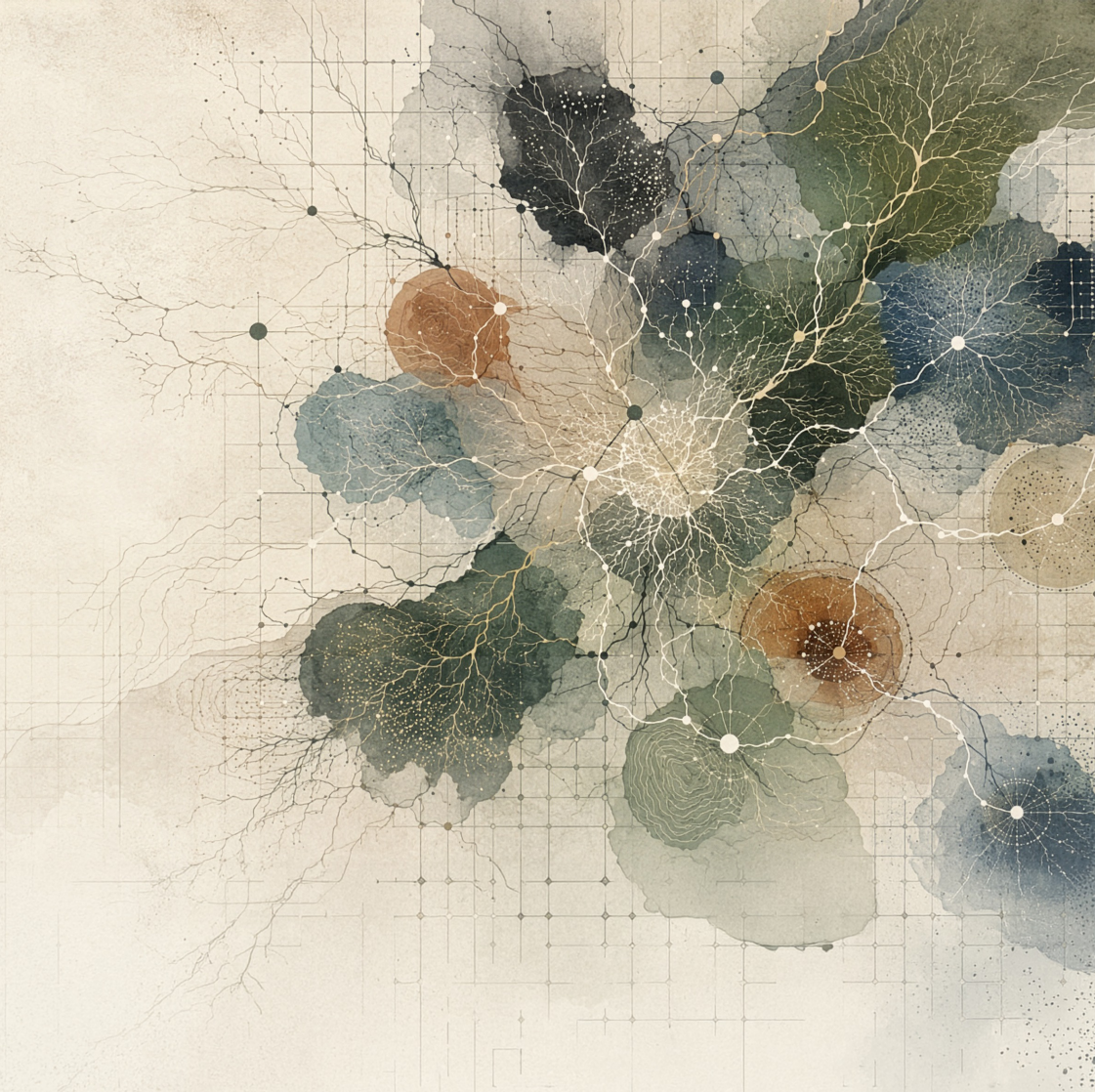


Key Insights on Education for Planetary Futures

2026

EDUCATION FOR PLANETARY FUTURES

ASU Julie Ann Wrigley Global Futures Laboratory
Arizona State University

BRIDGES unesco MOST

Publication details

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About *Key Insights on Education for Planetary Futures*

Education shapes how we understand the world, relate to one another, and imagine what comes next. As planetary conditions change, the challenge is not simply to add new knowledge to existing systems. It is to reconsider what—and whom—education is for.

Key Insights on Education for Planetary Futures looks for consequential shifts already taking shape across education. Rather than setting goals or prescribing a destination, ten interconnected insights bring what is emerging into view and ask what it might make possible. Together, the ten insights trace four movements: questioning inherited paradigms, deepening relational foundations, strengthening collective agency, transforming systems of learning.

Key Insights emerged through an open global survey and successive rounds of dialogue, interpretation, writing, and review across regions, disciplines, and knowledge traditions. These insights are provisional by design, and each revision dialogue offers a collective reading of what is shifting, what is becoming possible, and what we may not yet be seeing.

Key Insights is a joint initiative of Arizona State University and the UNESCO-MOST BRIDGES Coalition. At ASU, it is housed within the Education for Planetary Futures Collaborative—one of the Learning Futures Collaboratives at Mary Lou Fulton College for Teaching and Learning Innovation—and the Julie Ann Wrigley Global Futures Laboratory.

Editorial team

The Key Insights editorial team guided the development, synthesis, and review of the initiative, with overall editorial coordination by Iveta Silova, Gustavo Fischman, Victoria Desimoni, Steven Hartman, and Andrea Weinberg.

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INTRODUCTION

Education for Planetary Futures: Learning with a Changing World

Iveta Silova, Gustavo Fischman, and Andrea Weinberg

Modern education systems were largely shaped by a world of expanding economies, relatively stable institutions, and confidence in humanity's capacity to plan and manage the future. Today, they face profoundly different conditions. As ecological systems destabilize, social inequalities deepen, democratic institutions fray, and inherited models of progress reach their limits, education confronts a defining question: what forms of learning and relationships are needed to sustain life and collective flourishing in the decades ahead?

Educational transformations rarely emerge fully formed or become visible all at once. They take shape through dispersed practices, shifting relationships, renewed attention to long-standing knowledge traditions, and new responses to changing conditions. Some remain difficult to recognize because they do not fit established disciplinary categories, policy frameworks, or systems of measurement. Others are well established and clearly articulated, yet remain marginal to mainstream policy and practice because institutional structures and dominant paradigms have been slow to change. Emergence, therefore, does not necessarily mean novelty. Ideas and practices gaining wider attention today may have deep intellectual, cultural, and political histories; what is emerging may instead be their wider recognition, new relationships among them, or their growing significance under changing conditions.

Key Insights on Education for Planetary Futures therefore looks across this wider landscape: not only to what is new, but to what is becoming newly visible, connected, or consequential—and to what has long been known or practiced yet remains peripheral to dominant educational agendas. In doing so, the initiative seeks to bring into focus transformations that established categories and agendas may overlook or resist. By reading across practices, ideas, knowledge traditions, and contexts, *Key Insights* attends to what becomes visible in relation—the connections, tensions, absences, and possibilities that can reshape how educational change is understood.

Key Insights responds to this challenge through an ongoing global process of collaborative inquiry and collective sensemaking. Bringing diverse disciplines, regions, sectors, and knowledge traditions into dialogue, the initiative looks across and beyond established educational agendas to trace patterns, tensions, and connections that no single perspective can reveal on its own. Rather than treating educational transformations as isolated developments, it examines how shifts in knowledge, human agency, institutions, governance, and the wider conditions through which societies learn interact and reshape one another. Each cycle offers a provisional reading of a changing landscape, making connections visible, opening them to shared interpretation, and generating questions for the next cycle of inquiry. This inaugural report marks the beginning of that ongoing process.

Read together, the *Key Insights* trace four interconnected movements through which education is being questioned, reimagined, and remade under changing planetary conditions:

- **Questioning inherited paradigms**—examining how education systems shaped by industrial modernity are increasingly misaligned with changing planetary conditions (Insight 1).
- **Deepening relational foundations**—situating learning within interdependence, plural knowledge traditions, and socioecological relationships among people, place, and planet (Insights 2-4).
- **Strengthening collective agency**—connecting emotions, care, and ethical responsibility with civic participation and intergenerational collaboration as people navigate uncertainty and act together (Insights 5-6).
- **Transforming systems of learning**—reorienting governance, technology, assessment, and institutions toward more plural, participatory, and adaptive systems of learning (Insights 7-10).

These movements take shape in relation to one another and to their contexts, opening possibilities for transformation through participation and collective learning.

WHAT WE MEAN BY EDUCATION FOR PLANETARY FUTURES

Education for planetary futures begins from an expansive understanding of education as the interconnected ways societies organize and sustain learning across the lifespan. It encompasses formal, non-formal, and informal learning in schools, universities, communities, workplaces, cultural institutions, digital environments, and civic life. From this perspective, learning unfolds through a wide ecology of institutions, relationships, and places, extending well beyond the boundaries of formal education systems.

Education for planetary futures recognizes that learning is not separate from planetary change. It both shapes and is shaped by the ecological, social, cultural, political, and technological conditions through which collective futures are made. Its concern is how the purposes, relationships, practices, and systems of education participate in making some futures more possible than others.

Transformation, in this report, means more than improving existing practices or adding new programs to established systems. It involves change at different depths—from practices and pedagogies, to institutions and governance, to the underlying assumptions and purposes that organize education itself (Bateson, 1972; Sterling, 2001, 2004). These dimensions interact: new practices can unsettle institutional arrangements, changing relationships can alter what becomes possible, and shifts in underlying assumptions can reorient the purposes of education. Transformation therefore involves recognizing and unlearning inherited mechanistic and managerial assumptions about growth, individualism, human separability, control, and progress that continue to shape education, including within efforts intended to change it. Such change is neither linear nor fully predictable; it unfolds through participation, experimentation, contestation, reflection, and collective learning, with pathways continually reshaped by changing conditions, relationships, and what is learned along the way.

Education for planetary futures takes shape in relation to longstanding intellectual, philosophical, cultural, and educational traditions concerned with questions of interdependence, relationality, living systems, justice, and human relationships with the more-than-human world. These include Education for Sustainable Development (ESD), environmental and climate education, global citizenship education, peace and human rights education, holistic education, and Indigenous and decolonial education. It is also in conversation with international frameworks such as ESD for 2030, SDG 4.7, and UNESCO's Recommendation on Education for Peace, Human Rights and Sustainable Development (UNESCO, 2020, 2023; United Nations, n.d.).

Rather than positioning itself as another bounded field or agenda, *Key Insights* moves across these conversations, bringing developments often considered separately into relationship, while remaining open to knowledges, practices, and possibilities that exceed established frameworks. Its distinctive contribution lies in asking what becomes visible and possible through these encounters—in the connections, tensions, and absences among perspectives, and in the relationships among knowledge, practice, policy, and place. In this way, *Key Insights* creates a recurring space for collectively reading and re-reading education as a whole in relation to changing planetary conditions.

WHY IT MATTERS

We know a great deal about the challenges facing education. Yet a growing mismatch remains between what education systems are designed to cultivate and what changing planetary conditions demand. As ecological disruption, social fragmentation, and technological change reshape the conditions of collective life, education systems are being asked to prepare people for realities they were not designed to navigate. Yet standardized achievement, individual success, and economic competitiveness continue to shape what is valued and measured, while systems thinking, ethical judgment, collective action, ecological understanding, care, and civic imagination remain peripheral in many contexts.

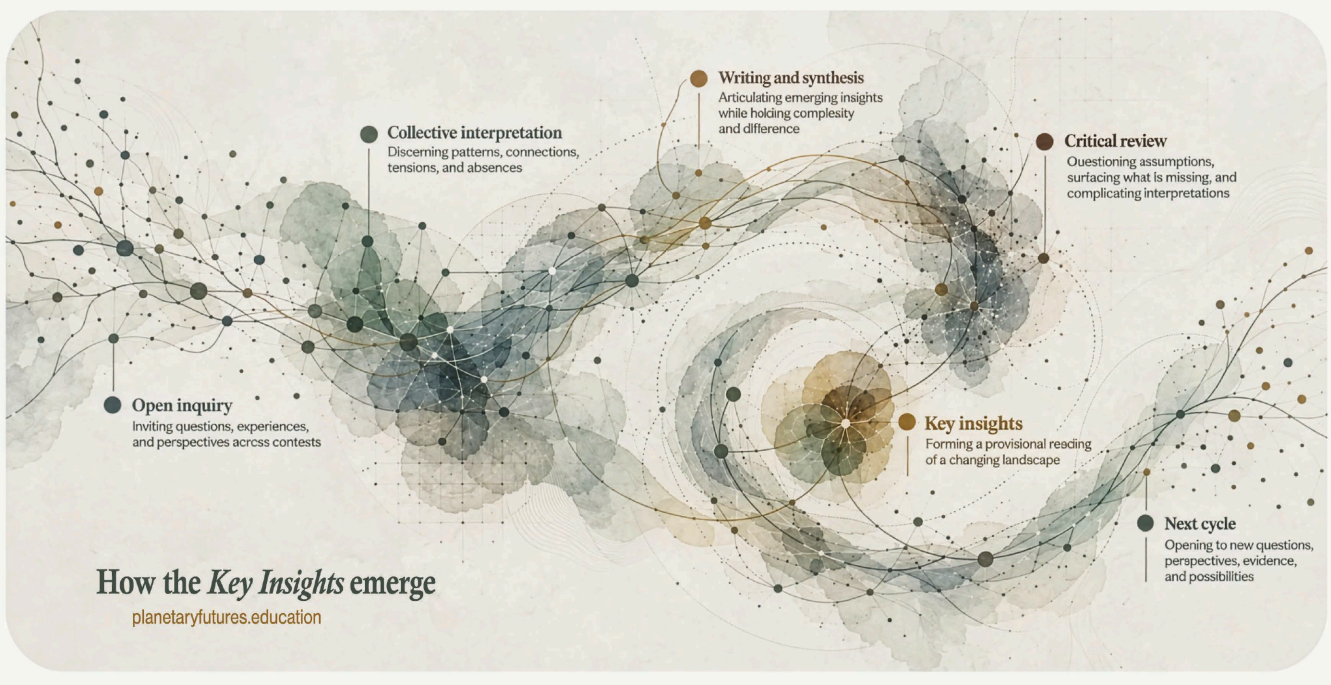
As a result, education systems often struggle to support the collective learning and action needed to navigate planetary change and, at times, continue to reproduce the very conditions they seek to transform. This mismatch is not simply a question of curriculum or pedagogy. It extends to the

purposes, structures, relationships, and institutional arrangements through which education is organized and decisions are made. Educators across formal and non-formal settings—including teachers, faculty, and community educators—are central to these processes as knowledge holders and co-creators of educational change. Their agency, voice, and meaningful participation in decision-making are integral to transformation, as are the professional autonomy and conditions that enable them to teach, learn, and act collectively.

What is at stake, therefore, is not simply whether education adapts to a changing world, but what kinds of worlds learning helps make possible. The ten insights illuminate this challenge from different but interconnected perspectives, pointing toward shifts in purposes, relationships, practices, and systems that can bring education into closer alignment with the conditions for just, regenerative, and resilient planetary futures.

Key Insights is designed not only to document educational change, but to help move it. By bringing knowledge, practice, and diverse perspectives into conversation, it challenges inherited assumptions, makes consequential connections visible, and opens possibilities for reimagining how education is understood, governed, and enacted. It invites policymakers, educators, researchers, and communities to carry these insights into the decisions, relationships, and practices through which education is continually made and remade.

