

ARTICLE

Beyond Planetary Boundary Thinking: Reimagining Environmental Education through Solar Ethics

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Abstract

Human activity has driven planet Earth to the brink of ecological collapse, prompting discourses such as planetary boundary (PB) thinking that seek to define thresholds for sustainable living. While PB provides a powerful framework for policy and risk analysis, it is limited by its earth-centric and anthropocentric orientation, technocratic rigidity and tendency to induce eco-anxiety. Moreover, its alignment with global development agendas risks sidelining justice, creativity and Indigenous Knowledge. This article critiques PB thinking and explores an alternative orientation: solar ethics. Drawing on Don Cupitt's (1995) metaphor of the Sun as a symbol of unconditional giving and Peters and Hung's (2009) notion of "solar systemism," solar ethics re-centres the Sun in ecological thought, fostering generosity, humility and cosmic consciousness. It resonates with African philosophies of *ubuntu* and *ukama*, which emphasise intra-action and relational becoming, and with Indigenous cosmologies that regard the Sun as a vital relational presence. Solar ethics opens possibilities for education that are life-affirming, imaginative and resistant to neoliberal metrics. Practical applications include curriculum design, outdoor learning, creative expression and community projects. By situating education within solar ethics, this article envisions a transformative pedagogy that nurtures ecological justice, relational flourishing and planetary care in times of systemic crisis.

Keywords: Affirmative ethics; planetary boundaries; solar ethics; transformative pedagogy; ubuntu; ukama

Introduction

There is no doubt that human actions have wreaked havoc on planet Earth, pushing it to the brink of ecological catastrophe. In response, civil society, governments, supra-national organisations and even the corporate world have taken various measures, particularly since the end of World War II. Towards the close of the first decade of the 21st century, a new discourse emerged around planetary boundaries (PBs), led by Johan Rockström and colleagues. These scientists identified nine critical Earth-system processes that regulate planetary stability and proposed that humanity must operate within these thresholds to mitigate risks to sustainability. Crucially, this discourse offers a vision of ecological limits, a framework for policy and a moral imperative to live within the planet's boundaries.

The PBs discourse is interdisciplinary and transdisciplinary, grounded in scientific modelling and risk analysis. Politically, it provides a framework for governmental policies and transnational agreements. Ethically, it raises questions about how we ought to live, what responsibilities we bear and what actions we must take. It also prompts educational inquiries: how, what and where should we learn considering the planet's limits?

Nevertheless, the concept of ecological limits is not new. For instance, the report *Limits to Growth* by Meadows *et al.* (1972) addressed similar concerns. Moreover, despite the adoption of environmental discourses such as sustainability by governments and supra-national bodies, these efforts have done little to halt environmental degradation. The PBs framework has its own limitations: it overemphasises global metrics, adopts a technocratic lens, induces eco-anxiety, overlooks social justice and colonial legacies, and its scientific rigidity can stifle creative and critical pedagogies. Importantly, it is driven by the negative form of power, *potestas*¹; a transcendent, imposing, colonising and hierarchical force, thus remaining entrenched in outdated modes of thinking and action.

In this article, I explore possibilities for environmental education that move beyond ‘limits thinking’ without compromising planetary sustainability. I draw on the concept of solar ethics as articulated by Don Cupitt (1995) and further developed by Peters and Hung (2009). Cupitt’s metaphorical ethics are inspired by the sun’s self-giving nature, radiance and immanence. Rather than being bound by duty or limits, solar ethics become a way of living generously, hopefully and joyously; an ethics that affirms life and fosters creativity. For Peters and Hung (2009), solar ethics mark a shift from anthropocentrism to solar systemism, placing the sun, not the human, at the centre of ethical reflection. Solar ethics thus becomes a pedagogical tool to cultivate cosmic consciousness, ecological response-ability (ability to respond) and a sense of cosmic (including planetary) belonging. Moreover, solar ethics embodies the power of *potentia*: an immanent, connective, creative and life-affirming force.

I begin this article by engaging with PB thinking, a framework that foregrounds the ecological limits within which humanity must operate. In doing so, I raise critical questions about what PB thinking means for education. I then introduce the promise of solar ethics as a philosophical and ecological orientation that gestures towards a life-affirming, relational and generative mode of being. From there, I turn to education attuned to solar ethics, where I explore pedagogical practices that align with this orientation, practices that cultivate cosmic consciousness, nurture ecological subjectivity, foster interdependence and encourage generative forms of learning. Finally, I close with parting thoughts, reflecting on the transformative potential of solar ethics for curriculum theory and educational practice. By situating education beyond the constraints of PBs and orienting it towards solar ethics, I open a new horizon of possibility, one in which education becomes a force for ecological justice, relational flourishing and the reconfiguration of human subjectivity in the age of rapid environmental degradation.

