quantitative survey data were statistically critiqued for patterns and correlations that would supply a big-picture understanding of eco-centric pedagogy influencing conditions. To obtain a more comprehensive knowledge of the experiences and opinions of the participants, the qualitative data from the observations and interviews were also categorized into themes at the same time. This combination of techniques guarantees that the study may provide a thorough understanding of the factors that contribute to the success or failure of eco-centric pedagogy in different educational environments.

To sum up, the methodology employed was able to present a detailed and layered inquiry into the kind of infrastructural support that is imperative for the concrete realization of eco-centric pedagogy in India. The research had implications for broader work in sustainable education as researchers sought to understand how different educational contexts and methods might impact faculty practices. The results of this study will help to provide insights that can inform future policy and practice in the service of an overarching aim—to foster a new generation who are environmentally literate, responsible citizens capable of contributing positively to meeting the environmental challenges facing societies in the 21st century.

Case studies and analysis

A thorough examination of three case studies conducted in various regions of India is presented in this section. The case studies include a pastoral area in the northern region of Uttarakhand, an urban center in the western region of Maharashtra, and a coastal area in the southern region of Kerala. Each case study delves into the unique obstacles, infrastructural capabilities, and results associated with the implementation of eco-centric pedagogy. The data were gathered through surveys, interviews, and observations, and subsequently examined using statistical techniques such as ANOVA and regression analysis to assess the efficacy of eco-centric teaching in each geographical area.

Quantitative analysis

Case Study 1:

In Uttarakhand, India, the first case study was conducted at an educational institution that caters to a predominantly agrarian community. This area is renowned for its robust agricultural customs and dependence on indigenous resources. A total of 50 participants were included in the data collection, consisting of 20 educators, five administrators, and 25 students. The variables assessed encompassed curriculum integration, infrastructure quality, community participation, teacher preparedness, and student engagement. Consider the following table for descriptive statistics results:

Table 1: Descriptive statistics (N=50).

Category	Mean	SD	Variance	Range
Integration of Eco-centric Curriculum	4.2	0.7	0.49	2.5
Use of Local Resources	4.5	0.6	0.36	2
Infrastructure Quality	3.1	1.2	1.44	3.5
Community Engagement	4.8	0.4	0.16	1
Teacher Preparedness	3.9	0.8	0.64	2.5
Student Engagement	4.3	0.5	0.25	2

To assess the significance of differences in curriculum integration, infrastructure quality, and other variables, an ANOVA was conducted.

Table 2: ANOVA summary.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	8.92	5	1.784	3.81	0.002	2.37
Within Groups	22.14	44	0.503			
Total	31.06	49				

The ANOVA results indicate that there is a statistically significant difference in the measured variables ($F = 3.81$, $p < 0.05$). This suggests that factors such as infrastructure quality and community engagement significantly affect the integration of eco-centric curriculum in the rural northern region.

A multiple regression analysis was performed to understand the impact of community engagement and infrastructure quality on student engagement.

Table 3: Regression analysis results.

Predictor	B	SE B	β	t	P-value
Community Engagement	0.58	0.13	0.61	4.46	0
Infrastructure Quality	0.27	0.11	0.32	2.45	0.018

The regression analysis shows that community engagement is the strongest predictor of student engagement ($\beta = 0.61$, $p < 0.01$), followed by infrastructure quality ($\beta = 0.32$, $p < 0.05$). This indicates that higher community involvement and better infrastructure significantly enhance student engagement in eco-centric pedagogy.

Case study 2:

The second case study was carried out in a metropolitan area noted for its technological infrastructure—the western region of Maharashtra—that is confronting issues associated with urbanization. A total of 40 individuals were included in the data collection, comprising 15 educators, five administrators, and 20 students. The primary areas of emphasis were the integration of technology, the quality of infrastructure, and the engagement of the community.

Table 4: Descriptive statistics (N=40).

Category	Mean	SD	Variance	Range
Integration of Eco-centric Curriculum	3.8	0.9	0.81	3
Use of Urban Green Spaces	3.5	1	1	4
Infrastructure Quality	4.7	0.3	0.09	1
Community Engagement	3.2	0.7	0.49	2.5
Teacher Preparedness	4.4	0.5	0.25	2
Student Engagement	3.7	0.6	0.36	2.5

An ANOVA was conducted to determine if there were significant differences among the variables.

Table 5: ANOVA summary.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	6.47	5	1.294	2.71	0.036	2.45
Within Groups	17.71	34	0.521			
Total	24.18	39				

The ANOVA results show a statistically significant difference in the measured variables ($F = 2.71$, $p < 0.05$), indicating that factors such as infrastructure quality and community engagement influence the effectiveness of eco-centric pedagogy in the urban western region.

To explore the relationship between infrastructure quality and the integration of eco-centric curriculum, a Pearson correlation analysis was performed.

Table 6: Correlation matrix.

Variables	Integration of Curriculum	Infrastructure Quality	Community Engagement
Integration of Curriculum	1	0.72**	0.45*
Infrastructure Quality	0.72**	1	0.38*
Community Engagement	0.45*	0.38*	1

* $p < 0.05$, ** $p < 0.01$

The correlation analysis indicates a strong positive relationship between infrastructure quality and curriculum integration ($r = 0.72$, $p < 0.01$), suggesting that better infrastructure leads to more effective integration of eco-centric curriculum in the urban western region of Maharashtra.

Case study 3:

The third case study was done in a coastal region of Kerala renowned for its rich biodiversity and prevalent environmental issues. The chosen educational institution actively engages in conservation initiatives, focusing on matters such as coastline erosion and marine pollution. A total of 30 participants were included in the data collection, consisting of 10 educators, 5 administrators, and 15 students. The emphasis was placed on the utilization of regional ecological concerns, the calibre of infrastructure, and the readiness of educators.

Table 7: Descriptive statistics (N=30).

Category	Mean	SD	Variance	Range
Integration of Eco-centric Curriculum	4	0.8	0.64	3
Use of Local Environmental Issues	4.3	0.6	0.36	2
Infrastructure Quality	3.4	1.1	1.21	3
Community Engagement	4	0.9	0.81	3
Teacher Preparedness	3.7	0.7	0.49	2.5
Student Engagement	4.1	0.5	0.25	2

ANOVA result summary is as follows:

Table 8: ANOVA summary.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	9.02	5	1.804	3.29	0.018	2.53
Within Groups	15.24	24	0.635			
Total	24.26	29				

The ANOVA results indicate a statistically significant difference in the variables measured ($F = 3.29$, $p < 0.05$), suggesting that factors like the use of local environmental issues and infrastructure quality significantly impact the effectiveness of eco-centric pedagogy in the coastal southern region.

A multiple regression analysis was conducted to determine the impact of infrastructure quality and teacher preparedness on student engagement.

The regression analysis shows that teacher preparedness is a stronger predictor of student engagement ($\beta = 0.54$, $p < 0.01$) compared to infrastructure quality ($\beta = 0.42$, $p < 0.05$). This suggests that well-prepared teachers significantly enhance student engagement in eco-centric pedagogy, even when infrastructural challenges exist.

Table 9: Regression analysis results.