HOW THE KEY INSIGHTS EMERGE



Key Insights is grounded in the premise that no single discipline, institution, region, or knowledge tradition can fully understand the educational transformations shaping planetary futures. The challenges facing education unfold across ecological, social, cultural, technological, and political

systems. Understanding them requires an equally interconnected process of inquiry—one capable of bringing different forms of knowledge and experience into relationship across disciplinary, geographic, institutional, and epistemic boundaries.

The initiative grew out of the Global Futures-Oriented Research Collective on Education for Sustainability (G-FORCES), a U.S. National Science Foundation (NSF)–supported AccelNet program led by Iveta Silova, Gustavo Fischman, and Andrea Weinberg at Arizona State University. G-FORCES was designed to create a network of networks for strengthening international collaboration across education and planetary sustainability. *Key Insights* extends this model through a distributed collaboration anchored at Arizona State University through the Education for Planetary Futures Research Collaborative at Mary Lou Fulton College for Teaching and Learning Innovation and the Julie Ann Wrigley Global Futures Laboratory. It works in collaboration with the UNESCO-MOST BRIDGES Coalition and partners across academic, policy, and practice settings. Together, these relationships provide the organizational foundation for recurring cycles of collaborative inquiry, synthesis, and engagement across regions and knowledge traditions.

The ten insights took shape through a multi-stage process of open inquiry and collective sensemaking, inspired in part by the *10 New Insights in Climate Science* (Future Earth et al., 2025). An open global survey invited researchers, educators, policymakers, practitioners, and others working across education and planetary futures to identify consequential shifts, questions, and developments. The survey generated 94 submissions from participants representing diverse geographic, institutional, and professional settings. These contributions were then brought into dialogue with relevant research and practice to identify wider patterns, connections, tensions, and absences among perspectives and contexts.

From this wider landscape, the editorial team worked collectively to interpret and prioritize the insights that anchor this report. Prioritization unfolded through dialogue, with attention to the significance of proposed developments, the connections they revealed across submissions and fields, their grounding in relevant scholarship and practice, and their potential to bring overlooked questions and possibilities into view. Interdisciplinary writing teams then developed each insight by bringing scholarship, practice, and situated knowledge into conversation. Illustrative cases were identified through this collaborative process for their ability to ground the pathways in particular places and practices, and were revisited through successive rounds of review to deepen contextual understanding and strengthen the care and accuracy with which they were represented. Dialogue within writing teams, across the wider network, and with external reviewers expanded the knowledge base, brought overlooked perspectives into view, and continued to reshape the insights. Differences were treated as generative openings for questioning assumptions, complicating interpretations, and deepening collective understanding.

The process is guided by four core commitments:

- **Epistemic openness**—engaging multiple ways of knowing while maintaining analytical rigor.
- **Contextual and cultural diversity**—bringing different places, experiences, and educational realities into conversation.

- **Methodological reflexivity**—critically examining the assumptions, perspectives, and frameworks that shape what becomes visible, consequential, or overlooked.

- **Relevance to policy and practice**—connecting collective inquiry with the decisions, practices, and conditions shaping education.

The resulting ten insights are neither exhaustive nor ranked; they reflect some of the consequential patterns that became visible through this cycle of inquiry. Future cycles will revisit and extend this reading as participation, evidence, and planetary conditions change. This process is necessarily partial. No cycle of inquiry can encompass the full range of educational knowledge, experience, and practice across regions and traditions, and what becomes visible is shaped by who participates, which evidence is available, and the conceptual and methodological lenses brought to the inquiry. Gaps and absences identified through review become questions for subsequent cycles of inquiry.

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01

BEYOND GROWTH

Modern education systems were built for an era of industrial expansion that is now exceeding planetary limits.



KEY MESSAGES

- Education systems are deeply embedded in prevailing economic and political models, often reproducing the logics and priorities of extractive development.
- Shaped by carbon-intensive growth and resource extraction, the dominant development paradigm increasingly destabilizes Earth's biophysical systems and social foundations.
- Education's continued alignment with growth-oriented development constrains its potential to support more just, regenerative, and ecologically grounded futures, calling for a broader reorientation of what education is for, what it values and measures, and whose knowledge shapes learning.

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INSIGHT

The current trajectory of global development is fundamentally unsustainable. A model historically powered by fossil energy, resource extraction, and the pursuit of economic growth for short-term gain is now destabilizing the very systems that sustain all life. More than fifty years ago, *The Limits to Growth* (1972) warned that continued exponential growth in population and industrial production on a finite planet risked ecological and economic overshoot and decline. The risks it identified are increasingly evident. The 2025 *Planetary Health Check* reports that seven of nine planetary boundaries have now been breached (Planetary Boundaries Science, 2025). The cascading disruption of interconnected systems—climate, biodiversity, water, food, political, and social—exposes the limits of a global architecture increasingly struggling to address the polycrises it has helped produce.

The post-war development architecture—organized through multilateral institutions, foreign aid, modernization agendas, and a growing commitment to economic growth as a measure of progress—is under increasing strain. Official development assistance has fallen sharply, with cuts concentrated among several of the largest donors, while geopolitical tensions, rising defense and security spending, fiscal pressures, and shifting domestic priorities are reshaping development finance. Multilateral channels are also under growing pressure, including substantial reductions in core funding to UN institutions (OECD, 2026). At the same time, long-standing definitions of progress and prosperity are being questioned, including the continued reliance on GDP as a dominant measure of societal progress despite its inability to account adequately for social and ecological wellbeing (Nature, 2025). A development model long presented as a pathway toward global equity and sustainability has not prevented ecological overshoot or persistent social inequities. Humanity is living outside the safe and just corridor for people and the planet (Rockström et al., 2021).

Education became closely entangled with industrial and growth-oriented economies, including through labor-force preparation and the organization of schooling around competition and individual achievement. Influential critiques of capitalist schooling have documented how education can reproduce labor-market hierarchies and prevailing economic relations (Bowles & Gintis, 1976). Human-capital theory further strengthened the framing of education as an investment in individual productivity and economic growth (Schultz, 1961; Becker, 1964). This framing remains influential in contemporary development policy, where education and skills continue to be positioned as drivers of employment, productivity, and economic growth (World Bank, 2026). In higher education, these connections extend across curriculum, research, institutional operations, governance, and relationships with wider society (McCowan, 2025). Efforts to "green" education can remain within assumptions of petroculture and perpetual growth when innovation, technological solutions, and green growth are pursued without deeper reconsideration of economic expansion, educational purpose, and human–nature relations (for related critiques and alternative framings, see Karsgaard & Shultz, 2025; Kwauk & Casey, 2021; Silova et al., 2025).

Importantly, the development paradigm is not only an economic model; it is also an organizing framework for how education is understood and governed. Sterling (2001, 2024) traces how mechanistic and instrumental assumptions—privileging fragmentation, prediction, control, and measurable outcomes—have become embedded in educational thought and practice. These assumptions resonate with the human-capital and modernization logics through which education has

been positioned in relation to economic growth, productivity, employment, and societal progress (Schultz, 1961; Becker, 1964; World Bank, 2026). Together, these logics can narrow educational purpose toward standardized and economically legible outcomes while marginalizing other purposes and pathways, particularly those rooted in care, cultural renewal, land-based practices, relationality, and more-than-human relations. They also leave deeper questions about what education is for—and for whom—less visible.

Education's entanglement with growth-oriented development can reinforce patterns that contribute to ecological overshoot while undermining conditions for human and more-than-human flourishing. To operate within the safe and just space for humanity (Raworth, 2017; Rockström et al., 2021), education must be reconfigured as an essential infrastructure for sustaining life within ecological limits and across biocultural diversity—the interconnected vitality of ecosystems, languages, lifeways, and knowledge systems. Such reorientation also calls for greater epistemic plurality, bringing Earth system science into dialogue with Indigenous, local, land-based, and relational knowledge systems while respecting their distinct foundations and forms of validation. These knowledge systems offer distinct ways of understanding ecological change, socioecological relationships, adaptation, and responsibility to place, while their encounters can expand the possibilities available for responding to planetary change (Tengö et al., 2014; IPCC, 2022).

These conditions mark a moment of rupture and reorientation. As the limits of growth-centered development become increasingly visible, education is implicated both in reproducing existing systems and in opening possibilities for alternatives. Reorientation reaches beyond improving efficiency within existing arrangements; it involves deeper shifts in educational purposes, relationships, institutions, and measures of success. Education can contribute to collective resilience by strengthening interdependence, sustaining plural ways of knowing and living, and supporting the collective learning and action needed to navigate change within the limits of a shared and finite planet.

This reorientation is already taking shape across diverse contexts through educational practices grounded in reciprocity, resilience, and more-than-human ethics. These are situated responses to changing conditions and vital resources for rethinking education’s purposes and possibilities. Read together, they suggest that alternatives to growth-centered education do not follow a single model; they emerge through different histories, relationships, struggles, and ways of knowing. The question is not whether change is possible, but whether we are willing to confront the political, economic, and epistemic forces that keep education tethered to a growth-centered paradigm that is destabilizing the conditions of life itself.

01 Pathways for transformation

These pathways outline the foundational shifts required to move education beyond the development paradigm and toward just, regenerative, and life-sustaining futures.

01 **Decouple education from economic growth imperatives.** Education systems must move beyond growth-aligned measures of educational progress toward measures of planetary wellbeing, ecological integrity, and intergenerational equity.

02 **Realign education systems with planetary and social boundaries.** Embed these boundaries across curriculum, infrastructure, procurement, governance, and daily operations, reflecting the realities of a finite planet and the conditions for collective survival.

03 **Strengthen public investment and participatory, place-based governance.** Provide sustained public financing and shared decision-making arrangements that support educational equity, social and ecological resilience, and long-term collective wellbeing.

04 **Reorient education toward relational and regenerative futures.** Center diverse knowledge systems, interdependence, collective wellbeing, and long-term responsibility to people, place, and planet.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illuminate different dimensions of moving beyond growth-centered development: redefining prosperity, reorienting educational purpose, and sustaining plural and autonomous ways of learning and living.

Reframing Prosperity: Doughnut Economics in Education

The Doughnut Economics Action Lab (DEAL) is helping schools, universities, and cities rethink education beyond GDP and endless economic growth. Inspired by Kate Raworth's Doughnut Economics framework, participating institutions redesign learning around ecological ceilings, social foundations, and the question of what it means to thrive within planetary limits. Rather than preparing learners primarily for economic productivity, these initiatives reposition education as a foundation for regenerative and distributive futures.

Learn more

https://doughnuteconomics.org

Learning Beyond Growth: Education for Degrowth

Degrowth education asks a fundamental question: what might education become if economic growth were no longer its organizing horizon? Initiatives such as Research & Degrowth create learning spaces that connect ecological economics and political ecology with environmental justice, activism, and transformative practice, exploring societies organized around sufficiency, care, equity, ecological regeneration, and collective wellbeing. These approaches invite learners to question growth-centered assumptions while imagining and experimenting with ways of living well within planetary limits. Degrowth does not mean "less education"; it calls for a deeper reorientation of its purposes—from preparing learners for growth-dependent economies toward cultivating the knowledge, relationships, and collective agency needed for just and regenerative futures.

Learn more

Research & Degrowth. *Education.* https://degrowth.org/projects/education/

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Sumak Kawsay (Buen Vivir): Reimagining Development and Its Contradictions

Sumak Kawsay (Buen Vivir) offers an influential challenge to development understood primarily through continuous economic growth. The concept encompasses diverse Andean Indigenous traditions, intellectual currents, and political struggles that foreground collective wellbeing, reciprocity, cultural plurality, and relationships with the living world. In Ecuador, these ideas entered the 2008 Constitution and subsequently shaped debates over educational purpose, intercultural bilingual education, teacher preparation, and relationships among knowledge, community, and nature. Their institutionalization has also exposed deep tensions: scholars and Indigenous movements have questioned whether state interpretations of Buen Vivir transform dominant development logics or accommodate them within continuing extractivism and centralized governance. These tensions make Buen Vivir especially instructive for education. Moving beyond growth reaches beyond adopting new language or frameworks; it raises deeper questions about who defines educational purpose, whose knowledge shapes learning, and whether institutions themselves are transformed in the process.

Learn more

FLACSOAndes — Sumak Kawsay https://www.flacsoandes.edu.ec/agora/documentos-por-tema/sumak-kawsay

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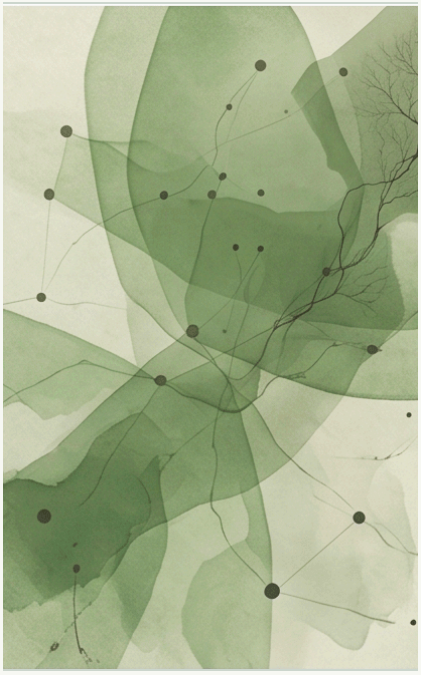
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02

LIVING IN INTERDEPENDENCE

Interdependence underpins human and planetary wellbeing, but remains marginal in education systems.



KEY MESSAGES

- Interdependence is a fundamental condition of biophysical, ecological, and social life. All life exists within complex, dynamic relationships across species, scales, and generations. Education systems need to engage more fully with these relationships to address planetary sustainability challenges.
- Despite growing understanding of the interconnected nature of Earth's systems, many education systems remain rooted in individualism, control, and separability—paradigms misaligned with the conditions for sustainable planetary futures.
- Education that centers interdependence can strengthen ecological awareness, collective resilience, civic engagement, and the forms of learning and action needed to live well within planetary boundaries.
- Reorienting education around interdependence means learning with and from Indigenous, land-based, and other relational knowledge traditions that have long placed reciprocity, responsibility, and relationships at the heart of life and learning, while respecting their distinct foundations and the authority of the communities that sustain them.

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INSIGHT

Human societies are embedded within a complex, tightly coupled planetary system in which biophysical, ecological, and social processes are fundamentally interdependent. Earth system science—particularly the planetary boundaries framework—shows that human activity has become a dominant force shaping planetary dynamics (Rockström et al., 2009; Steffen et al., 2015; Richardson et al., 2023). Climate regulation, biosphere integrity, and land-system change interact in nonlinear ways, allowing disruption in one domain to cascade across others. Human wellbeing is inseparable from these dynamics: it depends on social foundations—including health, education, equality, political voice, and access to essential resources—whose provision and distribution both shape and are shaped by ecological pressures (O'Neill et al., 2018). With seven of nine planetary boundaries already breached (Stockholm Resilience Centre, 2025), strengthening societal understanding of these ecological and social interdependencies has become urgent—and education has a central role to play.

Yet formal education systems have been slow to respond to this growing understanding of systemic interdependence, even as interdependence continues to be learned and sustained beyond formal institutions—in families, communities, and social movements. Many formal systems remain locked into 20th-century paradigms that privilege individualism, competition, disciplinary silos, and assumptions of unbounded economic growth (Silova et al., 2025; Sterling, 2024; Orr, 2023). These structures can detach learning from ecological realities and reinforce a view of the learner as autonomous and separate from the systems that sustain life. They can also constrain learners' ability to understand and respond to complex socio-ecological challenges, including climate disruption, biodiversity loss, and cascading risks across sectors and scales. The report by Future Earth et al. (2024) documents the interconnected character of these risks.