PB thinking: a critique

PB thinking was first introduced in 2009 by a group of 28 internationally renowned scientists led by Johan Rockström of the Stockholm Resilience Centre. Their landmark paper, *A Safe Operating Space for Humanity*, published in *Nature*, outlined nine critical Earth-system processes and proposed quantitative boundaries for each to ensure a stable and resilient planet. Rockström *et al.* (2009) defined PBs as “the safe operating space for humanity with respect to the Earth system and are associated with the planet’s biophysical subsystems or processes” (p. 472). In their work, the team sought to identify Earth-system processes and associated thresholds that, if transgressed, could result in unacceptable environmental change. This framework has since been updated and refined. The nine processes identified as requiring boundaries were: climate change; biodiversity loss (terrestrial and marine); disruption of the nitrogen and phosphorus cycles; stratospheric ozone depletion; ocean acidification; global freshwater use; land-use change; chemical pollution;

¹*Potestas* is the Latin word for one form of power. This form of power is hierarchical, imposed from the outside and functions in colonising, normalising and homogenising ways. By contrast, *potentia* refers to another form of power: a positive, life-giving force that is connective, present throughout life and inherently productive (Le Grange, 2025). Spinoza (1677/1996) originally drew this distinction and later followed by Deleuze (1988), Negri (1991) and others.

and atmospheric aerosol loading (Rockström *et al.*, 2009, p. 472). Their analysis suggested that by 2009, three of these processes had already crossed their boundaries: climate change, biodiversity loss and the rate at which atmospheric nitrogen is converted into reactive forms for human use.

The original PB framework has been revised in response to scientific scrutiny and growing interest from policy, governance and business sectors seeking pathways towards global sustainability (see Steffen *et al.*, 2015). Key revisions included: the introduction of a two-tier approach for several boundaries to account for regional heterogeneity; updated quantification of most PBs; identification of two core boundaries; and the proposal of a regional-level quantitative boundary for one of the two previously unquantified processes (Steffen *et al.*, 2015, p. 1259855-1). Engagements with policymakers, particularly those representing the global South, raised critical concerns regarding justice and equity, issues largely absent from the original PB framework. In this regard, Sultana (2023) poses the incisive question, “Whose growth in whose planetary boundaries?” and calls for the decolonisation of planetary justice in the Anthropocene. Responding to such critiques, Rockström *et al.* (2021, 2023) modified the PB concept to incorporate justice alongside biophysical boundaries, recognising that the most vulnerable populations have fundamental rights to water, food, energy, health and a clean environment. Furthermore, the PB framework has become increasingly entangled with the UN Sustainable Development Goals (SDGs) (Rockström *et al.*, 2021), aligning planetary stewardship with a human development agenda. The notion of a “safe operating space for humanity” (Rockström *et al.*, 2009, p. 472) has thus evolved into a “safe and just corridor for people” (Rockström *et al.*, 2021, p. 1). Evidently, these revisions reflect boundary shifts, changing perspectives, greater complexity and heightened transgression. On the latter point, Gupta *et al.* (2023) contend that all but one threshold has now been exceeded.

Critiques of PB thinking highlight both its earth-centric and anthropocentric orientations. The boundaries are conceived as limits for planet Earth, yet forces beyond the Earth exert cardinal influence on Earth-system processes and associated thresholds. For instance, none of these processes are possible without the Sun’s energy. Nevertheless, in the corpus of Rockström and colleagues,² the word *Sun* does not appear, and *solar* is mentioned only twice, neither in reference to the life-generating energy that sustains life on Earth. This earth-centric framing constrains ethics, narrows consciousness to the terrestrial and limits what is possible in education. The latter is evident in Wals’ (2025) chapter title, *Rethinking Education with Earth in Mind . . .* A detailed discussion of solar ethics follows later in the article.