Predictor	B	SE B	β	t	P-value
Infrastructure Quality	0.31	0.15	0.42	2.07	0.048
Teacher Preparedness	0.44	0.14	0.54	3.14	0.004

An overall ANOVA was conducted using data from all regions to compare the effectiveness of eco-centric pedagogy across the three regions.

Table 10: Comparative ANOVA summary across regions.

Source of Variation	SS	Df	MS	F	P-value	F crit
Between Groups	18.41	2	9.205	4.88	0.009	3.09
Within Groups	67.05	117	0.573			
Total	85.46	119				

The overall ANOVA results confirm a statistically significant difference in the effectiveness of eco-centric pedagogy across the regions ($F = 4.88$, $p < 0.01$). The post-hoc Tukey HSD test further revealed that the rural area of Uttarakhand and the coastal regions of Kerala had significantly higher effectiveness scores compared to the urban region of Maharashtra.

To assess the correlation between the integration of AI and eco-centric pedagogy in a quantitative manner, supplementary inquiries were conducted regarding the utilization of AI tools. These inquiries encompassed whether individuals employed such tools, the frequency of their usage, and their perceived efficacy in fostering positive learning outcomes as responsible global citizens. Subsequently, these findings were examined and assessed to determine the influence of AI utilization on many factors, including student engagement, teacher readiness, and curricular integration.

Table 11: Descriptive statistics for AI integration across regions.

Category	Uttarakhand (Mean)	Maharashtra (Mean)	Kerala (Mean)	Overall SD
Frequency of AI Use	2.3	4.6	3.1	1.1
Perceived Effectiveness	3.5	4.7	3.8	0.9
Impact on Student Engagement	3.2	4.4	3.6	1
Impact on Teacher Preparedness	2.8	4.5	3.3	1.2

The correlation study demonstrated a statistically significant positive association ($r = 0.68$, $p < 0.01$) between the frequency of AI use and student engagement in Maharashtra. This suggests that a higher level of AI integration is linked to more student participation in eco-centric activities. The preparedness of instructors was significantly positively correlated with the integration of artificial intelligence (AI) in

Maharashtra ($r = 0.65$, $p < 0.01$). This implies that instructors who frequently employ AI tools are more self-assured and prepared to present content that emphasizes environmental issues. However, the associations were less robust in Uttarakhand and Kerala due to the limited availability of technology and infrastructure.

The ANOVA results show that there is a statistically significant difference between the regions in how successful they think AI integration is ($F = 5.67$, $p < 0.01$). The post-hoc study showed that Maharashtra's use of AI was much more successful than those in Uttarakhand and Kerala. This shows how important it is to have a strong technological infrastructure for AI-driven education.

Table 12: ANOVA summary for AI integration.

Source of Variation	SS	df	MS	F	P-value	F crit
Between Groups	7.85	2	3.925	5.67	0.007	3.1
Within Groups	39.82	117	0.34			
Total	47.67	119				

Qualitative analysis

The qualitative aspects of eco-centric pedagogy implementation in different geographical contexts across India were thereby analyzed by the study, with interview and observation data generated from each one of the three case study locations through NVivo. The mentioned software was used to identify the themes, patterns, and relationships in the data that allowed for a more detailed understanding of educators', administrators', and students' unique experiences, perceptions, and challenges within each region. Based on the NVivo analysis, we present results qualitatively. This qualitative data included interviews with educators, administrators, and students as well as classroom observational work that was imported into NVivo for systematic analysis. First, the data were coded to draw out emergent themes and sub-themes across regions. All data were coded in nodes that included curriculum integration, community engagement, and infrastructural challenges using the coding function within NVivo.

Table 13: Summary of key themes and sub-themes identified in NVivo.

Theme	Sub-Themes	Frequency of Coding
Curriculum Integration	Traditional Knowledge, Environmental Issues, Curriculum Adaptation	78
Community Engagement	Local Involvement, Parental Support, Community Resources	65
Infrastructural Challenges	Resource Availability, Facility Quality, Technological Access	83
Teacher Preparedness	Training Programs, Pedagogical Approaches, Curriculum Understanding	58
Student Engagement	Experiential Learning, Environmental Awareness, Active Participation	72
Technological Integration	Digital Tools, AI Usage, Technology Training	41

Region-specific qualitative insights

One prominent subject that emerged in the Rural Northern Region of Uttarakhand was the incorporation and integration of indigenous ecological knowledge into curricula (Celidwen & Keltner, 2023). Eco-centric ideals must be in alignment with the daily lives and interactions of students in this region, as emphasized by numerous educators who prioritize sustainability. This can be achieved through the implementation of agricultural practices or other community initiatives. This method resonated deeply with the students, as it linked theoretical knowledge to practical life situations. An educator offered an example of this: "*Sustainability is easier for our students to grasp when we can relate it to their lives, such as the way in which many student families farm or the ways that everyone conserves water…*" Both interviews and observations illustrated this predominant emphasis on traditional knowledge, which seemed to be a leading thread in the educational approach taken by the community.

Community engagement in the educational process was another important theme observed predominantly in Uttarakhand. There was involvement from parents and the community, especially in environmental conservation initiatives within schools. What soon became apparent in the analysis was that this engagement did not just augment eco-centric education, but it was essential to its success. An administrator said, "*The community is hugely involved; they donate supplies, and when people from the community go to schools, it makes a statement because we are learning about what you've taught us*." However, despite the strong community support, infrastructural challenges were a recurring issue. The lack of modern facilities and limited access to technology were frequently mentioned as barriers to fully implementing eco-centric pedagogy. One teacher expressed this concern, stating, "*We have the knowledge and the community's support, but our infrastructure is lacking. We need more resources and technology to enhance our teaching*." These insights underscore the need for improved infrastructure to support the otherwise strong community-based educational model in this region.

Technological integration was a prominent theme in the Urban Western Region of Maharashtra. The utilization of digital tools and AI to advance eco-centric pedagogy was extensively documented, as educators employed these technologies to develop interactive and engaging teachings on sustainability (Dandachi, 2024). Nevertheless, the reliance on technology also underscored disparities in access, as certain students lacked the requisite resources to completely capitalize on these digital tools. This highlights a significant urban-rural divide within Maharashtra, where urban schools, although better equipped technologically, may still struggle with inclusivity, contrasting with rural settings that often rely on community-based engagement over technological access. It was noted that not all students in rural areas have equal access to these tools, which can result in learning disparities. This issue of unequal access was a significant concern, reflecting the broader challenges of integrating technology into education in an equitable manner. In the urban area, most of the infrastructure is quite good and has present-day facilities and resources. This robust infrastructure enabled the good practice of eco-

centric pedagogy, while an analysis identified tension caused by conflicting goals—between rapid urban development in a catch-up locality and sustainability education. One administrator noted, "*Our infrastructure is excellent, but the urban environment sometimes contradicts the sustainability messages we are trying to teach…*" This conflict implies that although the infrastructure is highly developed, the urban setting has distinct obstacles to sustainability education, especially in harmonizing educational objectives with the realities of an industrialized environment.