Empirical research underscores the depth of this misalignment. Cross-national studies reveal that countries with higher levels of educational attainment—measured by secondary completion rates and proficiency scores—also tend to report higher per capita CO_2 emissions (Komatsu et al., 2019, 2020; Rappleye et al., 2024). While this relationship does not establish that education itself causes ecological harm, it challenges the assumption that expanding education under prevailing models necessarily produces more sustainable societies. Related research shows that countries achieving high levels of human development often do so at the expense of ecological sustainability, highlighting the structural trade-offs embedded in prevailing development systems (O'Neill et al., 2018).

Rather than consistently preparing societies to live within planetary boundaries, many education systems continue to reproduce cultural ideals of autonomous individualism, self-reliance, mastery, and control that are difficult to reconcile with conditions of ecological interdependence. At the same time, research in cultural psychology finds associations between interdependent self-construals—understanding oneself in relation to others and the natural world—and stronger environmental concern and values, as well as more frequent pro-environmental behaviour (Tam, 2025; Bretter & Schulz, 2025; Duff et al., 2022). Together, these findings point to a deeper tension within dominant education systems: they continue to cultivate values associated with industrial-era notions of progress while giving less attention to the relational orientations and collective forms of agency needed for

planetary resilience. Unless education reexamines its core assumptions about who we are and how we relate to one another and the Earth, it risks reproducing some of the very logics implicated in the ecological crisis.

Education that centers interdependence offers an alternative—one that prepares learners to live well within planetary boundaries while realigning human development with Earth system stability and justice (Rockström et al., 2021). A growing body of research and scholarship suggests that pedagogies grounded in relationality—including place-based, food-systems, multispecies, and experiential approaches—can foster ecological literacy, systems thinking, relational awareness, and pro-environmental orientations (Rappleye et al., 2024; Rappleye & Komatsu, 2026; Bustillos Morales & Zarabadi, 2024; Ardoin et al., 2023; Verlie, 2021; Fu & Komatsu, 2024; Gravett et al., 2024; Common Worlds Research Collective, 2020). Complementing these approaches, research on transformative skills highlights systems thinking, anticipatory thinking, empathy, reflexivity, and relational responsibility as essential foundations for navigating complex societal transitions (Redman & Wiek, 2021; Barron et al., 2021; Kwauk & Casey, 2022). Together, these approaches cultivate not only cognitive understanding but also the capacity to recognize, sustain, and act within webs of relation, fostering collective flourishing within Earth's limits.

Contemporary efforts to center interdependence in education do not begin on new ground. Indigenous, land-based, community-rooted, and other relational knowledge traditions have long placed relationships, reciprocity, and responsibility at the heart of life and learning, despite their historical marginalization within dominant educational paradigms. Education can learn with and from these traditions only by respecting their differences, the contexts from which they arise, and the authority of the communities that sustain them. Their knowledge cannot be detached from particular places, histories, relationships, and responsibilities or collapsed into a single framework of relationality. This contextual grounding is central to many Indigenous, land-based, and community-rooted traditions, in which knowledge is understood as co-produced through reciprocal relationships with land, ancestors, and more-than-human kin (e.g., Kimmerer, 2020; Styres, 2019; Smith et al., 2019; Bawaka Country, 2016; Tuck & McKenzie, 2015).

Distinct relational understandings are also articulated across African philosophies of Ubuntu, which emphasize personhood through relationships (e.g., Cossa, 2020; Le Grange, 2018); Confucian and Buddhist thought, which highlight reciprocity, harmony, and the interdependence of human and more-than-human worlds (e.g., Abe, 2014; Komatsu & Rappleye, 2020; Sevilla, 2016); and Latin American knowledge systems and decolonial thought, which foreground relational ontologies and pluriversal politics (e.g., Escobar et al., 2024; de la Cadena & Blaser, 2018). Relational thinking also has deep roots within Western philosophical traditions, where the interconnection of thought, matter, and experience has long been a central concern (e.g., Spinoza, 1677/1996; Wittgenstein, 1953/2001; Bateson, 1972; Barad, 2007; Haraway, 2016; Latour, 2018). These traditions are not equivalent, but in different ways they challenge the assumption of an autonomous, separable human subject. Together, they demonstrate that relationality is neither new nor singular and broaden the conceptual resources available for reimagining education.

Taken together, this evidence suggests that centering interdependence does more than add ecological content to existing curricula. It reshapes learning across multiple, interacting levels. For individuals, it changes how learners understand themselves in relation to other people, places, and living systems.

Within groups and communities, it supports shared inquiry, reciprocal responsibility, and collective action. Within institutions and education systems, it directs attention to the relationships among actors, structures, functions, and feedback processes that shape how knowledge is produced, decisions are made, and connections with communities and places are sustained (Faul & Savage, 2023). At the societal level, it supports collective learning across differences, sectors, scales, and generations. Research suggests that relational and participatory approaches can support civic engagement (Ardoin et al., 2023), psychosocial resilience in climate change education (Ojala, 2016), and transformative agency in community-based learning for sustainability (Macintyre et al., 2018). Cross-national analyses also find associations between more interdependent cultural orientations and lower ecological footprints and per capita CO_2 emissions (Komatsu et al., 2019, 2020). Centering interdependence, then, is not simply about what learners know, but about how education situates people, communities, and institutions within the relationships through which collective life and planetary futures are made.

02 Pathways for transformation

01 **Reorient educational frameworks around interdependence and epistemic plurality.** Embed mutuality, reciprocity, and relationality across curricula, pedagogy, and assessment, while ensuring that Indigenous, land-based, ecological, spiritual, and other relational knowledge traditions are engaged on their own terms and in relation to the communities and contexts that sustain them.

02 **Integrate ecological and systems thinking** into core curricula through place-based, experiential, and transdisciplinary pedagogies that connect learners to their local and planetary contexts.

03 **Support educators in advancing relational change.** Reorient teacher education and professional learning toward relational, affective, ecological, and systems understanding. Protect educators' professional autonomy and meaningful participation in decision-making, and provide the time, networks, resources, and working conditions needed to translate this learning into practice.

04 **Transform educational institutions into relational learning systems.** Reconfigure schools, universities, and community learning spaces to support collective inquiry, participatory decision-making, institutional learning, and reciprocal relationships with communities, places, and more-than-human life—from food systems and school grounds to community partnerships and multispecies learning spaces.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illustrate how interdependence is already reshaping educational practice. While they emerge from different cultural and institutional contexts, each demonstrates how learning can cultivate relationships of reciprocity, care, and collective responsibility that strengthen our capacity to live well within an interdependent world.

Japan's *Shokuiku*: Learning Interdependence Through Food Systems

Japan's national *shokuiku* (food education) policy and associated school practices reimagine food as more than nutrition. Together, they promote healthy eating, while cultivating interdependence, gratitude toward nature, cultural continuity, and awareness of the relationships linking food production, consumption, and sustainability. Through growing, preparing, sharing, and reflecting on food, learners experience these relationships in everyday life, recognizing food as part of a living web connecting people, culture, and the more-than-human world. In this way, *shokuiku* embeds relational understanding into everyday educational practice, fostering reciprocity, collective responsibility, and care for both local communities and planetary wellbeing.

Learn more

Rappleye, J., Komatsu, H., & Nishiyama, S. (2025). School food, sustainability, and interdependence: Learning from Japan's shokuiku? *Oxford Review of Education, 51*(1), 129–147. https://doi.org/10.1080/03054985.2023.2296097

Common Worlds Research Collective: Learning to Become with the World

The Common Worlds Research Collective reimagines education around the understanding that humans are inseparable from the more-than-human worlds they inhabit. Rather than treating nature as an external object to be studied, Common Worlds pedagogies invite learners to learn with places, animals, plants, materials, and communities through relationships of care, reciprocity, and shared responsibility. Their work calls for a shift from "learning about the world in order to act upon it" toward "learning to become with the world," cultivating the relational orientations needed to live well within an interconnected and changing planet. Across research, teacher education, and pedagogical practice, the Collective demonstrates how interdependence can become a foundation for educational transformation.

Learn more

Common Worlds Research Collective website: https://www.commonworlds.net

Common Worlds Research Collective. (2020). Learning to become with the world: Education for future survival. *UNESCO Futures of Education Ideas Series.* UNESCO. https://unesdoc.unesco.org/ark:/48223/pf0000375141

Learning Interdependence Through Ecosystem Restoration in Somanga, Tanzania

In the coastal community of Somanga in southern Tanzania, community organizations, university researchers and students, local leaders, and government actors learn together through the restoration of degraded coral reefs and mangroves. Using participatory action research, community members bring situated knowledge of tidal rhythms, fish-breeding cycles, coral behavior, and mangrove propagation into dialogue with scientific knowledge and research practices, becoming knowledge producers and conservation leaders rather than simply beneficiaries. Their collective work has resulted in nearly 7,000 transplanted corals and more than 17,000 mangroves planted and cared for, while restoration knowledge has spread to neighboring communities (Mazigo et al., 2023; Mazigo & Mwita, 2025; Vergotine et al., 2025). Mazigo and McCowan (2025) relate the Somanga experience to Ubuntu and wider Bantu philosophies of relationality, showing how climate education can cultivate reciprocal learning, ecological care, and collective responsibility by learning and acting within the relationships among human livelihoods, marine life, and coastal ecosystems.

Learn more

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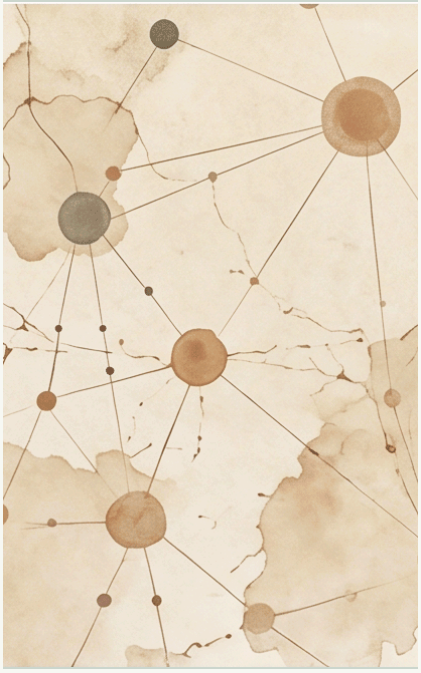
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03

MANY WORLDS, MANY KNOWLEDGES

Indigenous and Earth-based knowledge systems offer vital foundations for regenerating relationships among people, place, and planet.



KEY MESSAGES

- Dominant systems of knowledge and development have often separated human learning from the living Earth, weakening ethical and relational foundations for planetary wellbeing.
- Indigenous and Earth-based knowledge traditions offer diverse, place-based understandings of mutuality—grounded in reciprocity, responsibility, and care—that can support ecological regeneration and social cohesion.
- Education systems can cultivate ecological humility, ethical awareness, and interdependence by learning through sustained and reciprocal relationships with Indigenous and Earth-based knowledge holders.
- Bridging Indigenous, spiritual, ancestral, scientific, and technological knowledge traditions—while respecting their differences, custodial authority, and protocols of knowledge sharing—can support culturally grounded and ecologically responsive ways of living within Earth's limits.

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2026 · Version 1.0

INSIGHT

The planetary crisis is not only environmental—it is existential. It reflects a deeper rupture between dominant models of human development and the living systems that sustain life. Many modern knowledge systems, shaped by industrialization and the pursuit of economic growth, have reinforced this separation. Within them, some influential scientific paradigms have often privileged prediction, control, and productivity while marginalizing relational, spiritual, and ethical ways of knowing through which communities have understood and sustained their relationships with the natural world. This separation of learning from the living Earth has undermined both ecological integrity and human wellbeing.

These patterns of separation and marginalization have also shaped whose knowledge is recognized, whose authority is acknowledged, and which ways of knowing enter educational institutions. This insight therefore concerns more than introducing relational or ecological content into education: it asks who has the authority to define knowledge, on what terms knowledge may enter educational settings, and what responsibilities institutions assume when engaging with knowledge held by particular communities.

Responding to these intertwined ecological and epistemic ruptures requires rethinking how humanity understands its place and responsibilities within Earth's ecological community. One conceptual resource for this reorientation is Rogers's (1980) idea of organismic wisdom, which describes an embodied orientation toward growth arising from openness to experience. Here, we extend the concept beyond the individual to the adaptive, relational, and regenerative processes through which living systems sustain life. In this expanded ecological sense, organismic wisdom does not imply that ecosystems are always harmonious or naturally balanced. Rather, it directs attention to responsiveness, reciprocity, and interdependence.

Education must therefore shift from the pursuit of mastery over nature toward learning how to participate responsibly within Earth's living systems. This entails repositioning education as a participatory process that recognizes humanity as one participant in an intricate web of planetary reciprocity. Many Indigenous and Earth-based cosmologies have long understood knowledge not as a possession but as a practice of relationship, and learning as carrying ethical responsibilities to sustain the conditions that make life possible. Education pursuing this relational reorientation is therefore indebted to these traditions rather than discovering relationality anew. These traditions are neither equivalent nor reducible to a single understanding of relationship. They arise from distinct histories, communities, places, and responsibilities, including different protocols governing how knowledge is held and shared. Nor can they be reduced to environmental knowledge: they also concern relationships among people, generations, communities, and institutions, including obligations of care, reciprocity, justice, cultural continuity, and collective responsibility.

Across diverse contexts, Indigenous and Earth-based knowledge systems bring ecological observation into relationship with spirituality, ethical reciprocity, and collective responsibility. They offer distinct ways of understanding how human wellbeing is connected with the vitality of living systems. Thich Nhat Hanh's teaching "I have arrived, I am home" expresses dwelling on Earth with awareness as a practice of belonging and responsibility (Nhat Hanh, 2011). This sense of homecoming can cultivate compassion,

ethical restraint, and care, forming an inner foundation for ecological action. Without equating these traditions, this Buddhist account of belonging can be brought into dialogue with particular Indigenous teachings concerned with relational responsibility, reciprocity, and the more-than-human world.

These relational orientations take distinct forms in different communities and places, bringing close ecological observation into relationship with spiritual awareness and collective responsibility. In the forests of South Bengal, elephants are honored as living gods, their presence shaping patterns of coexistence that recognize mutual dependence between species (Green Hub Fellows, 2024a). In Assam, forests are treated as healers, central to both ecological balance and community health (Green Hub Fellows, 2024b). In the Brazilian Amazon, the Kayapó people steward more than nine million hectares of rainforest through governance systems that weave ancestral knowledge, ceremonial practice, and collaboration with scientific partners (Garcia et al., 2024; International Conservation Fund of Canada, 2024). Together, these examples illustrate how cultural relationships and ecological stewardship can reinforce one another in ways that differ fundamentally from purely market-based or technocratic approaches.

Such insights reveal that the work of regeneration is as much cultural and ethical as it is ecological. Education rooted in Indigenous and Earth-based ecologies can make this ethical dimension visible, reconnecting knowledge with the values of reciprocity, restraint, and reverence that sustain life within planetary boundaries. Similar insights arise in spiritual ecology, which understands environmental care as both an inner and outer practice. When learners cultivate mindful awareness—through practices such as breathing with trees, attentive walking, or contemplations of interbeing—they may experience ecological connection as embodied rather than purely abstract. Such experiential practices may complement land- and water-based pedagogies by cultivating presence, gratitude, and relational responsibility. At the same time, their realization depends not only on pedagogy, but also on the availability of safe, biodiverse, and accessible environments. In many urban and marginalized contexts, limited access to green and living systems constrains the possibility of land-based and relational learning, underscoring the importance of spatial justice and supportive infrastructure. These approaches can also bring ecological and planetary dimensions into conversation with social-emotional learning, trauma-informed practice, and relational pedagogy.

