



Vol.8 Special Issue No.1 (2025)

Journal of Applied Learning & Teaching

ISSN : 2591-801X

Content Available at : <http://journals.sfu.ca/jalt/index.php/jalt/index>

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

Anandita Saraswat^A

A

PhD Candidate, School of Humanities and Social Science, Indian Institute of Technology, Indore, India

Aratrika Das^B

B

Assistant Professor, School of Humanities and Social Science, Indian Institute of Technology, Indore, India

Keywords

Anthropocene;
decolonization;
Gond Art;
graphic narrative;
Indigenous;
stories;
science.

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 epistemologies 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.

Correspondence

ananditasaraswat@gmail.com^A

Article Info

Received 31 August 2024

Received in revised form 6 January 2025

Accepted 7 December 2024

Available online 14 January 2025

DOI: <https://doi.org/10.37074/jalt.2025.8.S1.3>

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 petroculturalism 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 subset 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.

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.



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.

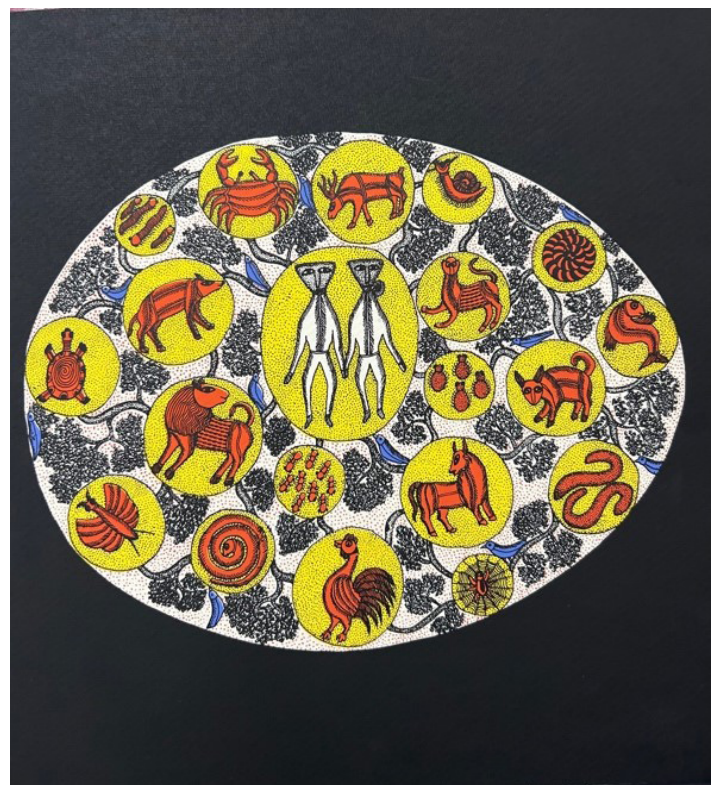


Figure 2. Painting of “Egg of Origin”. Art by Bhajju Shyam, for *Creation*, original Edition ©Tara Books Pvt. Ltd, Chennai, India. 2014, image reproduced with due permission.

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 "covenant" 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 sacred, a premise emphasized in the creation story of "The Sacred 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 Barendra 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.

Acknowledgments

Research for this article was supported by the School of Humanities and Social Sciences, Indian Institute of Technology, Indore. We extend our heartfelt gratitude to the editors and anonymous peer reviewers for their comprehensive feedback and insightful suggestions that significantly enhanced the analysis of this article

References

- Aaltonen, V. A., Hiljanen, M., Layne, H., Lehtonen, A., Löyttyniemi, M., Mykrä, N., Virtanen, A. S., & Heikkinen, H. L. T. (2023). Education for planetary well-being. In M. Elo, J. Hytönen, S. Karkulehto, T. Kortetmäki, J. S. Kotiaho, M. Puurtinen, & M. Salo (Eds.), *Interdisciplinary perspectives on planetary well-being* (pp. 246-248). Routledge. <https://doi.org/10.4324/9781003334002-24>.
- Adese, Jennifer. (2014). Spirit gifting: Ecological knowing in metis life narratives. *Decolonization: Indigeneity, Education & Society*, 3(3), 48-66. <https://jps.library.utoronto.ca/index.php/des/article/view/22191>.
- Agarwal, R., & Gupta, L. (2020). Introduction. *MARG*, 71(3), 12-16.
- Aldern, J. D., & Goode, R. W. (2018). The stories hold water: Learning and burning in North Fork Mono homelands.