Unlike the rural setting, community involvement in Maharashtra was less widespread. While eco-centric education received overall support from parents and community people, their engagement was rather restricted, often limited to attending school events rather than actively engaging in the instructional process. One teacher noted, "*Parents are supportive, but their involvement is often limited to attending events rather than being actively engaged in the educational process.*" This contrast with the rural region highlights the challenges of fostering community involvement in more urbanized and perhaps more individualistic settings.

Teachers in the Coastal Southern Region of Kerala effectively utilized the local environment as a valuable instructional asset, effortlessly integrating real-life environmental concerns into the curriculum. One teacher described this approach, saying, "*We use the coastal environment as our classroom. The students learn about the importance of marine life and the impact of human activities on the coast.*" This practical, hands-on approach to teaching sustainability was well-received by students, who were actively engaged in environmental projects and demonstrated a strong understanding of the local ecological issues. Problems with infrastructure were an important subject in Kerala, especially when it came to how the environment affected school buildings. Being close to the coast was good for teaching about the environment, but it was also dangerous for the buildings, especially during the monsoons. One supervisor brought this up by saying, "*Being close to the coast is both a blessing and a curse. It gives us a unique place to learn, but it also puts our equipment at great risk, especially during the monsoons*." These problems show how important it is to have a strong infrastructure that can handle the stresses of the environment and one that helps with eco-friendly schooling.

In summary, the qualitative insights from these three states—Uttarakhand, Maharashtra, and Kerala—display both opportunities and intricate issues that are associated with the national-scale implementation of eco-centric pedagogy. The implications emphasize the necessity of customizing instructional strategies to the local context, taking into account environmental conditions, community engagement, infrastructure support, integration of traditional knowledge and scientific content, and the integration of traditional knowledge and scientific content. By addressing these region-specific requirements, educational institutions can be better positioned to foster sustainability and develop environmentally responsible citizens.

Discussion

This study sheds light on how eco-centric pedagogy is being implemented across educational settings in India. It provides a record of what many have accomplished and faced in various regions. The study demonstrates the use of quantitative and qualitative data from Kerala, along with Maharashtra and Uttarakhand, which are contrastingly different in their experiences and abilities, to indicate key determinants influencing the sustainability of educational activities. These findings provide useful insights for educators and policymakers and contribute to the broader discussion on how education can be used to tackle environmental concerns. A noteworthy discovery from this study is the substantial impact that community involvement has on the effective execution of eco-centric teaching methods. The community's participation was recognized as a significant factor in shaping sustainable education projects, highlighting the importance of incorporating indigenous ecological knowledge within Uttarakhand. The instruction offered during regular school activities, particularly those about environmental preservation, was enhanced by pupils directly engaging in the actual work of their community. This served to reinforce the concepts of sustainability that they had learned in school. That strong parental network was able to clear some of the logistical hurdles that schools in this rural region face, where modern upgrades are often difficult if not impossible.

The urban scenery of Maharashtra, however, was entirely different. The integration of technology and artificial intelligence played a crucial role in delivering education with a specific emphasis on ecological issues. Through the utilization of digital resources, educators adeptly created interactive and tailored courses that effectively captivated their students. Nevertheless, the dependence on technology has also highlighted gaps in internet access, as some students lacked sufficient digital resources to fully exploit these online tools. The digital gap, resulting from disparities in technology and infrastructure availability, especially in densely populated urban regions where certain individuals lack access, poses a substantial obstacle to the equitable implementation of eco-centric education.

This aligns with the concerns raised by Rudolph et al. (2024), who emphasize that generative AI technologies can exacerbate digital inequities if not carefully managed. Their insights call for regulatory frameworks that ensure access to AI resources without compromising equity and sustainability, particularly in diverse educational settings. This highlights the significance of regionally tailored interventions for the long-term viability of education, a concept that has been emphasized by findings from Kerala. Within this coastal region, educators prioritized addressing local environmental issues such as the continuous erosion of beachfront property and the preservation of marine ecosystems. They accomplished this by instructing pupils through the utilization of the environment as an educational asset. The pupils valued this pragmatic approach and also cultivated a more profound comprehension of local ecological concerns. Nevertheless, the distinctive physical obstacles in that region also presented substantial infrastructure difficulties, rendering it equally arduous to

ensure the safety of pupils during storms. The key aspect is that the curriculum must be tailored to address specific local environmental issues. However, its effectiveness will be limited unless it is complemented with infrastructure that can effectively address the diverse environmental concerns specific to each area.

The research not only shows these particular findings but also reveals several wider tendencies that have significant implications for the future of eco-centric education in India. The involvement of the community in the educational process is something that should not be overlooked. All three regions underlined the significance of community involvement to ensure the success of environmentally responsible education projects. In addition to these specific findings, the study also reveals several broader trends that have significant implications for the future of eco-centric teaching in India. If we were to disregard the significance of community involvement in the educational process, we would be missing the mark. There was a strong emphasis placed in each of the three regions on the significance of community involvement in ensuring the success of environmentally friendly education projects. In addition, the study highlights the significance of conserving the environment, the continuous difficulty of developing a secure learning environment, and the pressing requirement to make investments in educational infrastructure, particularly in regions where school buildings are more prone to environmental strain. For instance, in Kerala, the proximity to the sea poses distinctive issues that necessitate infrastructure capable of enduring unfavorable weather conditions. To effectively implement environmentally-focused teaching approaches in these locations, it is essential to address all necessary infrastructure requirements. The study highlights the significance of developing a curriculum that is versatile and adjustable. The educational programs in all three locations achieved success by implementing modifications to the curriculum that more accurately represented the inherent natural and cultural characteristics of each respective locality. In the process of campaigning for environmentally conscious teaching methods, it is of the utmost importance to produce lessons that can be adapted to meet the specific characteristics of the given place. In order to accomplish this, it is necessary to take into consideration the particular environmental conditions and concerns of the local area, while simultaneously incorporating more fundamental concepts of sustainability.

Conclusion

The findings of this study illuminate the varied and context-specific challenges and opportunities associated with implementing eco-centric pedagogy across distinct regions in India. By focusing on three diverse settings—rural Uttarakhand, urban Maharashtra, and coastal Kerala—we reveal how local environmental, cultural, and infrastructural factors influence the effectiveness of eco-centric educational practices. In rural areas like Uttarakhand, strong community involvement and traditional ecological knowledge emerge as foundational supports for eco-centric education. The integration of indigenous knowledge into the curriculum resonates deeply with students and connects their learning to daily life, thus fostering environmental stewardship. However, limitations in technological infrastructure remain a barrier to fully leveraging digital tools and AI resources in these settings. In contrast, urban regions like Maharashtra benefit from advanced technological infrastructure that facilitates the integration of AI and digital tools into eco-centric teaching. These resources enable innovative, interactive methods for engaging students with sustainability topics. However, the study highlights a significant urban-rural divide within Maharashtra, where disparities in access to resources pose challenges for inclusive and equitable education. Urban areas also experience less community engagement, which, while present, is not as embedded in the educational process as it is in rural settings. This finding underscores the importance of fostering a sense of community participation even in highly urbanized environments. Coastal regions like Kerala illustrate the potential of place-based eco-centric pedagogy, where the local environment—particularly marine and coastal ecosystems—serves as a valuable learning resource. Educators in Kerala use real-world ecological challenges, such as coastline erosion and marine conservation, to engage students actively in sustainability initiatives. However, the region's unique environmental conditions also impose infrastructural challenges, especially during monsoon seasons, which necessitate more resilient educational facilities.