Much of this learning already takes place beyond formal education—in families, communities, ceremonial practices, land and water stewardship, and intergenerational knowledge transmission. The question is therefore not simply how schools can incorporate such knowledge, but how formal education systems can support and remain accountable to living knowledge practices without displacing, appropriating, or institutionalizing them on external terms.

Within formal education, these relationships cannot be sustained through curriculum change alone. Teachers and other education professionals play a crucial role in shaping how institutions engage with Indigenous and Earth-based knowledge, but they should not be expected to undertake this work individually or to speak on behalf of knowledge holders. They need professional autonomy, time, sustained learning, appropriate resources, and institutionally supported opportunities to build accountable relationships with custodial communities. Responsibility for ethical engagement must therefore be shared across educators, institutional leaders, policymakers, and the communities whose knowledge is involved.

UNESCO's *Greening Curriculum Guidance* (2024) supports locally grounded, participatory, and action-oriented climate education, including recognition of Indigenous knowledge and approaches relevant to local mitigation and adaptation. Relational, Indigenous, and place-responsive scholarship further emphasizes that re-grounding education begins with restoring relationships. Liu-Nelson (2026), for example, explores finding one's relations with Land, learning collectively, and reconsidering what counts as knowledge through land- and water-responsive pedagogy. This vision resonates with Smith et al. (2019) and Styres (2019), who affirm that knowledge itself is inseparable from place, spirit, and responsibility. Together, these approaches reposition education not as an abstract pursuit of information but as an embodied, relational practice—one that nurtures ecological consciousness, collective responsibility, and the ability to live well within Earth's limits.

Bringing Indigenous and Earth-based knowledge traditions into dialogue with scientific and technological knowledge can contribute to planetary regeneration. This does not mean absorbing Indigenous knowledge into dominant scientific or educational frameworks or treating different traditions as interchangeable. It means creating conditions in which distinct knowledge traditions can meet without being separated from their communities, responsibilities, places, or protocols. Such dialogue must be grounded in ethical partnerships with custodial communities, respect for cultural sovereignty and knowledge-sharing protocols, and community co-governance that guards against extractive or tokenistic inclusion. When relationships among knowledge traditions are ethically governed, they can create a dialogue across difference—one in which data and spirit, measurement and meaning, can be brought into conversation without assigning them exclusively to any one tradition or requiring epistemic convergence. This approach echoes the pluriversal vision articulated by scholars such as Le Grange (2018) and Escobar et al. (2024), who remind us that many worlds—and many ways of knowing—exist within the one Earth system we share.

Education, positioned at this intersection, can become a force of renewal, drawing on the analytical, ethical, relational, and imaginative contributions of multiple knowledge traditions. In this reimagined paradigm, learning becomes a planetary process—an act of reciprocity with the systems that sustain us, where, as Kimmerer reminds us, "all flourishing is mutual" (Kimmerer, 2020, p. 15). That mutuality extends across generations. Drawing on the *Seventh Generation principle,* Rodríguez-Fransen (2025) frames action in the present as a responsibility to safeguard the wellbeing of those yet to come. This principle echoes the growing call for *unitive justice* (Mustakova, 2023) and intergenerational ecological responsibility, grounding education in an ethics of care that extends across time, species, and the web of life itself. Such an education brings Earth system science into dialogue with ancestral and place-based knowledge traditions on terms shaped by and accountable to the communities that sustain them. In doing so, it can help humanity live responsibly within Earth's ecological limits while sustaining the conditions in which human and more-than-human life can flourish.

03 Pathways for transformation

01 **Recenter education within Earth's living systems.** Align education goals, curricula, and policies with the principles of reciprocity and regeneration that sustain life within planetary boundaries.

02 **Enable Indigenous and Earth-based knowledge systems to shape education on their own terms.** Recognize Indigenous knowledge holders and custodial communities as authorities, co-designers, and co-governors of learning systems; protect cultural and intellectual sovereignty; and respect protocols concerning what knowledge may be shared, how, and with whom.

03 **Bridge knowledge traditions through ethical dialogue.** Support community-governed research and practice that bring Earth system science, ethics, spiritual traditions, and Indigenous cosmologies into relationship without requiring epistemic convergence.

04 **Enable educators to learn and work alongside Indigenous and Earth-based knowledge holders.** Establish sustained, adequately resourced partnerships in which custodial communities retain authority over what may be shared, how it is interpreted, and how it enters educational settings. Provide teachers and other education professionals with time, preparation, professional autonomy, and institutional support to participate in these relationships, while ensuring that knowledge holders receive appropriate recognition and compensation.

05 **Transform learning environments into regenerative ecosystems.** Reimagine schools, universities, and community spaces as living systems that embody care, reciprocity, and interdependence among people, place, and planet.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illustrate how the pathways outlined above are already being enacted and articulated in diverse cultural and ecological contexts. Rather than serving as models to replicate, they demonstrate how educational transformations can take different forms while remaining grounded in local knowledge, relationships, and priorities.

Orang Suku Laut: Traditional ecological knowledge for climate resilience

The Orang Suku Laut, Indigenous sea people of Indonesia's Riau Islands, have developed rich systems of traditional ecological knowledge through generations of close observation of marine ecosystems. By reading wind patterns, ocean currents, bird and fish movements, tides, and seasonal changes, they anticipate environmental change and adapt their mobility and livelihoods in response to climate-related hazards. Their knowledge integrates ecological observation, cultural beliefs, and adaptive practices, demonstrating that resilience can emerge from long-term reciprocal relationships with the sea alongside—and extending beyond—formal technological forecasting. Today, however, rapid modernization, changing government policies, and environmental degradation threaten both these ways of life and the intergenerational transmission of this knowledge. The Orang Suku Laut demonstrate that climate resilience is cultivated through sustained relationships with place, learning across generations, and reciprocal care for marine ecosystems, offering powerful lessons for education that reconnects learning with ecological stewardship and planetary wellbeing.

Learn more

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Merri Merri Creekulum (Australia): Learning with Country

The Merri Merri Creekulum reimagines schooling by transforming the Merri Merri Creek on Wurundjeri Country into a living classroom where Indigenous knowledge, art, science, and community learning come together. Developed in partnership with the Wurundjeri Woi Wurrung Cultural Heritage Aboriginal Corporation, educators, artists, scientists, and local families, the program is grounded in Care for Country, deep listening, and reciprocal relationships with the more-than-human world. Rather than positioning Indigenous knowledge as an addition to the curriculum, the Creekulum reorganizes learning around Country itself, bringing together multiple knowledge systems while cultivating ecological humility, relational responsibility, and shared stewardship. It demonstrates how education can move from learning *about* the world to learning *with* the world.

Learn more

Merri Merri Creekulum: https://merri-creekulum.squarespace.com

Flynn, A. (2024). *Recuperating-with the world: Composting education with sympoietic relationalities* [Unpublished doctoral dissertation]. The University of Melbourne.

Obal and Budi: Reimagining Planetary Sustainability Through Relational Philosophies

The relational philosophies of *obal* in Kazakhstan and *budi* in Malaysia offer different but resonant ways of reimagining sustainability as an ethical, cultural, and relational practice rather than primarily a technical challenge. They emphasize reciprocity, humility, care, and responsibility to future generations, illustrating that sustainability is learned through relationships with people, place, and the more-than-human world. These philosophies offer reparative visions for higher education by challenging dominant, universalized models of sustainability and recovering locally rooted ways of knowing, being, and learning.

Learn more

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04

LITERACY FOR A LIVING PLANET

Socioecological literacy is foundational for planetary futures.



KEY MESSAGES

- Socioecological literacy is a situated and evolving practice of understanding and acting within the relationships among ecological, social, economic, and political systems across places, scales, and generations. Yet it remains marginal in many education systems.
- Learners need to understand how these systems interact to shape planetary futures; scientific knowledge about climate change, while essential, is not sufficient on its own.
- Learning is embedded in living systems, yet education often separates knowledge from the social and ecological contexts in which it acquires meaning and is put into practice.
- Grounded in place, plural knowledge traditions, and shared purpose, socioecological literacy can help individuals and communities interrogate systems, connect action across local and planetary scales, and co-create more just, adaptive, and regenerative futures.

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INSIGHT

Education systems are increasingly expected to prepare learners to respond to complex, interconnected planetary crises. Yet many dominant approaches to what is commonly described as "climate literacy" remain narrowly focused on scientific knowledge, understanding atmospheric processes, weather patterns, and greenhouse gas emissions. While this knowledge remains necessary, it is not sufficient on its own to prepare learners to navigate planetary change and act responsibly in an interconnected world.

This reflects a broader challenge. In many education systems, dominant understandings of literacy remain largely oriented toward the acquisition of knowledge and information. While reading, writing, and scientific understanding remain essential, they do not in themselves prepare learners to navigate uncertainty, respond to systemic disruption, or act in just ways within complex socioecological systems (Kwauk, 2024). The challenge is therefore not to replace established forms of literacy, but to expand them in ways that enable individuals and communities to flourish under rapidly changing planetary conditions.

This narrowing is not simply a gap in curriculum content. It is reinforced when knowledge is divided across disciplines, learning is detached from lived contexts, and assessment privileges decontextualized individual performance. These arrangements make it difficult for learners to trace relationships among ecological change, political and economic decisions, unequal exposure to harm, and possibilities for collective response. They can also constrain educators who need time, professional autonomy, institutional support, and sustained relationships with communities to work across disciplinary and institutional boundaries. Advancing socioecological literacy therefore requires changes not only in what is taught, but also in how learning is organized, supported, and connected with the world beyond educational institutions.

Global evidence reinforces the need for this broader understanding of literacy. UNESCO's review of education policies and curricula across 46 Member States found that more than half made no reference to climate change and only 19 percent mentioned biodiversity; where environmental issues appeared, they were often treated cursorily (UNESCO, 2021). At the same time, UNESCO's *Greening Curriculum Guidance* signals growing recognition of a more holistic approach, calling for climate learning to bring cognitive, social-emotional, and action-oriented dimensions together across formal, non-formal, and informal settings (UNESCO, 2024). Together, this evidence and emerging policy direction point beyond simply adding planetary issues to curricula toward changing how learning about them is understood and organized.

Socioecological literacy is a situated and evolving practice through which people and communities orient themselves within living systems: perceiving relationships, discerning responsibilities, navigating uncertainty, and acting in ways that sustain collective wellbeing across time and scale. It draws on ecological literacy's invitation to learn to read the living world—not as a backdrop to human activity, but as the web of relationships through which life becomes possible (Orr, 1992; Sterling, 2001; Capra & Luisi, 2014). The term *socioecological* makes explicit that these living relationships cannot be understood apart from the histories, institutions, economies, political arrangements, and unequal relations of power that shape them. It therefore concerns not only how ecological systems function, but also how benefits and harms are distributed, whose knowledge is recognized, how collective decisions

are made, and what responsibilities arise from human participation within living systems. Used here, literacy is not intended to divide people into those who are “literate” and “illiterate,” nor to position experts as transmitting correct knowledge to others. Instead, it emphasizes learning as relational, participatory, and continually developing.

The need for socioecological literacy is both epistemic and practical. Climate change unfolds through interconnected challenges involving energy, food, migration, health, justice, and other dimensions of collective life. Responding requires people and communities to perceive relationships, interpret complex systems, exercise context-sensitive judgment, and engage with possible futures—not as outcomes to be engineered, but as possibilities to be imagined and negotiated collectively (Miller, 2018). Systems thinking, intersectional and futures-oriented inquiry, collaboration, and action are therefore mutually reinforcing dimensions of socioecological agency. Action-oriented pedagogies offer one way of bringing these dimensions together by engaging learners in consequential, community-connected work that links inquiry, collective action, and critical reflection (Thanapornsangsuth et al., 2025; Weinberg et al., 2024). Grounded in shared responsibility, they create supported and participatory spaces in which learners work alongside educators, communities, and relevant institutions to determine what action is warranted, deliberate across differences, connect local initiatives with wider structural conditions, and reflect on consequences, limitations, and changing circumstances. In this way, agency becomes relational and collective.

Learning, in this sense, is not abstract or decontextualized. It is embedded within socioecological systems—relational networks that include people, places, and more-than-human worlds shaped by interdependence, unequal histories, and continual change (Vossoughi et al., 2023; Westley et al., 2011). Because socioecological conditions differ across places and change over time, responsible action cannot be prescribed through universal solutions. Socioecological literacy develops through sustained attention to how relationships, risks, and responsibilities are configured in particular contexts—and how they change.

Socioecological literacy emerges across the full ecology of learning—lifelong, life-wide, and life-deep—extending beyond formal schooling into communities, workplaces, cultural traditions, and everyday life (Orlovic Lovren, 2022). Within this ecology, knowledge is distributed and situated, developing through participation, interaction, and shared inquiry. As Battiste (2002) argues, this requires a shift from a singular to a relational understanding of knowledge, where learning becomes a process of participation within interconnected, contested, and changing systems.

This reframes literacy itself. Socioecological literacy is not only cognitive but also ethical, political, and relational. It shapes how people and communities interpret change, understand responsibility, and act in just ways within shared systems. It concerns how people, communities, and institutions become answerable for their participation in those systems and mobilize knowledge, experience, ethical judgment, and collective action in support of ecological integrity, social justice, and intergenerational and interspecies wellbeing.

In doing so, socioecological literacy also reframes educational purpose: from preparing individuals primarily to adapt to existing systems toward supporting people and communities in questioning and reshaping the systems that affect their lives. Education becomes a site for interrogating the structural drivers of planetary crises, challenging extractive logics, imagining alternatives, and participating in

collective responses. Learning thus becomes a practice of ethical participation and planetary action, grounded in relational responsibility and enacted through context-responsive, place-based, and community-rooted forms of education.

04 Pathways for transformation

Advancing socioecological literacy requires connecting systems understanding with situated inquiry, collective participation, and ethical action across the full ecology of learning.

01 **Organize curricula around socioecological relationships and questions.** Integrate systems, futures, and intersectional thinking across disciplines so learners can examine how ecological, social, economic, and political dynamics interact across places and scales, change over time, and produce unequal consequences under conditions of uncertainty.

02 **Ground learning in place, community, and plural knowledge.** Connect learning with local environments, lived experience, community priorities, intergenerational relationships, and more-than-human worlds. Engage Indigenous, local, scientific, experiential, and practice-based knowledge in ways that respect their distinct foundations and the authority of the communities and knowledge holders who sustain them.

03 **Advance action-oriented pedagogies through inquiry, participation, and reflection.** Create opportunities for learners to investigate consequential socioecological challenges, deliberate across different perspectives, participate in collective responses, connect local action with wider systems, and reflect critically on the effects and limitations of their actions.

04 **Enable educators to lead socioecological learning.** Provide educators with professional autonomy, sustained learning, interdisciplinary planning time, supportive networks, community partnerships, and the material conditions needed to connect learning with changing socioecological realities.

05 **Build learning ecologies across institutions, generations, and sectors.** Support collaboration among schools, universities, families, communities, workplaces, cultural institutions, social movements, and public agencies, recognizing that socioecological literacy develops throughout life and across formal, non-formal, and informal settings.