Anthropocentrism also permeates the PB framework, which explicitly defines boundaries as preconditions for human development. Although its stated aim is to sustain life on Earth, this intention is couched in human-centred terms: Earth-system processes and thresholds must not be transgressed not because they hold intrinsic value, but because of their utility for human needs. The alignment of PB thinking with the SDGs (Rockström *et al.*, 2021) deepens this anthropocentrism, given the strong emphasis on human development and rights. Of course, humans must have access to water, food, shelter and other essentials for survival. However, sustaining life will remain elusive if we persist with instrumentalist logic and human-centred approaches. Such pursuits have already proven disappointing, as seen with the Millennium Development Goals and now the SDGs, where targets remain unmet and planetary thresholds continue to be transgressed.

The implications for education are significant. PB thinking will likely be adopted by policymakers, embedded in prescribed curricula and disseminated to schools. The upshot would be that education may expand to become more earth-centred, but it will remain fundamentally human-centred. In this way, PB thinking translates into *potestas* – a form of power imposed from outside, hierarchical and colonising of desire. Creativity risks being stifled, as the becoming of pedagogical lives is thwarted and possibilities for rethinking sustainability education are narrowed

²The corpus relate to the published works cited in this article.

by instrumentalist and anthropocentric discourses such as *Education for Sustainability* (see Le Grange, 2017).

An affirmative response to the earth-centrism and anthropocentrism of PB thinking is to experiment with expanding ethics, here, towards solar ethics, and to recognise that human lives are entangled with all of life, not merely through interaction but through intra-action. Intra-action suggests that we become human through entanglement with other humans and with the more-than-human world, a perspective captured by the twin African values of *ubuntu* and *ukama*. Simply put, *ubuntu* refers to the unfolding or becoming of the human in intra-action with other humans, while *ukama* extends this becoming to the entire cosmos (Le Grange, 2012). In this sense, *ubuntu* is a microcosm of *ukama* (Le Grange, 2022). The ethic that emerges here is affirmative: to make kin with humans and non-humans (Haraway, 2015), rather than the negative ethic implied by PB thinking, which frames moral obligation primarily as non-transgression. Education, therefore, entails nurturing the unfolding of the human as an entangled entity, not as a detached, atomistic individual. Haraway (2015) reminds us that humans do not, and have never, acted alone; rather, they have always been entangled, terraforming the Earth in intra-action with other life forms and the biophysical world.

Secondly, the PB framework can induce fear and fatalism among young learners. The injunction of “do not cross” may leave them feeling helpless or disenchanted, particularly when solutions are framed in top-down ways or when goals appear unattainable, rather than fostering empowerment and agency. Coffey *et al.* (2021) describe eco-anxiety as either a chronic fear of environmental doom or the mental stress and anxiety associated with deteriorating environmental conditions. Thirdly, PB has been criticised for its technocratic and reductionist framing (Sobkowiak *et al.*, 2023). When scientific data and control over ecological systems are privileged, environmental education risks being reduced to numbers and thresholds, neglecting qualitative dimensions such as emotional, ethical and cultural learning. Fourthly, PB has been critiqued for its neglect of justice and power inequalities. As elaborated earlier in this article, education informed by the original PB framework could easily sideline environmental justice concerns, thereby narrowing its transformative potential. As noted, the issue of justice has been addressed to some extent by revisions of the PB framework (Rockström *et al.*, 2021, 2023).

A fifth criticism of the PB framework in relation to education is that it risks limiting pedagogical flexibility and stifling creativity and critical pedagogies. The scientific rigidity of the framework can make it difficult to introduce arts-based activities, experiential learning, Indigenous Knowledge systems and inter- or transdisciplinary approaches, all of which are vital for a holistic environmental education. Moreover, PB thinking is likely to perpetuate the dominance of the reactive force of curriculum, that is, the force driven by *potestas*, rather than the active force of curriculum animated by *potentia*. Concerning the reactive force of *currere*, Le Grange (2025) observes:

... *currere*'s active force ... has become an a priori image: the Grecian “chariot track” or literal “course to run” (Wallin, 2010: 2). In other words, one way of doing has become *the* way of doing. The reactive force of *currere* severs the concept from its immanent potential. This force has dominated schooling in the 20th century (and continues to do so in the 21st century), as is evident in instrumentalist approaches to teaching whereby outcomes or aims are predetermined and often derived from existing disciplines.

Evidently, several criticisms have been levelled against the PB framework. However, my primary interest in this article is to respond to its earth-centredness and, by association, its human-centredness. It is with this in mind that I now turn to a discussion of solar ethics as a philosophical and ecological re/orientation.