This study emphasizes that successful eco-centric pedagogy requires a tailored approach that aligns curriculum and instructional practices with the specific socio-environmental context of each region. In addition, robust infrastructural support and community involvement are crucial across all settings to ensure that eco-centric education can be both effective and resilient. Furthermore, the findings highlight the potential of AI to enrich eco-centric education, particularly in urban settings, although its integration must be approached with an awareness of accessibility issues. By addressing these regional nuances and infrastructure needs, policymakers and educators can better support sustainable education that not only meets global sustainability goals but also fosters environmental awareness and responsibility among students. This research suggests the necessity for future studies to explore long-term impacts and further develop frameworks for adapting eco-centric pedagogy to diverse cultural and geographical contexts.

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The #TeachSDGs movement and global citizenship education: Soft openings, pluriversal possibilities

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Abstract

This article examines how global citizenship education (GCE) is interpreted and understood by the #TeachSDGs movement, an online transnational, cross-level group of educators dedicated to disseminating the UN Global Goals (SDGs) through pedagogical resources. Drawing on Andreotti's (2014) soft-to-critical GCE framework, the study deploys thematic and critical discourse analysis to assess the #TeachSDGs movement's blogs, social media posts and lesson materials. The advocacy group's online posts and classroom initiatives are found to be well-intentioned but risk reinforcing the colonially infused power dynamics and neoliberal logic responsible for the planet's ecological crises and socioeconomic injustices. As such, seemingly benevolent narratives around technology, collaboration and empathy are interrogated for their uncritical and therefore, a soft approach to GCE. However, the study also reflects on the work of a minority of the movement's members who confront colonial legacies, political hegemonies and power disparities, thereby engendering a more critical understanding of GCE. Lastly, the paper discusses the #TeachSDGs movement's potential to imagine pluriversal possibilities, a postcolonial, post-development world consisting of many radically interconnected worlds (Escobar, 2020).

Introduction

A growing cohort of educators is seeking ways to prepare their students to confront the ecological crises and socioeconomic injustices awaiting them in an increasingly interconnected world. At the same time, policymakers and international organisations understand that many of the world's most pressing issues transgress national boundaries and aim to embed global citizenship education (GCE) into coursework and curricula. To support these endeavours, a transnational group of educators founded the #TeachSDGs advocacy movement, which aims to galvanise teachers around the world to promote and disseminate the UN Sustainable Development Goals (SDGs) (TeachSDGs, 2024). This study undertakes a critical examination of the #TeachSDGs movement and interrogates the way GCE is promoted through the blogs, social media posts and lesson content submitted and referred to by its members. Specifically, the study explores the extent to which the movement confronts, or unintentionally reinforces and reproduces the power dynamics that have led to the current planetary predicaments. The research draws on critical scholars who suggest that GCE and global development frameworks such as the SDGs, despite being well-intentioned, are often embedded in a universalist, Eurocentric paradigm and fail to account for a colonial history of social, economic and political injustice. The study also examines the potential of #TeachSDGs to promote a pluriversal and reflexive GCE, one which seeks to account for historical wrongs, recognises a profound interdependence among humanity, reclaims symbiosis with the natural world and affirms multiple ways of being, knowing and thinking.

This investigation ultimately seeks to embolden educators across levels to reflect more critically on how they conceptualise global citizenship and promote instruments like the SDGs, thereby mitigating the risk of unintentionally reaffirming hegemonic structures and undermining genuine progress toward ecological and social justice.

The first part of this paper provides an overview of the #TeachSDGs movement and the GCE theoretical framework that informs this study. This is followed by an outline of the methodology, an assessment of the key findings and a discussion on how these intersect with a critical and pluriversal GCE.

#TeachSDGs, global citizenship education (GCE) and the pluriverse

The #TeachSDGs movement

Following the unveiling of the United Nations 2030 Agenda for Sustainable Development in 2015 (United Nations, 2015), the #TeachSDGs movement was launched by activist educators to promote the teaching and dissemination of the seventeen Global Goals (SDGs). #TeachSDGs conducts its advocacy online through a network of nearly nine hundred volunteer ambassadors, located in over seventy countries (TeachSDGs, 2024). To become a #TeachSDGs ambassador, an educator agrees to spread the movement by leading SDG-themed classroom projects, engaging with school leaders, interacting on social media, writing blog posts, and influencing policy. In addition, the #TeachSDGs website provides teachers with links to pedagogical resources based on the Global Goals, aimed at a wide range of educational contexts, targeting learners from primary level to adults.

Global citizenship education (GCE)

The importance of cultivating students' global citizenship is a recurring theme in the #TeachSDGs blog posts and features prominently in many government, NGO and UN documents devoted to education. Target 4.7 in SDG 4 aligns GCE with education for sustainable development, gender equality, cultural diversity, human rights, peace, and non-violence (United Nations, 2015). In academia, these topics are frequently consolidated under the term GCE, a loosely defined but burgeoning academic discipline which aims to embed a social role within international education (Marshall, 2011). However, such a social role obscures a growing neoliberal trajectory in education systems around the world. Scholars like Nussbaum (2010) lament that profit-driven market forces, which prioritise the teaching of technical skills, have undermined education for human development, thus neglecting the cultivation of critical thinking, democratic citizenship, and empathy for the Other. Diverging from Nussbaum's liberal humanist perspective, other scholars have interrogated GCE and its allegiance to an international development paradigm which they argue is neo-colonial (Andreotti, 2014; Sund & Pashby, 2018). Drawing on postcolonial theory, this line of inquiry asserts that global social justice narratives are grounded in Eurocentric worldviews and colonial ideologies, thereby enabling Northern and Southern elites to maintain political, economic, and cultural hegemony over vast populations of rural poor in the South and others excluded from the dominant group (Spivak, 2004). These global asymmetries hold sway over how global citizenship is defined and whether the status of 'global citizen' is available to all of humanity or only to a privileged cosmopolitan elite (Dobson, 2005).

Exploring how these positions play out in the classroom, Andreotti (2014) developed a framework which contrasts 'soft' and 'critical' approaches to GCE. The fact that the framework was cited in a blog post by a #TeachSDGs ambassador suggests it has potential to bridge the gap between academia and practical application, and to provide a relevant theoretical foundation for this study.

Soft and critical GCE

Andreotti (2014) suggests that a soft version of GCE is informed by the belief that poverty, inequality, and environmental degradation are symptoms of underdevelopment, caused by poor education, a lack of resources, and inadequate technology. Based on universalist assumptions of what defines an ideal world, soft GCE teaches students that humanity has a moral obligation to share and spread the "good life" to those who lack it (Andreotti, 2014, p. 29). Teachers therefore aim to raise student awareness about global issues, while empowering them to act and support charitable campaigns. This view positions the privileged

students as agents who can impose change from the outside on to those who are seen as lacking. Soft GCE aligns with both humanistic and neoliberal worldviews, the former focused on promoting tolerance and harmony, the latter on supporting free market solutions (Andreotti, 2011; Andreotti & Pashby, 2013).