The implications of socioecological literacy for recognizing and assessing learning are considered further in Insight 9.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illustrate how socioecological literacy is already being cultivated across diverse educational contexts. Rather than prescribing a single model, they demonstrate how shared principles can be interpreted and enacted through different knowledge traditions and institutional settings.

Transformative Skills Collaborative: Advancing Climate Literacy Through Inner Skills

The *Transformative Skills Guide*, developed by the Transformative Skills Collaborative, expands climate literacy beyond scientific knowledge alone. It identifies "inner" skills, qualities, and capacities—including self-awareness, resilience, systems thinking, and collaboration—that can help translate understanding into changes in how people act individually and collectively. Designed for educators, communicators, and practitioners, the guide treats climate literacy as more than information acquisition and connects personal reflection and development with collective and systemic climate action.

Learn more

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Action-Oriented Pedagogies: From Learning About Change to Acting Within It

Across diverse settings, action-oriented pedagogies connect socioecological understanding with meaningful participation in real-world challenges. Two complementary bodies of work demonstrate how this orientation takes shape across different educational and cultural contexts. Drawing on K–12 sustainability education, Weinberg et al. (2024) articulate an Action-Oriented Pedagogies framework that engages students in "real work with real consequences," bringing inquiry into possible futures together with collective action and critical reflection (see Figure 1). Research involving 28 Regional Centres of Expertise on Education for Sustainable Development across Africa and the Middle East, Asia-Pacific, Europe, and the Americas identifies related practices spanning formal, non-formal, and

informal learning, including engagement with real-world problems, community participation, empathy, cultural and regional relevance, interdisciplinarity, and collaboration (Thanapornsangsuth et al., 2025; Insebayeva et al., 2025). One offers a pedagogical framework grounded in K–12 education; the other synthesizes practices emerging across regions, institutions, and community settings. Read together, they show that action-oriented pedagogy is a shared orientation that takes different forms in relation to place, learners, communities, and educational purposes.

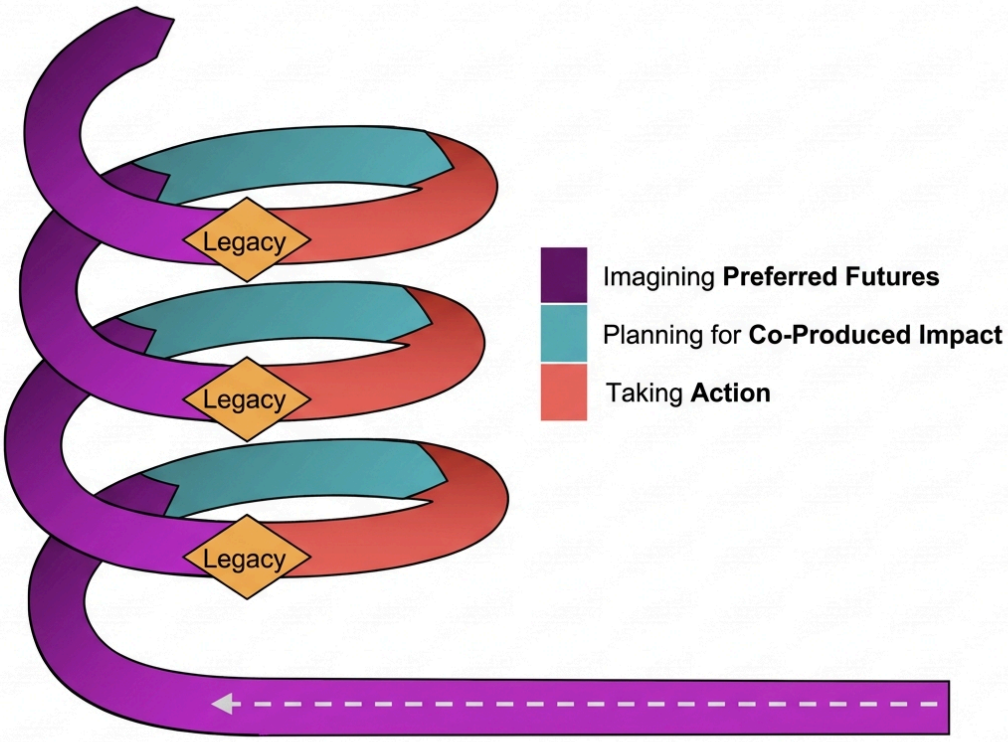


Figure 1: Cyclical Model of Action Oriented Pedagogies (AOPs)

Learn more

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Morris Area Rural Climate Dialogue: Engaging Adults in Lifelong Socioecological Learning

Using the Jefferson Center's Citizens' Jury method, the Morris Area Rural Climate Dialogues exemplify socioecological literacy as lived, non-formal adult learning. Fifteen randomly selected and demographically balanced residents participated in a three-day process of study and deliberation, hearing different perspectives and examining relationships among changing weather, agriculture, energy, infrastructure, insurance, equity, and community resilience. Rather than receiving information passively, participants identified shared concerns and developed community-based recommendations. The Dialogues demonstrate how deliberation grounded in local knowledge, diverse evidence, and shared purpose can strengthen collective judgment and action in response to complex socioecological challenges.

Learn more

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Cultural Reforesting: Cultivating Ecological Literacy Through Art and Place

At Orleans House Gallery in Richmond upon Thames, Cultural Reforesting turns a public gallery and its woodland grounds into a shared environment for ecological inquiry, imagination, and learning. Artists work with scientists, researchers, volunteers, young people, community groups, plants, and the living landscape through residencies, exhibitions, workshops, walks, and participatory research. Their work is organized around a central question: How can we renew our relationship with nature? The initiative demonstrates that ecological literacy involves more than understanding ecological concepts. It also requires learning to notice relationships, engage the senses and emotions, encounter other forms of life with curiosity, and imagine different ways of living together. By connecting artistic practice with ethnobotany, citizen science, community participation, and woodland stewardship, Cultural Reforesting crosses boundaries between art and science, culture and ecology, and learning and public action. It shows how cultural institutions can help people experience themselves not as observers outside nature, but as participants within living systems.

Learn more

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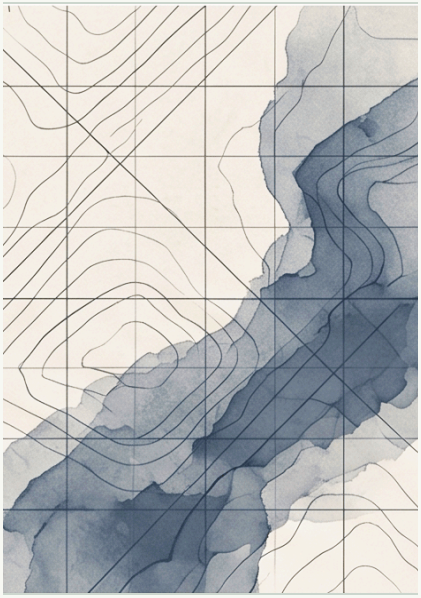
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05

EMOTIONS THAT MOVE US

Emotional and relational learning is central to how societies respond to planetary crises.



KEY MESSAGES

- **Emotional and relational learning is foundational to how societies navigate planetary disruption.** Empathy, compassion, emotional awareness, perspective-taking, and ethical judgment help people and communities respond to complexity, uncertainty, and rapid change.
- **Climate anxiety, grief, anger, hope, and disconnection are increasingly documented, particularly among young people.** These emotions are not simply individual responses to environmental change; they signal a deeper rupture in relationships between people, communities, institutions, and the living world.
- **How emotions are recognized and supported influences whether people engage, withdraw, or act collectively.** Supportive relational environments can help learners interpret difficult emotions, sustain hope, build solidarity, and participate in meaningful responses.
- **Many education systems continue to privilege cognitive and technical learning while giving insufficient attention to emotional, ethical, and relational dimensions.** Responding to planetary crises requires learning environments grounded in care, trust, belonging, dialogue, and shared responsibility.
- **Relational, justice-oriented, trauma-aware, creative, and place-based approaches can strengthen collective resilience and agency.** By connecting emotional learning with social and ecological responsibility, education can contribute to more peaceful, just, and life-sustaining societies.

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INSIGHT

The emotional landscape of the climate crisis offers a powerful window into how learners experience their relationships with communities, institutions, future generations, and the living world. Climate anxiety, grief, anger, fear, hope, and disconnection are increasingly documented, especially among children and youth, signaling not only environmental instability but a deeper rupture in the social and relational foundations that sustain human and planetary wellbeing (Hickman et al., 2021; Pihkala, 2020). These emotions can be further intensified by exposure to severe weather and other climate impacts, uncertainty about the future, and perceived institutional inaction, contributing to feelings of overwhelm and diminished agency (Hickman et al., 2021; Lewandowski et al., 2024). Without supportive relational environments, these pressures can contribute to distress that constrains learning, reduces engagement, and erodes trust in institutions. Importantly, these emotional responses should not be understood as signs of individual fragility. Rather, they are collective signals that something larger is unfolding—a lived experience of ecological disruption, social uncertainty, unequal exposure to harm, and institutional inadequacy.

Climate emotions can therefore serve as early indicators of strain across communities, institutions, and everyday life, revealing not only how individuals are coping with environmental change, but also how societies are struggling to sustain relationships of care, responsibility, and hope in an increasingly uncertain world. Far from being peripheral to learning, these emotional and relational dynamics shape how individuals and communities interpret risk, respond to disruption, imagine alternative futures, and participate in collective action.

A growing body of research suggests that learners' emotions significantly influence how they engage with the climate crisis. Positive emotional experiences—including joy, curiosity, awe, hope, and belonging—can support engagement, nature connection, and critical and creative thinking, while disconnection and despair can contribute to withdrawal or disengagement (Neurohr et al., 2024; Ojala, 2012, 2016). These insights resonate with—but should not be equated with—many Indigenous, land-based, and Earth-based knowledge traditions, in which emotional, ethical, and spiritual ties to land are inseparable from responsibilities of reciprocity, reverence, and long-term stewardship. Such traditions challenge dominant educational assumptions by recognizing emotions not solely as individual psychological states, but as dimensions of relationship, responsibility, and ethical orientation. From this perspective, emotional learning can help sustain reciprocity, responsibility, and long-term relationships with the living world.

Yet even as emotional pressures rise across communities, many education systems remain anchored in cognitive and technical approaches that do not adequately address the conditions learners must navigate. This recognition has brought renewed attention to social and emotional learning (SEL), highlighting emotional, relational, and ethical learning as essential dimensions of education (UNESCO, 2024). SEL can support empathy, emotional regulation, responsible decision-making, and relational resilience—qualities that can help learners engage constructively with climate disruption and uncertainty rather than becoming overwhelmed or disengaged (Ojala, 2012; Neurohr et al., 2024). Emerging work in climate justice education further emphasizes that SEL must address more than individual coping, extending to solidarity, collective care, and structural inequity (Chaudhary & Iyengar, 2025). Its transformative potential is constrained when it is framed primarily as an agenda of individual

competency and self-management. Climate emotions emerge from wider social, political, cultural, and ecological systems that shape how learners experience and make meaning of disruption. Educational responses must therefore cultivate individual and collective resilience alongside collective agency rooted in care, solidarity, democratic participation, and responsibility for social and ecological transformation.

Recognition of emotional and relational dimensions of learning is increasingly reflected in international policy frameworks. The UNESCO *Recommendation on Education for Peace, Human Rights and Sustainable Development* (2023) adopts a holistic understanding of learning that extends beyond cognitive achievement and emphasizes the development of empathy, compassion, solidarity, ethical responsibility, and an ethic of care. Among its guiding principles are cultivating "an ethic of care, compassion and solidarity" and protecting the "safety, health and well-being of learners and teachers" (UNESCO, 2023). These principles provide an important policy foundation for understanding emotional and relational learning not merely as a matter of individual development, but as a foundation of sustainable, peaceful, and just societies.

Emotional responses to the climate crisis are also shaped by how learners interpret what they are experiencing. Research in higher education suggests that distress and disengagement can be intensified by a disconnect between what people know and feel about planetary crises and how their institutions respond (Pigott et al., 2024). This disconnect can intensify feelings of uncertainty, isolation, and disbelief, especially when learners do not see their emotions acknowledged or validated in educational settings. Emotional meaning-making is not only an internal process but a relational one, shaped by family, culture, public discourse, and the trust learners have in societal institutions. These dynamics demonstrate why emotional literacy and relational support must be understood as foundational components of any educational response to the climate crisis. Evidence from a 63-country study further indicates that no single informational, emotional, or relational intervention produces consistent forms of climate engagement across audiences and outcomes. Its findings reinforce the need for approaches that are responsive to context, purpose, and the forms of action being supported (Vlasceanu et al., 2024).

As climate impacts intensify, emotional experiences are shaped by unequal burdens and histories of harm. Communities facing recurring or severe environmental risks—whether from disasters, pollution, or slow-onset degradation—may experience emotional pressures compounded by social inequality, historical injustice, and limited institutional support. Survey evidence indicates that climate distress varies across national and social contexts, is associated with perceived exposure to severe weather, and is often connected by young people to inadequate institutional responses (Hickman et al., 2021; Lewandowski et al., 2024). These patterns underscore the need for trauma-aware, context-responsive learning environments that acknowledge differing experiences of loss, risk, and injustice and help learners sustain connection and collective agency. Climate emotions therefore illuminate not only psychological stress but the uneven distribution of vulnerability, responsibility, and care across societies, making emotional inequity an important dimension of climate justice.

Recognizing the plurality and ethical complexity of climate emotions is essential. As Oberman (2024a, 2024b) argues, emotions evoked by ecological beauty, systemic injustice, or climate threat are distinct and carry different implications for learning, interpretation, and engagement. Climate education can create space for learners to differentiate and interpret these emotions—not to manage or suppress

them, but to understand what they reveal about values, inequities, and responsibilities. This orientation also resonates with the relational, embodied, and ethical approaches explored in Insight 3, including Indigenous and land-based traditions that emphasize care, humility, and responsibility across generations while remaining grounded in distinct communities, places, and knowledge systems.

Within this emotional terrain, hope emerges not simply as optimism, but as a form of relational and collective agency. Research and practice on climate coping distinguish active or constructive hope—grounded in an honest recognition of present conditions, relational support, possible pathways for action, and a sense of collective possibility—from passive optimism or denial (Macy & Johnstone, 2012; Ojala, 2012). Hope can become especially generative when learners experience it collectively, as members of communities capable of imagining and creating alternative futures together.

Educational approaches grounded in storytelling, creative expression, contemplative practice, and collaborative futures thinking can help learners rehearse alternative pathways and build a shared sense of agency in the face of uncertainty. These practices can enter into dialogue with relational and land-based pedagogies that emphasize continuity, reciprocity, and long temporal arcs of planetary responsibility. Research further suggests that educational interventions inviting people to consider future generations can strengthen concern for their wellbeing and willingness to act on their behalf, reinforcing intergenerational responsibility as an important dimension of climate education (Syropoulos et al., 2025; Law et al., 2025).

The UNESCO MGIEP report *Rethinking Learning: A Review of Social and Emotional Learning for Education Systems*(2020) provides additional support for this perspective. Synthesizing evidence from education, neuroscience, psychology, and the learning sciences, the report associates social and emotional learning with empathy, cooperation, prosocial behaviour, and capacities for working collectively across differences. These emotional and relational dimensions of learning are increasingly recognized as important foundations for addressing complex sustainability challenges, including climate change, which require collaboration, ethical reflection, long-term thinking, and collective action across generations and communities.