- Decolonization: Indigeneity, Education & Society, 3(3), 26-51. <https://jps.library.utoronto.ca/index.php/des/article/view/21228>.
- Berkes, F. (2008). *Sacred ecology* (2nd ed.). Routledge.
- Bertling, J. G. (2023). *Art education for a sustainable planet*. Teachers College Press.
- Bertling, J. G., Moore, T. C., & Farkas, L. (2024). High ecological integration within U.S. art teacher education: A collective case study. *Studies in Art Education*, 65(2), 165–184. <https://doi.org/10.1080/00393541.2024.2322411>.
- Bequette, J. W. (2007). Traditional arts knowledge, traditional ecological lore: The intersection of art education and environmental education. *Studies in Art Education*, 48(4), 360–374. <https://doi.org/10.1080/00393541.2007.11650114>.
- Cajete, G. (2000). *Native science: Natural laws of interdependence*. Clear Light Publishers.
- Cajete, G. (2011, July 21). *Re-building sustainable indigenous communities: Applying native science* [Video]. YouTube. <https://www.youtube.com/watch?v=wg5h7Fd0Bio>.
- Cajete, G. (2016). Foreword. In M. T. D. Tanaka (Ed.), *Learning and teaching together: Weaving indigenous ways of knowing into education* (pp. xi-xvi). UBC Press.
- Chatterji, R. (2012). *Speaking with pictures: Folk art and the narrative tradition in India*. Routledge.
- Cohen, J. J., & Duckert, L. (Eds.). (2015). *Elemental ecocriticism: Thinking with earth, air, water, and fire*. University of Minnesota Press.
- Crutzen, P. J., & Stoermer, E. F. (2000). The anthropocene. *Global Change Newsletter*, 41, 17–18.
- Dahake, S. (2018). Taming Godavari River: Navigating through religious, developmental, and environmental narrative. *WIREs Water*, 1-12. <http://dx.doi.org/10.1002/wat2.1297>.
- Das, A. (2019). When Bhimayana enters the classroom.... In Bodhisattva Chattopadhyay, Aakriti Mandhwani, & Anwesha Maity (Eds.), *Indian genre fiction: Pasts and future histories* (pp. 175-189). Routledge.
- Davis, H., & Turpin, E. (Eds.). (2015). *Art in the anthropocene: Encounters among aesthetics, politics, environment and epistemology*. Open Humanities Press.
- Demos, T. J., Scott, E. E., & Banerjee, S. (Eds.). (2021). *The Routledge companion to contemporary art, visual culture, and climate change*. Routledge. <https://doi.org/10.4324/9780429321108>.
- Dey, S. (2022). *Green academia: Towards eco-friendly education systems*. Routledge India.
- Ferdinand, M. (2022). *Decolonial ecology: Thinking from the Caribbean world*. Polity.
- Garimella, A. (2020). A tree grows in a painting: Tribal artists and the museum. *MARG*, 71(3), 40-51.
- Ghosh, A. (2016). *The great derangement: Climate change and the unthinkable*. Penguin Random House India.
- Gómez-Barris, M. (2017). *The extractive zone: Social ecologies and decolonial perspectives*. Duke University Press.
- Gosh, A. (2021). *The nutmeg's curse: Parables for a planet in crisis*. University of Chicago Press.
- Heikkinen, H. L. T., Huttunen, R., Mahon, K., & Kemmis, S. (2024). Beyond an anthropocentric view of praxis: Towards education for planetary well-being. *Environmental Education Research*, 30(7), 1147–1160. <https://doi.org/10.1080/13504622.2024.2326460>.
- Heise, U. K. (2016). *Imagining extinction: The cultural meanings of endangered species*. University of Chicago Press.
- Hogan, M., & Topkok, S. (2015). Teaching indigenous methodology and an Iñupiaq example. *Decolonization: Indigeneity, Education & Society*, 4(2), 50-75. <https://jps.library.utoronto.ca/index.php/des/article/download/22152/19322/58589>.
- Hubbell, J., & Ryan, J. (2022). *Introduction to environmental humanities*. Routledge.
- Iheka, C. (Ed.). (2021). Teaching postcolonial environmental literature and media. *Modern Language Association of America*.
- Iseke, J. (2013). Spirituality as decolonizing: Elders Albert Desjarlais, George McDermott, and Tom McCallum share understandings of life in healing practices. *Decolonization: Indigeneity, Education & Society*, 2(1), 35-54. <https://jps.library.utoronto.ca/index.php/des/article/view/19142>.
- Kerr, J. (2014). Western epistemic dominance and colonial structures: Considerations for thought and practice in programs of teacher education. *Decolonization: Indigeneity, Education & Society*, 3(2), 83-104. <https://jps.library.utoronto.ca/index.php/des/article/view/21148>.
- Marker, M. (2006). After the Makah whale hunt: Indigenous knowledge and limits to multicultural discourse. *Urban Education*, 41(5), 482-505. <https://doi.org/10.1177/0042085906291923>.
- Matsuoka, K., & Shyam, B. (2019). *Origins of art: The gond village of Patangarh*. Tara Books Pvt. Ltd.
- Mignolo, W. D., & Walsh, C. E. (2018). Interculturality and decoloniality. In *On decoloniality: Concepts, analytics, praxis* (pp. 57–80). Duke University Press. <https://doi.org/10.2307/j.ctv11g9616.7>.
- Mitra, S., Sarkar, S., & Ganguli-Mitra, A. (2023). On the need for an anticolonial perspective in engineering education and