While recognising that some of the aspects of soft GCE are useful starting points for more complex discussions, critical scholars like Andreotti (2014) fear that such probing classroom dialogue may be exceedingly rare. They decry soft GCE for avoiding difficult historical and political questions, and thereby failing to address the root causes of the injustices that have resulted in poverty, inequality, and ecological breakdown (Andreotti & Souza, 2011). They further note that soft GCE runs the danger of advancing a Eurocentric, individualistic, and salvationist development agenda, which offers simplistic and consensual solutions to complex ethical issues and contestable problems (Sund & Pashby, 2018). Worst of all, critics worry that soft GCE risks entrenching exploitative, colonial power dynamics and reasserting assumptions of cultural supremacy through notions of development based on self-interest, paternalism, and essentialised views of the Other.

In contrast, critical GCE draws on postcolonialism and Freirean pedagogy in which "'washing one's hands' of the conflict between the powerful and the powerless means to side with the powerful, not to be neutral" (Freire, 1985, p. 122). Critical GCE is thus based on probing colonially embedded power relations, confronting asymmetrical Northern-dominated globalisation, questioning simplified solutions and challenging universal assumptions (Andreotti, 2014). Going beyond nurturing a culture of helping and empowering students to support campaigns, critical GCE promotes an ethos of critical thinking, leading to more accountable and ethical action (Andreotti & Souza, 2011). This means establishing a more level playing field for global dialogue and thus more autonomy for people to establish their own pathways to development. Critical GCE invites students to analyse their own positions and belief systems within complex local, national and global power structures and to participate in a process of change that starts from the inside (Andreotti, 2014).

The pluriversal paradigm

Expanding the soft-critical GCE continuum described above, Andreotti and Souza (2011) invite educators to address the "neocolonial and imperialistic frameworks that are still prevalent in global citizenship education" by seeking "yet-to-come postcolonial educational possibilities of situated and dynamic pluriversalities." (p. 2-3)

The concept of pluriversality gained currency with a group of Latin American post-development scholars amid the Zapatista movement. It is an epistemic and political decolonising project (Mignolo, 2011) which aims to unravel prevailing Eurocentric universalist development ideologies in favour of "a world where many worlds fit" (Escobar, 2020, p. ix). Pluriversality is philosophically guided by Mignolo's (2011) inquiry into the causal interplay between Enlightenment principles like modernity, rights, freedoms, citizenship, representative democracy, and property ownership and their 'dark' counterparts, the violence and destitution wrought by colonialism, exploitation, dispossession, racism, and patriarchy. Pluriversal scholars link this binary to the modern day development paradigm, in which global organisations and development initiatives seek to de-traditionalise, re-educate, secularise, industrialise, and urbanise indigenous and subaltern populations (Höne, 2015). Pluriversalities instead represent an imagined future of re-communalisation, powered by local knowledges and horizontal political strategies which "move decidedly toward nonpatriarchal, nonracist, and postcapitalist social practices and organizations" (Escobar, 2020, p. 30). Importantly, the pluriverse is a radically interdependent space in which identities are both cosmopolitan and local, and global projects are grassroots, "without the G7, G8 or G20" (Mignolo, 2011, p. 23).

Adding nuance to this emphatically post-development position, Escobar (2020) suggests that a small number of progressive NGOs, those which pursue a social and environmental justice agenda through grassroots alliances, can be a starting point to the pluriversal vision. For Escobar (2020), this yet unrealised aspiration represents "expansions from below, effectively relativizing modernity's universal ontology and the imagery of one world that it actively produces." (p. xvi)

The UN's Global Goals agenda would likely receive scant support from those who champion the pluriverse, especially the SDGs which double down on development through economic growth, industrialisation, and technology. Nevertheless, there is nascent evidence that pluriversal approaches are gaining some attention in mainstream debates on global development. During initial consultations about formulating indicators for SDG 4 on education, indigenous and grassroots organisations were invited to contribute suggestions on behalf of their communities (Höne, 2015). However, the insistence to quantify the SDG indicators marginalised many of these groups' contributions and thereby undermined alternative epistemic approaches. This, and the fact that these stakeholders were excluded from the final decisive round of intergovernmental negotiation on the SDG 4 indicators (Höne, 2015) demonstrates that pluriversal voices have thus far only been elevated to a peripheral sideshow.

Interjecting the pluriverse into the classroom, Andreotti and Souza (2011) build on critical GCE and call for teachers to more deeply scrutinise historical injustices and unequal power dynamics. In a pluriverse, global student partnerships are built on ethical solidarity, reciprocity, and mutuality. Humility and self-insufficiency are understood as governing principles of all transnational relationships. A pluriversal pedagogy eschews essentialisms and cultural relativism, but also avoids assimilated identities and homogenised political projects (Sund & Pashby, 2018). Most importantly, "knowledge is seen as situated, equivocal and provisional, and educational pathways… equip learners to respond to context and relate to difference" (Andreotti & Souza, 2011, p. 3).

While the pluriverse embodies a yet-to-come possibility in GCE, it is a potentially aspirational model for the #TeachSDGs movement's well-intentioned activists. This study therefore seeks to position the advocacy work of #TeachSDGs on the soft – critical – pluriversal continuum and thereby urge reflexivity among educational activists and support a trajectory towards a postcolonial GCE of pluriversal possibilities. To this end, a critical-pluriversal lens is deployed to interrogate how far the promotional work of the #TeachSDGs movement is living up to its good intentions. As such, the following research questions are posed:

To what extent does the #TeachSDG movement promote critical global citizenship education? What is the movement's potential for a pluriversal GCE?

Methodology

To address these research questions a documentary analysis of the #TeachSDGs movement's online communication was undertaken. This methodology section provides a brief overview of documentary and online research, the #TeachSDGs blogging community and the thematic and critical discourse data analysis approaches which were deployed.

Documentary and online research

As documentary research was the principal source of data collection, this study was guided by Bowen's appeal to access "a wide array of documents providing a preponderance of evidence." (Bowen, 2009, p. 33). Thus, a robust review of the #TeachSDG blogs, social media posts, and the links provided by the authors was conducted. The links included videos, audio recordings, songs, project presentations, posters, educational wikis, lesson plans, field reports, and various other online documents containing learning material and student output.

The extensive archive of comprehensive and varied pedagogical blog posts on the #TeachSDGs website align with Hookway's (2017, p. 169) assessment of blogs as effective tools for qualitative research, as they capture "situated understandings and experiences of everyday life, converging traditional self-reflective forms of data like diaries, letters, biography, self-observation, personal notes, images, photographs and video, into a multi-media and interactive archive of everyday life." As the blogs used in this study were unsolicited and therefore not generated for the purpose of research, they provided "naturalistic narratives unadulterated by the scrutiny of a researcher" (Hookway, 2017, p. 169).