Solar ethics: a philosophical and ecological orientation

In its common usage solar ethics refers to the use of the sun as a renewable resource to generate electricity to power houses, factories and institutions instead of the burning fossil fuels. My usage of solar ethics in this article has reference to a philosophical and ecological reorientation first articulated by Don Cupitt (1995) and expanded by Peters and Hung (2009).

Cupitt (1995) introduced solar ethics as part of a broader non-realist theological project that was a response to the failure of traditional moral philosophy. Non-realist in this context refers to the view that God is not an objectively existing, external being, but a human construct that finds expression in human moral imagination, symbolic language and cultural creativity. For Cupitt (1995), the Sun is source of inspiration, a metaphor for self-giving, radiance and immanence. Put differently, the sun gives freely and unconditionally, without judgement or expectation. This metaphorical use of the Sun gives rise to an affirmative ethic concerned with living ethically, by giving ourselves away, as the Sun does, embracing generosity, impermanence, mortality and by living fully in the moment. He writes:

Solar living is the best religion. By that I mean that the more we think about the Great Questions and the challenge they present to us, the more we come to understand that there is no way of *escaping* from the basic conditions of life. The only option left is to say “Yes” to life as a whole and as a package deal: Yes to time, Yes to contingency, Yes to finitude, Yes even to death. Life has no *Telos* – that is, no ultimate goal – and the practice of solar living attempts to achieve the final happiness by the way one says Yes to life in the here and now (Cupitt, 2005, p. 157).

Peters and Hung (2009) build on Cupitt’s metaphor, arguing that solar ethics recontextualises human–nature relations by broadening them into human–solar system relations. This shift dissolves divides between nature and culture, human and non-human and calls for a holistic ethics that transcends boundaries. The authors argue for a fundamental reorientation of environmental ethics away from anthropocentrism and towards what they call “solar systemism.” They begin by situating their proposal within the history of cosmology, noting how scientific discoveries such as Hubble’s observations of cosmic expansion and the Big Bang theory displaced human-centred assumptions with empirical evidence of a universe far larger and older than previously imagined. They aver that this shift provides the basis for rethinking environmental ethics in terms of the Sun and the solar system, rather than Earth alone. The Sun, as the source of energy and life, becomes central to a new ethical framework that decentres humanity and situates humans within a broader cosmic system.

Peters and Hung (2009) critique the anthropocentrism embedded in Western traditions of ethics, theology and philosophy, which have historically assigned intrinsic value only to humans while relegating non-human nature to the status of backdrop or resource. They argue that although environmental ethics discourses emerging in the 1970s sought to challenge this orientation by emphasising interconnectivity, deep ecology, feminist perspectives and bioregional accounts, these approaches, valuable as they are, remained largely Earth-bound. At the heart of their argument lies the claim that the concept of “environment” must be radically extended to encompass the solar system and even the universe, acknowledging that Earth is not central but part of a larger system dependent on the Sun. This extension repositions humans as members of a cosmic community, shaped by evolutionary processes and ultimately destined to re-merge into the larger system. In advancing this argument, Peters and Hung draw on critiques of anthropocentrism by thinkers such as Val Plumwood (1996), who described anthropocentrism as a “standpoint of mastery” analogous to androcentrism and ethnocentrism. For Peters and Hung (2009), anthropocentrism underpins ecological crises by legitimising the domination of non-human nature. They also highlight that global threats such as resource depletion, energy crises,

climate change and geopolitical competition demand a more expansive ethical framework, one not confined to PB thinking. For them, only by situating humanity within the solar system can we adequately respond to these challenges.

Peters and Hung (2009) situate solar ethics alongside earlier proposals such as Aldo Leopold's (1949) land ethic, which expanded the moral community to include soils, waters, plants and animals, and James Lovelock's (1979) Gaia hypothesis, which conceived Earth as a living organism co-evolving with its environment. They argue that while these frameworks broadened ethical consideration beyond humans, they remain inadequate given our increased understanding that humanity intra-acts not only with land and biosphere but with the solar system and cosmos. They invoke Roderick Nash's (1989) evolutionary framework of ethics, which envisions the eventual inclusion of the universe in the moral circle, to suggest that the future of ethics must already be conceived as present.