Positive emotions such as joy, fascination, and wonder can play an important sustaining role in climate education. Encounters with nature that evoke these emotions can offer learners a sense of vitality, connection, and belonging alongside the grief and fear often elicited by climate learning. Research associates experiences of awe, interest, beauty, compassion, and other positive emotions with nature connectedness, creative engagement, and prosocial or pro-environmental orientations (Lumber et al., 2017; Richardson et al., 2020; Oberman, 2024a; Piff et al., 2015; Neurohr et al., 2024). The broaden-and-build theory further suggests that positive emotions can expand attention and gradually build cognitive, psychological, and relational resources (Fredrickson, 2001). Far from trivial, joy can provide affective energy that helps sustain civic participation and regenerative action.

Together, this body of evidence points to the need for a shift in how education understands learning, agency, and transformation. Emotions are not secondary to cognition, nor are they merely personal responses to environmental change. They are relational forces that shape how individuals and communities interpret risk, sustain hope, build solidarity, and mobilize for change. As planetary pressures intensify, education must engage more fully with these emotional and relational dimensions of collective resilience, democratic participation, and societal transformation. The challenge for education is therefore not simply to help learners understand planetary crises, but to cultivate forms of

learning that sustain connection—to themselves, to one another, to future generations, and to the living world. Emotional and relational learning is not a supplementary educational outcome; it is central to how societies respond to planetary crises and shape more just, regenerative, and life-sustaining futures.

05 Pathways for transformation

Advancing emotional and relational learning requires changes in educational cultures, pedagogies, institutional conditions, and relationships with communities and the living world.

01 **Build education systems and whole-institution cultures grounded in care, belonging, and emotional wellbeing.** Embed emotional and relational learning across curriculum, leadership, governance, community partnerships, and everyday educational practice, creating conditions of trust and collective responsibility that support learning, resilience, social cohesion, and democratic participation.

02 **Integrate social and emotional learning through relational and justice-oriented approaches.** Move beyond individual coping and skill-building to cultivate solidarity, moral imagination, collective responsibility, and engagement with structural inequities.

03 **Create trauma-aware and context-responsive learning environments.** Provide safe, supportive, and culturally responsive conditions in which learners can navigate climate-related distress, uncertainty, disruption, and differing experiences of loss and harm.

04 **Strengthen place-based, land-based, and experiential learning.** Foster sustained engagement with ecosystems, cultural landscapes, and local communities to cultivate belonging, reciprocity, joy, and responsibility toward human and more-than-human worlds.

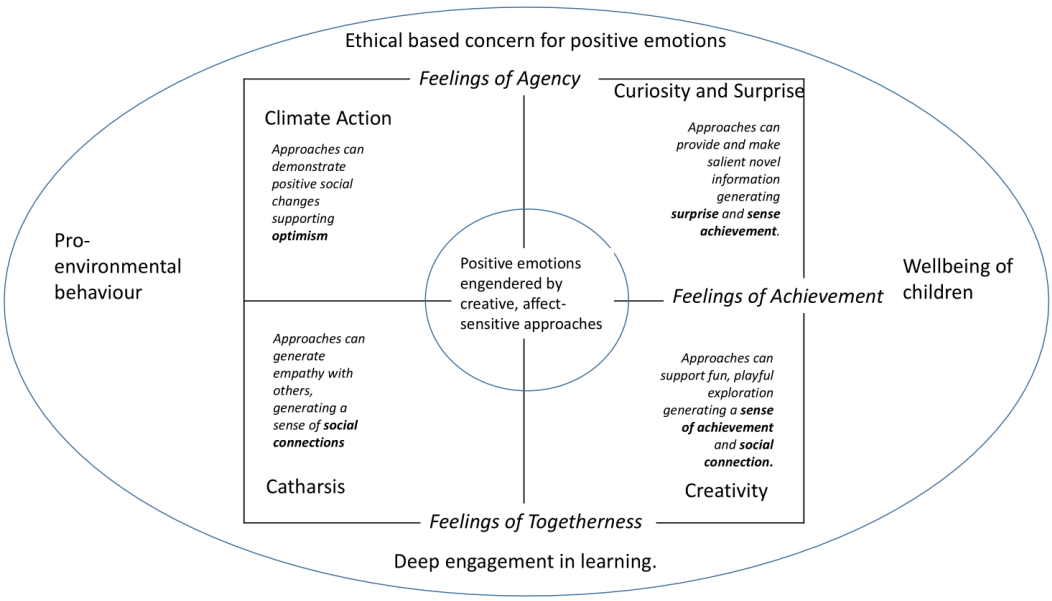
05 **Connect emotional meaning-making with imagination, collective agency, and action.** Use storytelling, the arts, contemplative practice, collaborative futures inquiry, and civic participation to help learners engage with difficult emotions, sustain constructive hope, imagine alternatives, and contribute to collective responses.

06 **Equip and support educators to facilitate emotional and relational learning.** Provide sustained professional learning, time, appropriate resources, supportive networks, and access to specialist services, while recognizing that educators should not be expected to respond to climate-related distress without institutional support.

07 **Recognize and assess what matters.** Expand assessment beyond cognitive attainment to attend to wellbeing, belonging, relational agency, resilience, and collective capacity, using participatory, qualitative, and context-responsive approaches appropriate to these complex dimensions of learning (further explored in Insight 9).

Figure 1. Emotional Pathways in Climate Learning

Oberman (2024a) maps the positive emotional experiences supported by picturebook use in climate change education. Building on that analysis, this figure traces pathways through which creative and affect-sensitive approaches to climate learning may support learners' wellbeing, strengthen learning, and encourage pro-environmental engagement.



Source: Adapted from Oberman, R. (2024a). Creativity, curiosity and catharsis: Positive emotions in climate change education through picturebooks. *Environmental Education Research, 30*(11), 2031–2056. https://doi.org/10.1080/13504622.2023.2286940

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples show how emotional and relational learning can emerge through mobile libraries, community-based storytelling, environmental filmmaking, and pedagogies that bring feeling and thinking into relationship. Although situated in different cultural and institutional contexts, each illustrates how learning can cultivate connection, belonging, ethical responsibility, and collective agency.

Sentipensante Pedagogy: Feeling-Thinking Ecological Relations

Sentipensar, or feeling-thinking, offers a powerful foundation for emotional and relational learning. Colombian sociologist Orlando Fals Borda learned the concept from riverine fishing communities of Colombia's Caribbean region, where *sentipensar* joins what modern education often separates: thought and feeling, mind and body, knowledge and lived experience. As an educational orientation, it invites learners to study ecological systems as relationships in which they are already involved. Through observation, dialogue, bodily awareness, reflection, movement, and engagement with place and community, learners can come to both understand and feel interdependence. It expands environmental learning beyond acquiring information toward cultivating the emotional awareness, relational judgment, and ethical responsibility needed to notice relationships, question established habits, and act with care within a living world.

Learn more

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Children and Youth Artists' Grief Deck: Making Space for Loss

The *Children and Youth Artists' Grief Deck*, developed by the Artists' Literacies Institute, offers an arts-based approach to recognizing and processing loss. Its 60 cards pair 58 original artworks created by artists between the ages of 6 and 26 with prompts written by young people and bereavement experts. Designed for independent or facilitated use across different age groups, the deck provides multiple entry points for naming grief, expressing difficult experiences, and opening supportive conversations among learners, educators, counselors, and families. Although developed in response to losses associated with the COVID-19 pandemic, it illustrates how youth-created art and carefully facilitated reflection can make experiences of loss more visible and shareable. Adapted with care, such approaches may also help learners engage with ecological grief and climate-related loss without reducing these experiences to individual problems or expecting educators to provide therapeutic care.

Learn more

Artists' Literacies Institute. (n.d.). *Children and youth artists' grief deck* [Card deck]. https://griefdeck.com/category/youth/



Green Hub Fellowship, India

Climate action begins with relationships. The Green Hub Fellowship in India demonstrates how environmental education can strengthen emotional, relational, and ecological capacities through storytelling, place-based learning, and community engagement. Working primarily with youth from tribal and marginalized communities, Green Hub uses digital storytelling to help participants document local environmental knowledge, conservation practices, and community experiences. Through a one-year residential fellowship, young people develop skills in filmmaking, editing, and communication while deepening their relationships with the landscapes, cultures, and communities in which they live. By encouraging participants to view their villages and ecosystems through the lens of environmental stewardship, the fellowship cultivates a sense of belonging, responsibility, and care for local environments. Fellows not only gain technical and professional skills, but also develop stronger connections to place, community, and cultural identity. Many participants go on to internships and employment opportunities with governmental agencies, civil society organizations, and environmental initiatives, demonstrating that environmental stewardship and livelihood opportunities can be mutually reinforcing. Founded in Tezpur, Assam, in 2014 and now operating across multiple regions of India, Green Hub illustrates how climate and sustainability education can foster agency, hope, ecological responsibility, and collective care for the future.

Learn more

GreenHub. (2022). GreenHub | Youth Fellowship and Video for Change. https://www.greenhubindia.net/fellowship

Books and Environment Mobile Libraries (Kitab Mahol Gari), Pakistan

In Pakistan, the *Books and Environment Mobile Libraries* initiative (*Kitab Mahol Gari*) brings climate learning, storytelling, and community engagement directly to children and young people through mobile learning festivals operating in Karachi, Lahore, Multan, and Swat. Following the devastating floods of 2025, the initiative was also used as an emergency educational response to learning disruption and loss. Complementing these mobile festivals, the initiative has established more than 100 interactive libraries in government schools in Punjab, with plans to expand to an additional 200 schools in Sindh between 2026 and 2027. Through books, environmental activities, storytelling, dialogue, and community participation, these spaces help learners build connections with place, strengthen environmental awareness, and develop the emotional and relational capacities needed to respond to climate risks and uncertainty. The initiative illustrates how climate education can move beyond information delivery to foster belonging, agency, hope, and collective engagement—capacities that are increasingly recognized as essential for navigating planetary futures.

Learn more

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06

ACTING WITH YOUTH

Young people are already shaping planetary futures. Education systems must recognize their agency, support their participation, and share power.



KEY MESSAGES

- Young people are already shaping planetary futures through collective action, advocacy, and change.
- Education systems often constrain youth agency through rigid structures and assumptions that position young people as future citizens rather than present civic and political actors.
- Participatory, critical, and action-oriented learning can enable young people to question dominant assumptions, engage diverse ways of knowing, imagine preferred futures, and take meaningful action on issues that affect their lives and futures.
- Youth agency is collective and relational. It is strengthened when young people participate as co-creators and decision-makers in equitable intergenerational partnerships.
- Supporting youth agency requires adults and institutions to share power without transferring responsibility for planetary crises onto young people. Such participation can advance intergenerational justice, democratic renewal, and more inclusive governance.

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INSIGHT

As the climate crisis unfolds alongside democratic backsliding and rising authoritarianism, young people are already navigating changing climate realities and taking action in spaces where adults and institutions have struggled to respond. Yet many education systems continue to position youth as *future* leaders rather than present civic and political actors whose experiences, perspectives, and actions already shape planetary futures. Critical, participatory, and action-oriented approaches interrupt this logic by creating space for young people to question dominant assumptions, bring different ways of knowing into conversation, produce and communicate knowledge, shape public narratives, co-create responses with communities, and act on issues affecting their lives and futures. Youth agency emerges through these relationships and is exercised collectively with other people, communities, places, and the living world. Through meaningful participation and shared decision-making, young people build solidarity, exercise political voice, and contribute to change as it happens. The task for education systems is to recognize and connect with the agency young people already exercise across communities, movements, civic life, and relationships with the living world, while supporting their participation and sharing power with them.

Across contexts, young people are exercising agency in many forms—shaping public agendas, mobilizing collective action, protecting land, water, and living systems, and creating alternative ways of living and relating (Ritchie, 2021; Evans et al., 2025). From global movements such as #FridaysForFuture to Indigenous youth-led movements and local civic initiatives, young people are influencing public discourse and climate governance while also prefiguring different planetary futures (UNICEF, 2021; Karsgaard et al., 2026). Their action unfolds across multiple scales and spaces. Opportunities to participate in global summits and other formal decision-making spaces can enable young people to exercise political voice, influence decisions, and build relationships across contexts (Bindal, n.d; Buhre & Josefsson, 2025). At the same time, everyday forms of youth-led action—including community organizing, local environmental initiatives, advocacy, and other place-based practices—can cultivate sustained engagement and collective capacity (Skovdal & Benwell, 2021; Trott, 2024; Karsgaard et al., 2026). This agency is not limited to adolescents: younger children also exercise environmental agency through action in their schools and communities (Merritt et al., 2024). Recognizing this wider landscape of youth agency is especially important because many young people are systematically excluded from formal civic and political institutions. Their agency may take forms that conventional understandings of civic participation fail to recognize (Ritchie, 2021; Sambai Usek & Dunlop, 2025). Under authoritarian conditions, youth activism may become less visible as young people navigate repression and political scrutiny (Erfani, 2025). Together, these practices show young people already contributing to the political, social, cultural, and ecological transformations shaping planetary futures.

For education systems, the challenge is to recognize and sustain young people's existing agency while removing the structures that exclude them or restrict their opportunities to act. Education systems can support young people to lead, make decisions, act collectively, and shape the institutions and communities around them by sharing power and providing the necessary time, resources, and institutional support. Yet schools often operate on assumptions about students' readiness to participate meaningfully, reinforced by curricula and pedagogies that privilege knowledge acquisition over

collective problem-solving, experiential learning, and action (Merritt et al., 2021; Merritt et al., 2024; Trott, 2024). These conditions can leave youth participation and collective agency peripheral rather than integral to education (Merritt et al., 2024; Iyengar et al., 2023).

These constraints operate at multiple levels. Epistemically, dominant curricula often prioritize abstract knowledge over lived, relational, and place-based learning. Critical and decolonial approaches can support young people to question these hierarchies, examine the assumptions underlying dominant responses to planetary crises, and engage with diverse ways of knowing and relating to the world. Structurally, rigid curricula, siloed subjects, limited resources, standardized accountability regimes, and individualized and competitive models of learning can restrict participatory, action-oriented education (Bartlett, 2023). Culturally, norms that frame students as needing protection from the emotional weight of climate crises or the complexity of real-world problems, while underestimating their capacity to act, can limit meaningful participation and shared decision-making. Educational cultures that reinforce human separation from the more-than-human world can further constrain the relational forms of agency, care, and responsibility needed to respond to planetary change.

Supporting youth agency is also a matter of rights. The UN Committee on the Rights of the Child (2023) affirms children's right to a clean, healthy, and sustainable environment, including their right to be heard in environmental decisions that affect them. Realizing these rights requires education systems and other adult-led institutions to retain responsibility for addressing structural crises while sharing decision-making power, recognizing young people's political agency, and creating conditions for meaningful intergenerational collaboration (Kappelman & Reynoso, 2026). Equitable and sustained intergenerational partnerships can strengthen civic identity, support the exercise of agency, and sustain engagement over time (Rousell et al., 2025; Stollberg et al., 2024), while land-based and relational pedagogies can situate agency within relationships of responsibility and reciprocity with place and other forms of life (Karsgaard, Pillay, & Shultz, 2024). When young people are recognized as contributors with decision-making power rather than included symbolically, they can influence institutional decisions, mobilize peers, strengthen community action, and expand opportunities for participation, particularly in rural and historically marginalized communities.