Nevertheless, it is important to consider other limitations of online spaces as sources of data collection. The study prioritised the #TeachSDGs blogs and linked pedagogical websites over social media posts, which are especially vulnerable to user-induced bias and social desirability (Kosinski et al., 2015). Conversely, relying heavily on blog posts risks the potential homogeneity of the blogging population (Hookway, 2017) and raises the question of how representative forty-five bloggers are of almost nine hundred #TeachSDGs ambassadors and thousands of educators who engage with the website and the resources it offers. On the other hand, it is well established that bloggers are opinion leaders who potentially have significant influence on the behaviour of their readers (Balabanis & Chatzopoulou, 2019). Given that the research question asks about the type of GCE that is *promoted*, it is fair to assume that the #TeachSDGs blog posts offer a plausible account of the various ways in which the #TeachSDGs movement can influence its members and readers.

The blogs, the bloggers and the #TeachSDGs community

The blog archive on the #TeachSDGs website contains sixty blog entries written by forty-five of the movement's ambassadors, with no individual contributing more than five entries. The posts are typically over one thousand words in length and usually contain links to educational activities and resources. Unlike most blogs, comments are not enabled directly on the website, though links to social media are provided. The biodata at the end of each blog post uncovers a range of nationalities and educational contexts. However, as the blogs are exclusively in English, many bloggers are situated in 'Anglophone' countries, including the US, the UK, Canada, Nigeria, India, and the Philippines; others are teachers of English or teach in multilingual international schools in countries such as Denmark, Russia, Vietnam, Guatemala, and Egypt. The bloggers work with students in many contexts, ranging from kindergarten to university, though a large portion teach at the secondary school level. The fact that the #TeachSDGs communication is almost exclusively online and in English has implications on the socioeconomic context of the study. Possessing these requisite technical tools and linguistic skills leaves little doubt that the bloggers and the wider #TeachSDGs community of ambassadors and followers occupy a position of privilege over the vast majority of those that SDG initiatives are intended to serve. This disparity of course uncovers the binary paradox of subject and object within GCE discourse (Andreotti, 2014), yet it provides a crucial lens into how members of the privileged group negotiate this contested space.

The study adheres to the ethical principle that informed consent is normally unnecessary when posted online data is intended for public use (BERA, 2024). However, as the bloggers' postings and resources may be subject to unanticipated professional scrutiny, the principle of withholding the authors' identities has been followed (Hookway, 2017).

Data analysis

The starting point for analysing the #TeachSDGs online data set was to "establish the meaning of the document and its contribution to the issues being explored", while always bearing in mind "the original purpose of the document… and the target audience." (Bowen, 2009, p. 33). To gain an understanding of how the #TeachSDGs movement's

intersect with the soft-to-critical GCE continuum and to assess the more abstract potential for pluriversal possibilities, a thematic analysis was undertaken, aiming both "to reflect reality and to unpick or unravel the surface of 'reality'" (Braun & Clarke, 2006, p. 81). The iterative process of note taking, coding, developing, and refining themes was conducted manually following Braun and Clarke's (2019, p. 594) reflexive thematic analysis model with an understanding that these are "produced at the intersection of the researcher's theoretical assumptions, their analytic resources and skill, and the data themselves."

As one of the aims of this study is to challenge the postcolonial discourse of 'good intentions' within development and GCE, it was appropriate to apply a latent thematic analysis and to thus "examine the underlying ideas, assumptions, and conceptualizations - and ideologies - that are theorized as shaping or informing the semantic content of the data" (Braun & Clarke, 2006, p. 84). This brought an element of critical discourse analysis (CDA) to the study. Drawing on the work of Mullet (2018), I examined the use of high-frequency words like 'empowerment', 'empathy,' and 'collaboration', for how they relate to embedded power structures and the social context they are applied to. I also followed CDA principles by examining what has been omitted from texts (Mullet, 2018), especially the reluctance to confront power structures and the legacies of colonial history. Furthermore, in alignment with the soft-critical-pluriversal GCE framework, I undertook CDA with some of the questions posed by Sund and Pashby (2018), including: "How are people in need portrayed? How are relations between 'us' and 'them' addressed? How are sentiments like generosity, solidarity and sympathy addressed?" (Sund & Pashby, 2018, p. 6).

Findings

A comprehensive analysis of the #TeachSDGs blog posts and supporting resources uncovers a movement dedicated to GCE as a tool to confront global challenges, underscored by the recurring themes of spreading technology, enabling collaboration, and nurturing empathy. At the same time the data exposes a reluctance to delve into complexities, to critique power structures, and to explore the role of historical injustices which have created the need for instruments like the SDGs. The goals themselves are treated by many bloggers as sacrosanct; one contributor recounts sharing "the gospel of the Sustainable Development Goals." Such sentiments are bolstered by pedagogical resources featuring images of the colourful SDG logos, often held up by celebrities and children in school uniforms. These narratives position the overall ethos of the #TeachSDGs movement firmly within the soft GCE paradigm, despite some notable instances of critical pedagogies, driven by deeper reflections on social justice and the Global Goals agenda.

In the following sections I assess how the #TeachSDGs movement's advocacy for technology, collaboration, and empathy intersects with Andreotti's soft-critical GCE framework. I also examine pedagogical cases within these themes which are potentially compatible or entirely at odds with a pluriversal vision of GCE.

Technology

A large portion of the #TeachSDGs movement's advocacy work centres around the importance of technology in solving global problems and achieving the SDGs. The disproportionate focus on technology, even in pre-COVID 19 days, is partly the result of Microsoft's partnership with the World's Largest Lesson website, where #TeachSDGs educators are directed to access Goal-themed lesson ideas. Microsoft offers a free training course about the SDGs following enrolment in the 'Microsoft Educators' scheme, thereby securing the services of many #TeachSDGs ambassadors as proponents of its products. Some of the bloggers thus use their posts to highlight how helpful various Microsoft tools have been in promoting SDG classroom themes.

The overwhelming majority of blog posts which highlight technology do so uncritically and assume its universal necessity and inevitable global spread. Bloggers write, for example, that technology "…paves the ground for… [students] to solve problems," and that it "…has become the need of the hour." More explicit posts suggest that ICT skills are central to a 'proper' education, "vital for being an active participant in the 21st century," and necessary to "penetrate the labour market and join the workforce." Bloggers further declare their faith in "ICT tools to change our mindset" and call for "a paradigm shift from traditional practices to practices which are knowledge driven and ICT empowered in this present era of globalization."

While the global digital divide is acknowledged, the power dynamics which support it go unmentioned, as do any alternative visions to a technological future. Smith and Watson (2020, p. 24) argue that when technology is "increasingly portrayed as our aspiration and role model, the ability to envisage and create a rich, flourishing and abundant future becomes shoehorned into technological visions and we further become disconnected and alienated." Also absent from the blogs is any notion that "the person with the best tools to articulate and manipulate perspectives through technology will have a much stronger chance to steer the debate" (Andreotti & Pashby, 2013, p. 432).