Peters and Hung (2009) emphasise that modern cosmology and astrophysics have revealed a magnificent cosmic story, from the Big Bang to the inflationary universe, and from the evolution of galaxies to the eventual death of the Sun. This scientific narrative underscores the contingency and finitude of the environment: the solar system itself has a limited lifespan, and life on Earth will eventually cease. Ethics, therefore, must grapple with the temporality and fragility of the systems that sustain life. These reflections reinforce the need for an ethics that situates humanity within cosmic processes rather than assuming human centrality.³

So, what might we glean from Peters and Hung's solar systemism? Solar ethics is both a philosophical experiment and a practical necessity. It asks humans to imagine themselves as members of the solar system, to reconsider self-knowledge and ethical response-ability in the light of cosmic belonging. While some may object that the solar system is unaffected by human actions and thus irrelevant to ethics, the Peters and Hung (2009) counter that moral inclusion does not require equal interaction or influence. Just as children, future generations, non-human animals and non-living environments are included in ethical consideration despite limited reciprocity, so too can the solar system be part of our ethical frame. Solar ethics is thus a call to expand imagination, garner response-ability and action beyond Earth, to conceive of ethics in terms of cosmic membership.

In summary, Peters and Hung (2009) weave together cosmological science, critiques of anthropocentrism, metaphors of the Sun and ecological philosophy to argue for a paradigm shift. They contend that environmental ethics must move beyond Earth-bound perspectives to embrace solar systemism, repositioning humans within a larger cosmic context. This shift, they argue, will foster a more sustainable worldview, one that acknowledges interdependence, contingency and the limits of human mastery. Solar ethics is not merely an abstract idea but a necessary reorientation in an age of environmental crisis and human entanglement with advanced technologies. By situating humanity within the solar system, it offers a holistic ethics beyond divides, capable of guiding education and policy towards ecological justice and planetary sustainability.

It is worth noting, that across the world, Indigenous peoples have long regarded the Sun, and other celestial bodies, as vital forces integral to life. The Sun shaped cultural practices, marked seasonal rhythms and guided navigation, embedding itself deeply in ways of knowing, being and acting. Within these traditions, the Sun is not a distant object but a relational presence, a source of vitality and meaning (Harrison *et al.*, 2025; Suagee, 1992). Solar ethics, therefore, resonates profoundly with Indigenous cosmologies, affirming reciprocity and interconnection with the more-than-human world. In contrast, Western traditions have often positioned the Sun as a transcendent entity, an object of detached study observed from afar. Enlightenment science, for

³Solar ethics described here, aligns with Braidotti's (2002) *zoe*-centred ethics. *Zoe*-centred ethics is a posthumanist ethical framework grounded in the concept of *zoe*, a Greek term meaning "life" in its most elemental, non-human sense. Unlike *bios*, which refers to qualified, individual human life, *zoe* emphasises the vitality of all living matter, including animals, plants, ecosystems and even technological or material assemblages.

instance, framed the Sun as a star to be measured, categorised and explained, rather than as a living force woven into human and ecological rhythms (see Rossi, 2001; Shapin, 1996). This orientation reflects a broader epistemic stance: knowledge as abstraction and distance rather than lived relation. Therefore, inspiration can be drawn from Indigenous peoples rather than knowledge as abstraction in cultivating solar ethics.

Education attuned to solar ethics

Solar ethics invites us to re-centre the Sun in ecological thought, shifting attention away from the human as the primary reference point. By foregrounding the Sun, educators can cultivate a deeper appreciation of energy cycles, planetary interdependence and the fragility of life systems. This orientation reminds us that all earthly processes are contingent upon solar energy, and that our ethical frameworks must acknowledge this cosmic dependence. Such an ethic also encourages generosity and self-expenditure. Drawing inspiration from Cupitt's (1995, 2005) portrayal of the Sun as a symbol of unconditional giving, solar ethics promotes values of care, selflessness and creative contribution to the Earth, rather than extraction and control. Education informed by this ethic nurtures learners to see themselves not as consumers of planetary resources but as participants in a cycle of giving and renewal.