- practice. *Nature Communications*, 14(8453), 1-5. <https://doi.org/10.1038/s41467-023-43952-2>.
- NCERT. (2006a). *Science textbook for class IX*. New Delhi: NCERT.
- NCERT. (2006b). *Science textbook for class X*. New Delhi: NCERT.
- NCERT. (2024, December 8). *About Us*. <https://ncert.nic.in/>.
- Nuttall, S. (2022). On pluviality: Reading for rain in Namwali Serpell's the old drift. *Interventions*, 24(3), 323-339. <https://doi.org/10.1080/1369801X.2021.2015705>.
- Oppermann, S. (2023). *Blue humanities: Storied waterscapes in the anthropocene*. Cambridge University Press.
- Padhi, S., & Goswami, M. (2020). Tribal folklore to aesthetic and religious painting: Transition of oral narratives to visual art. *Journal of Religion and Health*, 63, 877-888. <https://doi.org/10.1007/s10943-020-01099-0>
- Pratt, Y. P., Louie, D. W., Hanson, A. J., & Ottmann, J. (2018). Indigenous education and decolonization. *Oxford Research Encyclopaedia of Education*, 1-32. <http://dx.doi.org/10.1093/acrefore/9780190264093.001.0001/acrefore-9780190264093-e-240>.
- Saraswat, A., & Das, A. (2024). Decolonizing the forest: The myth of Panjurli and Guliga in Kantara (2022). *Religion*, 15(11), 1307, 1-13. <https://doi.org/10.3390/rel15111307>
- Shyam, B., Bai, D., & Urveti, R. S. (2006). *The night life of trees*. Tara Books Pvt. Ltd.
- Shyam, B., & Wolf, G. (2014). *Creation*. Tara Books Pvt. Ltd.
- Simpson, L. B. (2014). Land as pedagogy: Nishnaabeg intelligence and rebellious transformation. *Decolonization: Indigeneity, Education & Society*, 3(3), 1-25. <https://jps.library.utoronto.ca/index.php/des/article/view/22170>.
- Sium, A., & Ritskes, E. (2018). Speaking truth to power: Indigenous storytelling as an act of living resistance. *Decolonization: Indigenous storytelling as an act of living resistance*, 2(1), 1-X. <https://jps.library.utoronto.ca/index.php/des/article/view/19626>.
- Sterling, S. (2001). *Sustainable education: Re-visioning learning and change*. Green Books.
- Sterling, S. (2010). Transformative learning and sustainability: Sketching the conceptual ground. *Learning and Teaching in Higher Education*, 5(11), 17-33. https://www.researchgate.net/publication/266184629_Transformative_Learning_and_Sustainability_Sketching_the_Conceptual_Ground
- Strang, V. (2013). Conceptual relations: Water, ideologies, and theoretical subversion. In C. Chen, J. MacLeod, & A. Neimanis (Eds.), *Thinking with water* (pp. 185-212). McGill-Queen's University Press.
- Strauß, A. (2023). Narrating future(s) with others: Teaching strategic sustainability management in a relational key. *Journal of Applied Learning & Teaching*, 6(1), 289-295. <https://doi.org/10.37074/jalt.2023.6.1.ss5>
- Tan, E., Wanganoo, L., & Mathur, M. (2023). Generation Z, sustainability orientation and higher education implications: An ecopedagogical conceptual framework. *Journal of Applied Learning & Teaching*, 6(1), 314-323. <http://dx.doi.org/10.37074/jalt.2023.6.1.ss2>
- Tanaka, M. T. D. (2016). *Learning and teaching together: Weaving Indigenous ways of knowing into education*. UBC Press.
- Todd, Z. (2015). Indigenizing the anthropocene. In H. Davis and E. Turpin (Eds.), *Art in the anthropocene: Encounters among aesthetics, politics, environment and epistemology* (pp. 379-385). Open Humanities Press.
- Tuck, E., & Yang, K.W. (2012). Decolonization is not a metaphor. *Decolonization: Indigeneity, Education & Society*, 1(1), 1-40. <https://jps.library.utoronto.ca/index.php/des/article/view/18630>.
- Vyam, D., Vyam, S., Natarajan, S., & Anand, S. (2011). *Bhimayana: Experiences of untouchability*. Navayana.
- Wildcat, M., McDonald, M., Irlbacher-Fox, S., & Coulthard, G. (2014). Learning from the land: Indigenous land based pedagogy and decolonization. *Decolonization: Indigeneity, Education & Society*, 3(3), 1-XV. <https://jps.library.utoronto.ca/index.php/des/article/view/22248>.
- Wolf, A., & Wolf, G. (Eds.). (2015). *Between memory and museum: A dialogue with folk and tribal artists*. Tara Books Pvt. Ltd.