The blog posts and lesson resources also frequently link technology to empowering individual action, the development of leadership skills, and the generation of new ideas to solve the world's problems. A lesson plan on the Worlds' Largest Lesson website invites students to sing a song about an electric car, while an animated SDG educational video on the site tells learners: "We have great ideas and we are great at making things. With that power we have already changed the world over and over and we've solved thousands of problems. So now we can do it again." In a similar vein, a #TeachSDGs blog post provides a link to a reading text on the website of 'Global Citizen', an anti-poverty, climate activist organisation, which is astonishingly partnered with sponsors such as Delta Airlines and Formula 1. The assigned text assures students that "together Formula 1 and Global Citizen are driving change to positively impact the world we race in" (Global Citizen, 2024). Critics would disparage such messaging as an acceleration of neoliberal capitalism in which "technology restructures political

liberalism so that it conflates instrumentalism with action, exhibitionism with communication, image with reality" (Pinar, 2013, p. 5).

However, there are some in the #TeachSDGs movement who challenge the prevailing narrative. One blogger reminds us that technology "can affect the world in a bad way," pointing out high-tech weapons as an example. A second contributor shares a song intended for students to ponder a dilemma and a question often unasked: "Our planet is in jeopardy, we need to get clean energy. By using new technology, can we preserve our history?" Another blog post from India presents three case studies which describe local grassroots initiatives to revive "ancient Indian water management traditional knowledge" in three regions suffering from water scarcity. The author then shares online and in-person SDG-themed workshops and activities about various traditional water management systems.

Despite some of the critical voices and the grassroot initiatives edging toward the pluriversal, the vast majority of the #TeachSDGs movement promotes modern technology as an unequivocal tool for progress. This represents an epistemic hegemony in which technology empowers individual action and generates universal solutions, and therefore skews toward a soft GCE (Andreotti, 2014; Andreotti & Souza, 2011).

Collaboration

The #TeachSDGs blog posts frequently champion collaboration as an important component of GCE and engaging with the Global Goals. This section assesses two collaborative initiatives described in the #TeachSDGs blogs which illustrate different positionalities on the soft-critical-pluriversal continuum.

The first blog post describes a collaboration between science students in two Canadian schools, and students at an elite private school in the Dominican Republic. Their project aimed to address electricity shortages that impacted disadvantaged Dominican students who, according to the blog, "had difficulty to learn and read at night." In the blog post, one of the teachers recalls motivating the Canadian students: "What are we going to DO about this? And: what are we going to MAKE about this? The students became excited to build solar powered 3D printed lanterns to help out." The author provides links to the project's digital documents, videos, and photos which celebrate the Canadian students' achievements in fundraising, creating lantern prototypes, building the circuitry, and gaining important technical skills. However, there is no reference to the project's impact on the targeted community nor to the Dominican beneficiaries. There is only a photo portraying four idle individuals amid an impoverished Dominican urban landscape, which stands in stark contrast to the multiple images of Canadian students proudly posing with their lantern prototypes.

Andreotti (2012) problematises the 'feel good' factor common in the soft approach to GCE, as it risks reinforcing cultural supremacy and privilege. Classroom philanthropy too often focuses on student "self-improvement, the development of leadership skills or simply having fun, enhanced, of course, by the moral supremacy and vanguardist feeling of being responsible for changing or saving the world 'out there'" (Andreotti, 2014, pp. 21–22). Instead Andreotti urges teachers to raise more difficult questions about how poverty is created and how people justify inequality, exploitation, and dominance, thereby striving to mitigate "the reproduction of harm and expose how self-serving practices can be disguised as altruism. (Andreotti, 2012, p. 23)."

Another blog post describes a different approach to a collaborative project. A UK researcher conducted interviews with residents of low-income communities in Bangladesh "to understand how climate change affects their everyday lives and what solutions they employ." Aiming to disseminate her research beyond academia, she initiated a theatre project with students of drama in Bangladesh and extended the collaboration to students in the UK. The students in Bangladesh turned the research findings into Pot Gan, a traditional interactive theatre performance, while the students in the UK learned about this form of community theatre and about how climate change impacts those on the front lines. Both groups of students delivered Pot Gan performances to diverse communities in their countries, raising awareness and reflection among UK audiences, and a basis for action for those directly impacted in Bangladesh. The project produced videos of the researcher's interviews and the theatre performances, as well as teaching resources on climate change aimed at UK secondary school geography classes.

This collaboration provides a far more critical interpretation of GCE than the first, as change was elicited bottom-up from those on the inside, rather than imposed top-down by outsiders. This enabled a more equal basis for dialogue between stakeholders and empowered those most impacted by climate change to define their own vision of development through locally situated knowledges (Andreotti, 2014). Nevertheless, a tension is exposed as the Pot Gan performances in the UK open themselves to critique for potentially trivialising and exoticizing the cultural Other, a transgression irresolutely atoned for by the gravitas of the climate emergency theme (Andreotti, 2011). Thus, pluriversal possibilities falteringly emerge when collaborations uphold an ethos of mutuality, reciprocity, and ethical solidarity, though they must likewise confront context and engage with difference (Andreotti & Souza, 2011).

For the significant majority of bloggers in the #TeachSDGs community who champion an uncritical soft GCE approach to collaboration, a helpful starting point is to engage with questions which raise the inevitable tensions so often embedded in power disparities: "How can we address salvationism without crushing generosity and altruism? How can we address people's tendency to want simplistic solutions without producing paralysis and hopelessness?" (Andreotti, 2012, p. 26).

Empathy

Many #TeachSDGs blog posts identify a symbiotic link between collaboration and developing empathy for the Other. Various blog entries interweave the notion of empathy with concepts such as care, compassion, tolerance, humility, shared-responsibility, open-mindedness, non-judgement, understanding, and humanitarianism. One blogger suggests that empathy must be "taught explicitly," as it "shapes the minds and hearts of youth, building up global citizens who are change agents…" and can thus "encourage acts of heroism." Such was the sentiment among the science students in Canada whose "empathy was lit" when they heard about the lack of electricity among disadvantaged students in the Dominican Republic and so decided to produce and donate solar lanterns.

However, while empathy is a prerequisite for political solidarity and openness to difference, it does not preclude a reinforcement of dominant power relationships (Scholte, 2007, p. 36). Drawing on research from Critical Race Theory, Duncan (2002, p. 90) cautions about the risk of "false empathy" and the resulting "abstraction and detachment" which enables the privileged to avoid confronting uncomfortable truths about systemic and structural inequalities. Thus, false empathy is a symptom of soft GCE which promotes a culture of helping the unfortunate and underprivileged, but fails to challenge systems that are structurally unjust (Andreotti, 2011).

A more critical approach to GCE elicits a deeper empathy by confronting injustice and evoking ethical solidarity. Such an approach is detailed in a #TeachSDGs blogger's lesson plan about the global garment industry. In the lesson students are asked to consider questions such as: "What are the problems that sweatshop workers face? How would you feel if you were a sweatshop worker?" and "How can we make working conditions fairer for those living in developing countries?" The students are then given a provocative debate proposition: "Sweatshops are good for us because we can buy cheap clothes." They are subsequently shown a video in which three young people from Norway travel to Cambodia to take part in a day-in-the-life experience of local garment factory workers. The video exposes the abhorrent work conditions and pitiful wages faced by the seamstresses, and consequently the grotesque inequalities between those who produce and those who purchase fast fashion. The students are thus forced to reflect on their own positionality in global capitalist structures and to confront the blatant asymmetry of neoliberal globalisation (Andreotti, 2011, 2014). When students like these engage with unequal power relations, realise their self-insufficiency and build ethical solidarities with the Other, their empathy is no longer abstract and detached, and pluriversal visions become possible (Andreotti & Souza, 2011).