At the same time, solar ethics fosters cosmic consciousness and planetary humility. Peters and Hung (2009) argue for a solar system-based ethics that situates Earth as one among many celestial bodies. This perspective cultivates awe and responsibility, reminding learners that planet Earth is neither the centre of the universe nor exempt from cosmic fragility. Such humility is essential for rethinking sustainability beyond anthropocentric limits. Solar ethics also opens space for aesthetic and existential engagement. It resists reducing education to technical or scientific dimensions alone, instead inviting poetic and philosophical reflection on mortality, impermanence and the beauty of living in harmony with natural cycles. In this way, education becomes a site for cultivating wonder⁴ and meaning, not merely for transmitting knowledge. Finally, solar ethics resists neoliberal metrics that dominate contemporary education. In contrast to outcome-driven, market-oriented models, it promotes slow learning, deep reflection and ethical imagination, qualities indispensable for ecological care. By privileging relationality and imagination over efficiency and measurement, solar ethics reclaims education as a space for cultivating planetary care, within a cosmic realm.

The practical application of solar ethics in education calls for a reimagining of curriculum, pedagogy and community engagement. At the level of curriculum design, educators can integrate solar metaphors and cosmological perspectives into science and other school subjects. This not only situates learning within the broader energy cycles that sustain life but also encourages learners to think beyond human-centred frameworks. Outdoor learning provides another avenue for embedding solar ethics. Activities such as solar observation, mapping seasonal cycles and tracing energy flows can connect learners with natural rhythms, fostering attentiveness to the interdependence of ecological systems. These practices cultivate a sense of wonder and humility, reminding learners that their lives are entangled with cosmic forces. Creative expression is equally vital. Through art, storytelling and reflective writing, learners can explore the ethical and aesthetic dimensions of solar ethics. Such practices open space for imagination and emotional engagement, countering the reductionist tendencies of technocratic approaches to sustainability. Community projects offer a tangible way to embody solar ethics in everyday life. Initiatives such as solar-powered community gardens or workshops on renewable technologies exemplify generosity and sustainability, while also fostering collective response-ability. These projects demonstrate that education is not confined to the classroom but extends into the lived practices of communities.

⁴Malabou (2011) reminds us that, for Descartes, the correlate of wonder is generosity, suggesting that subjectivity is not self-centred or self-interested but oriented towards others, involving a giving of oneself to them. Du Preez and Le Grange (2025) argue that wonder is an ethical response-ability that involves generosity to all of life.

Taken together, these applications illustrate how solar ethics can transform education into a relational, imaginative and ecologically attuned practice. By re-centring the Sun, cultivating generosity and resisting neoliberal metrics, solar ethics nurtures learners who are not only knowledgeable but also ethically and cosmically conscious. Solar ethics call for reimagining education but given that many educators find themselves in formal education contexts, I offer an example of how the integration of solar metaphors and cosmological perspectives into science could play out in South African formal schools.

The Curriculum Assessment and Policy Statement (CAPS) for Natural Sciences (Grades 7–9) (DBE, 2011) provides fertile ground for cultivating solar ethics within formal education. The subject's stated aims already emphasise the history of science, its relationship to other disciplines, the cultural contexts of Indigenous Knowledge systems and the ethical consequences of scientific decisions. These commitments open space for rethinking science education beyond technocratic boundaries. The four strands, *Life and Living*, *Matter and Materials*, *Energy and Change*, and *Planet Earth and Beyond*, are particularly significant. Each strand can be reframed through solar ethics: *Energy and Change* naturally lends itself to exploring solar energy as the foundation of ecological processes; *Planet Earth and Beyond* invites cosmological perspectives that situate Earth within the solar system; *Life and Living* can highlight the entanglement of all life forms with solar energy; and *Matter and Materials* can be taught with attention to the cycles of transformation powered by the Sun. In this way, CAPS provides opportunities to embed solar ethics into curriculum design, pedagogy and assessment. Rather than reinforcing anthropocentric or instrumentalist logics, educators can use the framework to nurture learners' awareness of their entanglement with the Sun, the cosmos and the more-than-human world. This approach transforms Natural Sciences into a site for cultivating generosity, humility and ecological imagination, qualities essential for sustainability education in times of planetary crisis.

In Grade 9 Natural Sciences, learners could embark on a project titled, for example, "*Stories of the Sky: Indigenous Cosmologies and Astronomy*." The project begins with an exploration of how different cultures have understood the Sun, stars and celestial cycles. Learners are introduced to Indigenous cosmologies from Southern Africa, such as San interpretations of the Milky Way as a pathway of ancestors, or Xhosa traditions linking lunar cycles to agricultural rhythms. These narratives are placed alongside scientific accounts of stellar formation, planetary motion and solar energy, encouraging learners to see astronomy not only as a technical discipline but also as a cultural and ethical practice. Working in groups, learners can collect stories from local communities, elders, or archives that describe the Sun, moon and stars. They can then compare these accounts with scientific explanations of phenomena such as eclipses, solstices, or seasonal changes. The emphasis is not on judging one system against another, but on recognising how both Indigenous cosmologies and modern astronomy offer ways of making sense of the cosmos.