To support and expand collective agency, schools can make civic and climate action part of everyday learning. Participatory classrooms enable young people to exercise agency through real-world action, reflection, collaboration, and shared decision-making. Participatory approaches—such as Action-Oriented Pedagogies (Weinberg et al., 2024; Weinberg & Jordan, 2023), Green Schools Participatory Budgeting (Bartlett & Schugurensky, 2024), and critical and reflective pedagogies informed by Freire (2000) and Palmer (1998)—position students as active participants in imagining and enacting change, even in polarizing contexts. Action-Oriented Pedagogies, in particular, bring together preferred futures, collective orientations, systems thinking, and meaningful action through "real work with real consequences" (Weinberg et al., 2024). Green School Participatory Budgeting extends participation into institutional governance by involving students in decisions about how resources are used (Bartlett & Schugurensky, 2024). Across these approaches, students deliberate collectively, take action, and reflect on its consequences, bringing cognitive, affective, relational, and behavioral dimensions of learning into relationship.

What distinguishes these practices is their shared orientation toward learning as lived, relational, creative, and consequential. Transformation in these contexts can involve creating new possibilities as well as supporting communities to sustain and revitalize ancestral, Indigenous, and other knowledge traditions that dominant education systems have marginalized. Initiatives grounded in young people' environments—including community-based inquiry, local environmental projects, participatory design, youth-produced art and media, climate decision-making through games, and explorations of food systems through cooking and cultural inquiry—enable learners to experience the effects of collective actions and understand themselves as participants in wider social and ecological relationships (Merritt et al., 2021; Attala, 2017). When young people create knowledge and cultural materials addressed to educators, policymakers, and wider publics, they can reshape conventional educational relationships: youth become educators and contributors to public understanding rather than merely recipients of adult knowledge. Learning becomes a practice of acting, creating, and communicating with others—human and more-than-human—through relationships of reciprocity, care, and shared responsibility. In these contexts, youth agency is exercised and strengthened through participatory, place-based, and creative practices that make education for planetary futures tangible, hopeful, and shared.

When young people participate as contributors and decision-makers rather than symbolic representatives, their knowledge, values, and creativity can reshape schools and communities. Through consequential action—co-creating responses, collaborating with communities, influencing decisions, and challenging structures that constrain their participation—they exercise and strengthen capacities for collective action and democratic engagement (Enverga, 2025; Iyengar et al., 2023). Critical pedagogies further support this exercise of agency by enabling young people to examine how power operates, question whose knowledge and interests shape existing systems, and imagine and enact alternatives (Freire, 2000). Sustaining such participation requires institutional structures that recognize diverse forms of youth agency and embed shared decision-making across curriculum, governance, and everyday educational life. Education can thereby become one setting through which young people's existing agency contributes to social and systemic transformation.

The challenge is no longer whether young people are ready to participate. It is whether education systems are prepared to recognize and support their agency, share power, and create conditions for meaningful participation. Doing so requires aligning curriculum standards, teacher preparation, school improvement plans, and accountability frameworks so that youth participation and shared decision-making become integral to how learning is organized. Whole-school approaches and cross-school networks further expand reach and amplify impact (Hargis et al., 2021). When young people are recognized as present political and civic actors, supported in exercising collective agency, and included in decisions that shape their lives and futures, participation becomes part of how education itself is governed and transformed.

06 Pathways for transformation

Advancing youth agency means recognizing young people as present civic and political actors and creating conditions for their knowledge, participation, and collective agency to shape education and society.

01 **Institutionalize shared decision-making with young people.** Embed meaningful youth participation across curriculum, governance, budgeting, accountability, and policy, moving beyond consultation and symbolic representation to shared authority.

02 **Remove structural and cultural barriers to participation.** Address rigid curricula, standardized accountability, inaccessible processes, unequal resources, and assumptions about young people's readiness that determine whose agency is recognized and supported.

03 **Cultivate critical consciousness.** Create opportunities for young people to examine how power operates, question dominant assumptions and knowledge hierarchies, and imagine and act toward alternative futures.

04 **Design action-oriented learning with young people.** Co-create learning environments in which students investigate consequential issues, imagine preferred futures, deliberate collectively, undertake meaningful action, and reflect on its consequences through approaches such as Action-Oriented Pedagogies and Green School Participatory Budgeting.

05 **Build intergenerational partnerships.** Create sustained opportunities to learn across generations, share power and responsibility, and act together on planetary challenges.

06 **Ground agency in place, community, and the living world.** Connect learning with lands, waters, ecosystems, cultural knowledge, and lived realities, cultivating reciprocity and responsibility across human and more-than-human relationships.

07 **Sustain participation through institutional support.** Invest in educators, accessible participatory structures, community partnerships, networks, time, and resources so that youth agency becomes an enduring feature of education rather than a short-term project.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples show how youth agency is exercised through knowledge production and public pedagogy, shared governance, and intergenerational organizing. Although different in scale and setting, each moves beyond symbolic participation by positioning young people as contributors and decision-makers whose knowledge, creativity, and collective action help shape institutions, communities, and planetary futures.

From Classroom to Climate Governance: Youth as Knowledge Producers

An international climate education project called Learning Collective Worldmaking: Youth Activism for Climate Futures brought together 145 young people from 11 intensely fossil fuel-reliant countries to investigate climate change within and across their various contexts, lands and waters, knowledge systems, and subject areas. Developed by Carrie Karsgaard, Lynette Shultz, and Sheena Wilson, the project recognizes young people's co-agency with the land, all living beings, and one another, supporting co-creation of policy over time. The culminating policy paper, *The Earth Is Speaking: A Call for Climate Justice from the Next Generation*, which has been translated and shared with policymakers in the young people's home contexts, argues that climate change is "fundamentally a crisis of listening: our failure to hear the earth, each other, and the communities most vulnerable to climate breakdown. We call for climate justice rooted in connection, accountability, and education, a future built not above nature, but with it." The initiative created opportunities for youth to articulate their experiences, deliberate across differences, and bring their perspectives into spaces where climate futures are being shaped.

A complementary initiative, *Turn It Around! Youth Visions of Education Futures*, invites young artists and writers around the world to create learning materials for educators, policymakers, and political leaders. By reversing the conventional direction of teaching, it positions young people as public educators whose creative work can shape conversations about education, ecological justice, and planetary futures. Together, the two initiatives demonstrate how youth agency can move from creative expression and collaborative inquiry into public learning and policy dialogue.

Learn more

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Green School Participatory Budgeting: Learning to Govern for Planetary Wellbeing

Green School Participatory Budgeting transforms decisions about designated school funds into opportunities for democratic learning, shared governance, and ecological action. Rather than reserving financial decisions for adults alone, it enables students, educators, and other members of the school community to deliberate, decide, and steward shared resources together. Students identify challenges, develop proposals, deliberate over priorities, and collectively determine how funds should be invested in projects that advance sustainability and community wellbeing—from school gardens and biodiversity initiatives to energy conservation and climate resilience. By linking consequential decision-making with environmental action, Green School Participatory Budgeting turns governance into a living curriculum through which learners practise democratic participation while helping align institutional priorities with ecological responsibility. Its democratic promise depends on inclusive design that enables students who are often excluded from school governance to participate meaningfully. The approach demonstrates how education can support young people in co-creating more just, democratic, and regenerative futures.

Learn more

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Youth, Intergenerational Organizing, and the Rights of Nature in Ecuador

Ecuador's 2008 Constitution established an important legal foundation by becoming the first national constitution to recognize Nature as a subject of rights. Against this legal and political background, young people have participated alongside Indigenous movements, environmental organizations, and other social actors in challenging extractive development and defending Yasuní National Park. After the government announced plans in 2013 to permit oil extraction in Block 43, young people became prominent participants in Yasunidos, a broad coalition seeking a national referendum. The coalition submitted approximately 750,000 signatures, although electoral authorities initially rejected its petition. Following almost a decade of organizing, advocacy, and legal struggle, a national referendum was held in 2023, and Ecuadorians voted to end oil extraction in Block 43. The campaign demonstrates that youth-led action need not mean young people acting alone. Yasunidos drew strength from longer Indigenous struggles to defend territory and the Rights of Nature while creating space for another

generation to carry that work forward. Education can support this form of agency by connecting learners with communities and movements, supporting their collective organizing, and enabling them to participate meaningfully in decisions affecting their territories and futures.

Learn more

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07

ACROSS BOUNDARIES

Planetary crises transcend borders—so must education.



KEY MESSAGES

- **Planetary crises unfold through interconnected ecological, social, economic, and political systems.** Their causes and consequences cross national and institutional borders, but responsibility, vulnerability, and capacity to respond are distributed unequally.
- **Education must be organized to learn and act across borders and boundaries.** This requires connecting disciplines, sectors, institutions, generations, geographies, and human and more-than-human worlds while respecting differences and boundaries that protect sovereignty, safety, and communities' authority over their knowledge.
- **Physical and virtual mobility, exchange, and multilingual knowledge infrastructures can deepen learning and cooperation across contexts.** Yet funding, migration and visa regimes, language hierarchies, digital access, displacement, and recognition of qualifications shape who can participate and whose knowledge travels.
- **Whole-institution and networked approaches can connect curriculum, governance, operations, research, and community learning across formal, non-formal, and informal settings.** Their success depends on reciprocal partnerships and on educators having the professional autonomy, academic freedom, time, resources, and support to work across boundaries.
- **Plural knowledge systems are essential to adaptive capacity.** Bringing scientific, Indigenous, local, and experiential knowledge traditions into dialogue can reveal connections, risks, and possibilities for action that no single tradition can see alone, linking Earth-system understanding with lived realities and enabling more robust, context-responsive action across scales.

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INSIGHT

Planetary crises unfold across interconnected ecological, social, economic, and political systems. Climate disruption, ecological degradation, and social instability interact across regions, sectors, and scales, crossing political, institutional, and disciplinary boundaries and reshaping relationships between human societies and the more-than-human world (Meadows, 2008; Vossoughi et al., 2023). These dynamics do not stop at national borders or sectoral silos; disruption in one domain can reverberate through others, requiring coordinated responses across institutions and scales. The planetary boundaries framework makes the Earth-system dimensions of this challenge visible. According to the 2025 *Planetary Health Check,* seven of the nine planetary boundaries were assessed as transgressed (Sakschewski et al., 2025). These transgressions are systemic in their drivers and transboundary in their consequences, yet responsibility, vulnerability, and capacity to respond remain distributed unequally. Responding to them therefore requires forms of knowledge, learning, governance, and collective action capable of moving across the boundaries that have traditionally structured education.

Nevertheless, educational institutions and infrastructures remain fragmented along national, disciplinary, and institutional lines, often reproducing the idea that human societies exist apart from the living world. This fragmentation limits their capacity to respond to complex, systemic challenges (Sterling, 2001, 2004). To meet the planetary moment, education must become border-crossing by design, supporting learning, exchange, and cooperation across disciplinary, sectoral, geographic, political, generational, and species boundaries while recognizing that access to the sites and pathways of such crossings is profoundly unequal within and across social, political, and ecological systems.

The challenge is not only that planetary crises cross borders, but that the boundaries around which education systems have traditionally been organized do not adequately reflect the realities of an increasingly interconnected world. Educational institutions continue to separate disciplines, sectors, generations, and forms of knowledge into distinct domains, even as climate change, biodiversity loss, migration, and technological transformation unfold across them. These divisions are reinforced by reductionist assumptions that complex problems can be understood and addressed by separating them into discrete parts. As Meadows (2008) argues, the behavior of complex systems cannot be understood by examining their parts in isolation. Educational responses to planetary challenges therefore require forms of connection that:

- bring scientific, Indigenous, local, and experiential knowledge traditions into dialogue without collapsing their differences;
- connect research, policy, and practice;
- enable physical and virtual mobility, exchange, and collaborative learning; and
- recognize humanity as inseparably part of, rather than distinct from, the living systems on which societal social systems depend.

Responding to such complexity requires new forms of coordination and learning. Polycentric governance highlights the importance of distributed, interconnected decision-making across local, national, and global levels (Ostrom, 2010). Its effectiveness, however, depends on coordination, accountability, and meaningful participation by actors with unequal power and resources. Without reflexive dialogue and practices

designed to address unequal power, polycentric governance can reproduce existing inequalities and structural rigidities. Similarly, transdisciplinary approaches bring academic disciplines into collaboration with communities, practitioners, policymakers, and other social actors, connecting research, policy, and practice (Jahn et al., 2012; Klein, 2017). Without such boundary-crossing capacities, knowledge co-production, learning, and decision-making can remain disconnected, limiting their contribution to coordinated action and systemic transformation (Cash et al., 2003).

Whole-institution and networked approaches provide practical pathways for turning border-crossing principles into institutional practice. Embedding sustainability across leadership, teaching, research, operations, and institutional culture creates coherent environments for deep learning and meaningful participation (Wals et al., 2024; UNESCO, 2024). Rather than treating sustainability as a discrete topic, whole-institution approaches position it as an organizing principle that connects governance, pedagogy, infrastructure, and community engagement in mutually reinforcing ways (Sterling, 2004). Such approaches depend on the professional autonomy, academic freedom, time, resources, and institutional support that enable educators and other institutional actors to sustain collaboration across boundaries—conditions that cannot be taken for granted. When institutions operate in isolation, interconnected priorities—such as climate education, global citizenship, and digital learning—can become fragmented, competing for time and attention and reinforcing the very silos they seek to address. By contrast, cross-institutional networks and collaborative learning communities enable knowledge to circulate, reduce duplication, and support reciprocal learning and shared innovation across formal, non-formal, and informal settings.

At the same time, borders are not only institutional but epistemic and political. Dominant reductionist worldviews fragment knowledge and reinforce separation across disciplines, sectors, and species. Long-standing relational and ecological traditions of thought offer ways of knowing that connect understanding across perspectives, places, and communities (Escobar, 2018; Le Grange, 2018). Bringing scientific knowledge into dialogue with distinct Indigenous, local, and Global South knowledge traditions—without absorbing them into a single framework—can expand what counts as evidence and who counts as an educator, strengthening collective responses to uncertainty (Smith et al., 2019; de la Cadena & Blaser, 2018). This requires attention to power, authority, reciprocity, and the rights of communities and knowledge holders to determine how their knowledge is represented, shared, and used.

Digital divides, language hierarchies, unequal funding, visa and migration regimes, displacement, and uneven recognition of qualifications continue to shape who can move, participate, and be heard, as well as whose knowledge circulates and whose remains marginalized. These asymmetries reflect broader inequalities in knowledge systems and governance, underscoring the need for more equitable infrastructures for physical and virtual mobility, multilingual participation, reciprocal exchange, and recognition across contexts (Cash et al., 2003). Addressing these structural barriers is essential if border-crossing education is to widen participation rather than reproduce existing inequities. Emerging technologies, including AI, further underscore the need for equitable digital systems and governance that enable meaningful participation, plural knowledge production, and greater community agency over how data and technologies are developed and used (BRIDGES et al., 2025).

In these and other ways, education can move from fragmentation toward connection, developing as a networked, relational system capable of learning and responding across places, institutions, and scales. Such a transformation requires changing how knowledge is organized, shared, and enacted across formal, non-formal, and informal settings, as well as across institutions, sectors, and societies. It aligns with systems thinking perspectives that emphasize attending to and transforming the relationships and structures through which systems operate, rather than adjusting individual components in isolation (Meadows, 2008; Sterling, 2001).

Ultimately, border-crossing education is not simply about connecting what has been separated or eliminating meaningful differences; it is about cultivating the capacities, relationships, and infrastructures through which societies can learn, govern, and flourish together while navigating difference, inequality, and interdependence in an increasingly interconnected world.

07 Pathways for transformation

Advancing border-crossing education requires coordinated shifts in how knowledge is organized, shared, and enacted across formal, non-formal, and informal learning settings.