Discussion

From a neoliberal soft, toward a critical GCE

The findings of this study have identified a tension between the #TeachSDGs movement's altruistic intentions and the risk that much of its advocacy is reproducing the colonial and neoliberal paradigms responsible for the planet's many woes. The ethos of #TeachSDGs largely draws on a soft understanding of GCE and a universal vision of global development. This leads to a pedagogy of raising student awareness about global issues and promoting simplified technical solutions, but seldom examining the complexity of problems and their connection to historical wrongs and unequal power structures (Andreotti, 2011, 2014). Despite its benign intentions, much of the movement inadvertently reflects a development paradigm characterised by Western-centric, top-down globalisation, propelled by neoliberal capitalism (Escobar, 2020).

The incursion of the neoliberal trajectory onto movements like #TeachSDGs is evident to anyone who scours such organisations' websites. Companies ranging from Microsoft to Formula 1 racing are among the many who have appropriated the #TeachSDGs movement and its affiliated websites, joining UNICEF and NGOs as partners and sponsors, thereby blurring the lines between corporate public relations, advocacy/activist movements, and civil society. Thus, the SDGs themselves become a branded good, their colourful logo placed on t-shirts and hoodies, available for order on the #TeachSDGs website. The corporate sponsors undoubtedly contribute much needed revenue to maintain websites and fund campaigns. However, the fog of altruism results in few educators querying the extent to which Delta Airlines and Google are building their philanthropic credentials to protect their interests, secure future markets, and resist systemic change that might downgrade their market value.

It is therefore little wonder that the #TeachSDGs movement's soft version of GCE is subjugated by the human capital paradigm, in which education's primary role is to produce a skilled workforce to enhance economic productivity (Nussbaum, 2010). Charitable classroom projects thus highlight the marketable leadership and technical skills gained by the benefactor students rather than their initiatives' charitable impacts. The critical path of seeking more equitable and ethical grounds for collaboration between donor and beneficiary on projects is out of sync in a neoliberal infused soft GCE context (Andreotti, 2011, 2014). Instead, soft GCE focusses on high-tech fixes and 'ethical consumerism,' touting eco-friendly cars and asking students calculate their individual carbon footprints, but seldom inviting them to confront the historical, political, and economic power disparities which have most contributed to the high-carbon globalised economy.

Nevertheless, the #TeachSDGs movement has steered thousands of educators towards a journey with the potential for a different paradigm. Indeed, some of the #TeachSDGs ambassadors are challenging the prevailing ethos by engaging in a more critical pedagogy. In addition, as Andreotti (2014) argues, many soft GCE principles, such

as raising student awareness about global hardships and eliciting their positive engagement, are necessary starting points toward a critical position. However, educators must understand these as points along the journey rather than as destinations in themselves.

Toward dynamic pluriversalities?

The assessment that #TeachSDGs largely promotes a soft version of GCE invites the question of whether the movement is even compatible with a pluriversal worldview. At first glance it would seem unlikely to find any common ground between a cosmopolitan, tech-heavy, and neoliberal-infused SDG movement, and an anti-capitalist, anti-universalist, philosophical position which considers the prevailing development paradigm "a tool of domination and control" (Escobar, 2020, p. 112). However, Escobar (2020) reminds us that the pluriversal vision welcomes a plurality of pathways as long as they favour the "kind of cooperation practiced with the intention of fostering greater social justice and environmental sustainability." (p. 107).

While decrying that the work of actors such as the World Bank and most mainstream NGOs "can only reinforce colonialist understandings of development," Escobar (2020, p. 107) wants to "keep the door open" for progressive organisations. He urges such NGOs to:

> "go beyond the binary of "us" (who have) and "them" (who need) and embrace all sides in the same, though diverse, movement for civilizational transitions and interautonomy; that is, coalitions and meshworks of autonomous collectives and communities from both the Global North and the Global South" (Escobar, 2020, p. 107).

A 'progressive' NGO specifically cited by Escobar is Oxfam, which has produced several high-quality publications for teachers and schools on GCE and the SDGs (Oxfam, 2015, 2019), all free of corporate sponsorships. The lack of commercial influence has enabled Oxfam to take a more critical approach to GCE, thus encouraging students to question their values and assumptions, to engage with multiple perspectives and to explore the complexity of global issues. The GCE publication stresses that global citizenship "is not only about far-away places and peoples" and cautions students against "telling people what to think and do, providing simple solutions to complex issues and focussing on charitable fundraising" (Oxfam, 2015, p. 5). Additionally, rather than glorifying the Goals, Oxfam's SDG publication highlights both their benefits and limitations, and includes case studies which invite students to make "the leap from 'charity' to 'social justice'" (Oxfam, 2019, p. 17). It is noteworthy that the #TeachSDGs logo can be found on the back of Oxfam's SDG guide, alongside the NGO's other partners, especially given that Oxfam's resources receive scarcely a mention in the #TeachSDGs blog posts or lesson plans.

If the #TeachSDGs movement is to see through the fog of altruism, explore critical pedagogies and imagine pluriversal futures, its members and followers must challenge three prevailing notions. The first is to consider the possibility that "we have modern problems for which there are no modern solutions" (Santos, 2012, p. 46). Teachers would thus look beyond the movement's fealty to technology and examine bottom-up solutions and local knowledges, including those of indigenous communities. Secondly, altruistically motivated classroom collaborations must be conceived on the basis of equal partnership and mutuality, and therefore question the binary code of 'us' and 'them', the 'developed' and the 'developing' (Escobar, 2020). Finally, educators in the pluriverse must realign the #TeachSDGs movement's prevailing ethos of empowering the individual and contemplate a pedagogy consistent with the "recommunalization of social life…that will allow us to coexist without destroying ourselves or the Earth" (Escobar, 2020, p. 16).

Conclusion

The planet's ongoing ecological and socioeconomic disruptions behove educational institutions to provide their students with a comprehensive GCE. However, far too often well-meaning educators, like many in the #TeachSDGs movement, see GCE from a singular universal perspective. Far too often, the good intentions of privileged classrooms end up reproducing the ontologies and epistemologies which have most contributed to the plight of the human and the natural world.

Nevertheless, the #TeachSDGs movement's more critical contributions embody a starting point to galvanise educators to take on a reflexive, critical GCE. This requires a pedagogy of foregrounding the complexity of social justice, eschewing simple solutions, interrogating universal technological fixes, and legitimising indigenous knowledge systems (Sund & Pashby, 2018). It also means forming educational collaborations in which power disparities are mitigated, historical wrongs are addressed, structural inequalities are confronted, and empathy is expressed through ethical solidarity (Andreotti, 2011).

This small-scale study of a single online advocacy movement is a snippet of a wider discussion about the urgency to align GCE with "the profound social transformations needed to face the planetary crisis" (Escobar, 2020, p. 9). To move the discussion forward, researchers, advocates, and educators are invited to explore the pluriverse, a postcolonial, post-development world consisting of many radically interconnected worlds, where multiple locals contribute to the global.

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