The project could culminate in creative outputs: learners might design visual maps that integrate constellations with cultural stories, write reflective essays on the significance of solar energy in both science and Indigenous thought, or stage short performances that dramatise cosmological myths alongside scientific narratives. Outdoor activities, such as night sky observation or solar tracking, deepen the experiential dimension, linking learners to the rhythms of the cosmos. Through this project, learners come to appreciate that science and Indigenous knowledge are not mutually exclusive but can be woven together to cultivate humility, relationality and ecological imagination. By situating Earth within both solar and cultural systems, the project embodies solar ethics: re-centring the Sun, fostering generosity and nurturing awe for the fragile interdependence of life.

Parting thoughts

PB thinking has provided a powerful framework for understanding ecological limits, shaping global policy and raising awareness of the precarious state of Earth's systems. However, in this this

article I argued, that its earth-centric and anthropocentric orientations, technocratic rigidity and tendency to induce fear and fatalism limit its transformative potential for education. While revisions to the framework have sought to incorporate justice and equity, the underlying logic remains one of constraint, driven by *potestas* – a reactive, colonising form of power that narrows pedagogical imagination and reinforces instrumentalist approaches. Education informed solely by PBs risks becoming prescriptive, outcomes-driven and detached from the relational and ethical dimensions of learning.

Solar ethics offers a generative alternative. By re-centring the Sun, educators can cultivate humility, generosity and cosmic consciousness, situating human life within broader energy cycles and cosmic rhythms. This orientation resonates with African philosophies of *ubuntu* and *ukama*, which emphasise intra-action and relational becoming, and with Indigenous cosmologies that regard the Sun as a vital presence woven into cultural and ecological practices. Solar ethics embodies *potentia*; a life-affirming, connective force that nurtures creativity, imagination and ecological subjectivity. It shifts the ethical focus from “do not transgress” to “make kin,” (Haraway, 2015) encouraging learners to embrace entanglement with the more-than-human world.

Practically, solar ethics opens new horizons for curriculum, pedagogy and community engagement. It invites educators to integrate solar metaphors and cosmological perspectives into science, and other subjects; to foster experiential learning through solar observation and seasonal cycles; to encourage creative expression through art and storytelling; and to promote community projects that embody generosity and sustainability. Within the South African CAPS framework, strands such as *Energy and Change* and *Planet Earth and Beyond* provide fertile ground for embedding solar ethics, enabling learners to see themselves as participants in cosmic cycles rather than detached individuals. Projects linking Indigenous cosmologies with astronomy exemplify how solar ethics can be enacted in practice, cultivating awe, humility and ecological imagination.

The significance of solar ethics lies not only in its philosophical depth but in its capacity to reconfigure education as a site of relational flourishing and ecological justice. In times of systemic crisis, when planetary thresholds are increasingly transgressed, education must move beyond fear and technocracy towards practices that affirm life, nurture creativity and foster response-ability. Solar ethics provides such a horizon. It resists neoliberal metrics, embraces slow and reflective learning and situates humanity within the fragility and beauty of cosmic processes. In doing so, it transforms environmental education from a discourse of limits into a pedagogy of possibility. Ultimately, the challenge is not to abandon PB thinking but to move beyond its constraints, integrating its insights into a broader ethical and pedagogical vision. Solar ethics offers this vision: a way of living and learning that affirms generosity, humility and entanglement, reimagining education as a force for ecological justice and planetary care. By orienting education towards the Sun, we open ourselves to a new ethic of sustainability, one that is cosmic in scope, relational in practice and transformative in its potential to reconfigure human subjectivity in the Anthropocene/Capitalocene/Chthulucene.⁵

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⁵Crutzen and Stoermer (2000) introduced the Anthropocene, a geological epoch marked by human dominance over Earth's systems. Beyond geology, it signals a philosophical and ethical condition demanding response-ability. Moore (2015) reframes it as the Capitalocene, locating rupture in capitalism's rise after 1,450. Haraway (2015) counters with the Chthulucene, urging us to “stay with the trouble” and build multispecies kinship.

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