01 **Design for boundary-crossing learning.** Embed interdisciplinary, cross-sectoral, and cross-scale learning within curricula and institutional structures, enabling learners to engage with complex challenges that span disciplines, communities, and ecosystems.

02 **Adopt whole-institution approaches.** Align governance, pedagogy, research, operations, and community engagement in mutually reinforcing ways. Ensure that educators have the professional autonomy, academic freedom, time, resources, and institutional support needed to collaborate across boundaries.

03 **Build reciprocal knowledge and learning infrastructures.** Support networks, platforms, and partnerships connecting schools, universities, communities, workplaces, and policymaking spaces. Enable physical and virtual mobility, multilingual exchange, collaborative knowledge production, and continuity of learning during displacement and emergencies.

04 **Enable polycentric and collaborative governance.** Strengthen coordination across local, national, and global levels while addressing unequal power and ensuring that educators, learners, communities, researchers, and policymakers participate meaningfully in shared decision-making.

05 **Bring plural knowledge systems into dialogue.** Create conditions for scientific, Indigenous, local, and experiential knowledge traditions to inform collective learning and action without collapsing their differences, while respecting the authority of the communities and knowledge holders who sustain them.

06 **Address structural barriers to participation.** Confront unequal funding, digital access, language hierarchies, visa and migration restrictions, displacement, and uneven recognition of qualifications that shape who can move, participate, and be heard.

07 **Cultivate relational and systems thinking capacities.** Support learners and educators in understanding interdependence, engaging across differences, navigating complexity and uncertainty, and acting collaboratively across places and scales.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illustrate how educational transformation grows through connection. By linking communities, institutions, knowledge systems, and places, they demonstrate how crossing boundaries can expand what education is, who participates in it, and what becomes possible for planetary futures.

Ecoversities Alliance: Learning Across Boundaries

The Ecoversities Alliance is a global ecosystem of more than 400 community-rooted learning initiatives that challenges the idea that education happens primarily in schools and universities. Connecting Indigenous knowledge holders, grassroots organizations, educators, artists, farmers, and local communities across more than 40 countries, the alliance creates spaces where diverse ways of knowing can learn from one another. In doing so, Ecoversities reimagines the boundaries of education itself—where learning happens, who teaches and learns, and what forms of knowledge are valued.

Learn more

Ecoversities Alliance. (n.d.). *Ecoversities: Learners and communities reclaiming diverse knowledges, relationships, and imaginations*. https://ecoversities.org/

Whole-School Approaches: Reimagining the Institution

Whole-school approaches to sustainability recognize that education cannot fully prepare learners for regenerative futures if schools continue to reproduce fragmented or extractive ways of organizing learning. Across diverse contexts, schools are reimagining themselves as living learning ecosystems, connecting curriculum, governance, food systems, buildings, biodiversity, and community partnerships within a shared educational vision. Sustainability is no longer confined to the classroom but becomes embedded in how schools make decisions, steward resources, and relate to surrounding communities and ecosystems. By engaging learners, educators, leaders, and community partners, these approaches demonstrate how institutional practices can embody and reinforce the principles taught through the curriculum.

Learn more

Wals, A. E. J., Bjønness, B., Sinnes, A., & Eikeland, I. (Eds.). (2024). *Whole school approaches to sustainability: Education renewal in times of distress*. Springer. https://doi.org/10.1007/978-3-031-56172-6

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Climate-U: Connecting Universities and Communities Across Borders

Climate-U is an international network bringing together 29 universities and other organisations across 17 countries in Africa, the Americas, Asia, Europe and the Pacific to explore how higher education can contribute to locally grounded and socially just responses to climate change. Through international dialogue, reciprocal exchange, coalition-building, and participatory action research, the initiative connects students, educators, university leaders, community organizations, local governments, and other social actors. Rather than transferring a single model across settings, participating institutions co-produce responses grounded in their own ecological, social, and institutional contexts while learning across countries and regions. Climate-U demonstrates how universities can cross disciplinary, institutional, and geographic boundaries while connecting research, teaching, community knowledge, and climate action. The network grew out of a research project that ran from 2020-2024 in Brazil, Fiji, India, Indonesia, Kenya, Tanzania and the UK, focusing on the role of universities in climate action (Climate-U 2021; Nussey et al. 2023; Rolleston et al. 2023; Sasidevan et al. 2025).

Learn more

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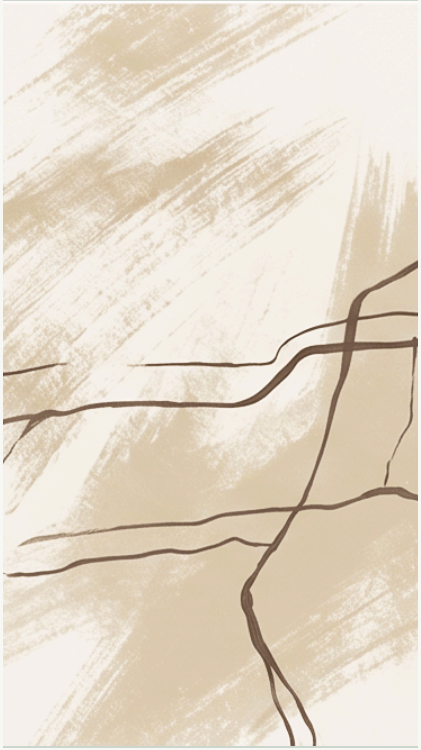
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08

WHEN INTELLIGENCE CHANGES

As AI systems gain capabilities, education must cultivate the human readiness and collective agency needed to shape how AI enters learning and life.



KEY MESSAGES

- Human readiness extends beyond technical literacy to the psychological, cognitive, and relational dimensions learners need to retain judgment, agency, and meaningful human relationships.
- AI systems carry epistemic and material conditions into education—from whose knowledge and languages become legible to the energy, water, minerals, and infrastructures that sustain them—making AI an issue of educational, ecological, and epistemic justice.
- Learners and educators need meaningful decision-making roles about how AI is selected, designed, governed, and used in education, shifting their position from recipients of technological change toward participants in shaping it.
- AI futures remain open. Education can strengthen the capacities and collective agency through which people question technological inevitability and participate in shaping more plural futures.

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INSIGHT

Artificial intelligence has entered education from every direction, and often the loudest debates treat it as a race to keep pace and stay competitive. Yet AI is becoming more than another educational technology. The same systems that answer a student's homework question also rank what young people and others see about themselves. These systems shape people's experiences and opportunities in two distinct ways. Some act as intermediaries between learners and their world, shaping what is seen and what is skipped. Beliefs are still formed by the person, but increasingly in relation to the information and environments the system supplies. Others make decisions with real-world consequences, shaping access to jobs, loans, and educational opportunities. Young people are now growing up inside the first system and beneath the second. The worldviews formed through their interactions with these systems shape how learners understand themselves and their relationships with other people and the planet.

AI brings fundamental questions about education into unusually sharp focus: what counts as knowledge, what education values in human learning, how relationships are mediated, what remains unnoted, unmeasured, whose interests shape technological systems, and who gets to participate in shaping educational futures. Global dialogues, including the 2025 Global Forum on the Ethics of AI in Bangkok, have called for critical and values-based AI literacy, knowledge diversity, and more participatory approaches to AI and learning (BRIDGES et al., 2026). Yet the accelerating presence of AI across learning and everyday life raises questions that reach beyond AI literacy alone. AI is entering not only classrooms but the wider environments through which people learn and come to know the world: media, play, and conversation; the bond a child has with a grandparent; an encounter with an animal or a stretch of unsettled land; and the everyday settings through which we come to know the world, both human and more-than-human. Across these settings, ways of relating, judging, and trusting take shape and continue to develop over the course of a lifetime. AI is increasingly entering these spaces as well, often before learners encounter it through a formal curriculum (OECD, 2025; UNICEF, 2025; Burns et al., 2026). This matters because learners may already be forming habits of trust, judgment, and relationship with AI before education explicitly asks them to examine those relationships.

The implications of AI also differ across developmental stages. Younger learners may encounter algorithmically mediated environments while developing a sense of self or learning both to trust their own judgment and to stay with uncertainty. Older learners face different questions as AI increasingly takes on cognitive and relational functions they might otherwise exercise themselves. What a younger learner may still be developing, an older learner may increasingly need to exercise and sustain. Across these differences, three questions become central: What do learners need to engage with AI critically and well? What epistemic and planetary conditions structure the systems they encounter? And who gets to shape how AI enters learning and life?

BEYOND AI LITERACY: HUMAN READINESS

Responses to AI in education now swing between the extremes of mandating AI training on the one hand and classroom bans on the other. Both treat the technology as the thing to manage while the human remains unexamined. Underlying both is the same assumption that deployment amounts to

readiness, that exposure produces the capacities learners need, and that adaptation will happen on its own. The impulse behind critical AI literacy is important: learners need to understand how these systems work, where they fail, whose interests they serve, and how to engage with them critically and responsibly (Miao et al., 2024). But even strong forms of critical AI literacy leave a deeper question.

This insight builds on Sellick's (2026) Human Readiness framework, which shifts attention from what learners need to know about AI to what they themselves must remain able to do as AI becomes increasingly woven into learning and life. The framework foregrounds three interconnected dimensions of readiness: psychological, cognitive, and relational. Psychologically, readiness involves sustaining a sense of self and agency in encounters with systems increasingly capable of capturing attention and simulating intimacy or attachment. Cognitively, it means sustaining independent judgment: noticing what is being asked of learners, answered for them, and ignored on their behalf, and noticing when fluent answers let performance outpace understanding. Relationally, readiness involves bringing what was formed through human bonds to encounters with entities that simulate them (Sellick, 2026; Burns et al., 2026). It also means valuing human bonds themselves and what they teach through empathy, repair, patience with imperfection, reciprocity, vulnerability, and forms of friction that synthetic interactions do not reproduce in the same ways.

A learner can understand that a companion chatbot is designed to sustain engagement and still feel the pull of its validation. They can also know that fluent answers can be inaccurate and still accept them without scrutiny. Readiness is also uneven: the same system that steadies one learner may unsettle another, depending on stress, prior understanding, loneliness, and circumstance. Mandates and bans alike can assume a uniform learner, and there is no such learner. Emerging research on adolescent use of AI companions reinforces this concern: young people use these systems for social interaction, emotional support, and serious conversations, raising questions about trust, attachment, and relational development (Robb & Mann, 2025).

Yet when human–AI interaction is evaluated, the machine is what gets measured. Developers benchmark capability, safety teams assess for harm, institutions track adoption. Where human subjectivity appears, it is often reduced to metrics such as satisfaction, engagement, or performance with the tool. Far less visible is what sustained interaction enables, displaces, strengthens, or weakens in learners. Generating information has become effortless, yet understanding depends on effort. Understanding remains slow, embodied, situated in a life and a place. Early evidence illustrates this distinction: high-school students given unrestricted AI assistance improved during practice but performed worse than peers without such assistance once the tool was withdrawn (Bastani et al., 2025). The educational question is therefore larger than whether AI improves immediate performance: what remains when the tool is removed—not only in what learners know, but in how they understand learning, knowledge, and their own agency?

Human readiness cannot be separated from institutional readiness. Education systems must also exercise judgment about where AI adds value, where human relationships and expertise should remain central, what learning deserves time and attention, and what should not be delegated to technological systems.

EPISTEMIC AND PLANETARY CONDITIONS: MAKING THE INVISIBLE VISIBLE

Behind the visible tools sit invisible conditions: what trains them, what powers them, and at what cost. Whose language and knowledge train these systems? Whose knowledge and values become legible to these systems, and whose remain invisible or marginalized? When AI enters classrooms, it carries assumptions about what constitutes knowledge. Underrepresented ways of knowing, including local, traditional, and Indigenous knowledge, may become less visible or legible only through categories that do not reflect their own epistemological foundations (UNESCO, 2026; Kwok, 2026). The knowledge that trains the system shapes what learners encounter and may influence what they come to trust, making AI a question of epistemic justice as well as technical competence.

The question is therefore larger than whether AI systems contain sufficiently diverse information. It concerns how particular systems make some ways of knowing visible while rendering others marginal, extractable, or commensurable on terms not their own (Kwok, 2026). Learners need opportunities to ask not only whether an AI-generated answer is accurate, but whose knowledge makes that answer possible, what assumptions organize it, and what remains outside its frame.

These epistemic inequalities are entangled with the material geographies through which AI is built. AI depends on energy, water, minerals, data centers, semiconductor supply chains, and other physical infrastructures whose environmental burdens are unevenly distributed (Hlabisa, 2025; Xiao et al., 2025). These infrastructures make AI a planetary as well as technological question. Education can leave these conditions invisible or bring them before learners as questions worth investigating. Technologies that appear frictionless at the interface remain embedded in material landscapes, political economies, labor, and relationships of extraction.

COLLECTIVE AGENCY: FROM USERS TO ACTORS

In AI policy, both educators and young people tend to be framed primarily as users. They are often positioned as people expected to develop the skills required to adapt to new technologies (Faul, 2024). Yet learners and educators are also knowledge holders and actors, with a stake in how AI enters education and with experience that should inform decisions about its design, selection, deployment, evaluation, and governance (UNESCO, 2021; UNICEF, 2025). Such a scenario requires building not only training programs but appropriate participatory structures. Students, teachers and the institutions that learn with them need a seat at the table when tools are chosen, and a voice in what gets piloted for and with them—not just on them.

This is also a question of power. The capacity to shape AI is distributed far less evenly than the consequences of its deployment. A generation that only ever receives AI tools, without also shaping decisions about how they are introduced, risks learning that someone or something else has the overall say in the decisions being made for and about them. Participation in AI governance is therefore itself educational: how institutions select, procure, introduce, and govern AI teaches learners something about whose judgment matters and who has agency in shaping technological change (UNICEF, 2025).

This opens the question beneath all three challenges. Before asking how to use AI more effectively, the education sector, as indeed all sectors of society, needs to ask to what end these uses are being defined. Does the technology help us live with uncertainty, or does it reinforce the belief that increasingly complex futures can be predicted, answered instantly, and optimized until they feel

controllable? None of this is inevitable. Inevitability is itself a narrative, one that can narrow the space for questioning and collective choice. The work of education opens up different narratives: preferred futures that young people can see themselves building, and renewed value for the experiential, embodied, and relational ways of learning and being.

Taken together, these challenges shift the educational question posed by AI. The task is larger than preparing learners to use increasingly capable technologies. It means enabling learners to judge, relate, question, and act; making visible the epistemic and planetary conditions behind AI systems; expanding collective agency over how those systems enter learning and life; and strengthening the capacity of education systems themselves to decide what should—and should not—be delegated to AI. Education has a vital role to play in keeping futures plural. But this responsibility does not rest with learners or educators alone. It is shaped by the institutions, governments, technology companies, funders, and other actors involved in developing, financing, selecting, governing, and bringing AI into collective life. Education's task is not simply to prepare learners for an AI-shaped future, but to enable them to participate in determining what role AI should have in learning and life.

08 Pathways for transformation

01 **Evaluate the human side of human–AI interaction.** Alongside measures of machine capability, safety, and adoption, examine what learners are gaining, keeping, or ceding through their interactions with AI.

02 **Make human readiness explicit in AI literacy.** Extend literacy efforts beyond understanding and using tools to encompass the psychological, cognitive, and relational dimensions that critical engagement requires.

03 **Build institutional readiness alongside human readiness.** Education systems must exercise judgement about where AI adds value, where human relationships and expertise should remain central, what learning deserves time and attention, and what should not be delegated to AI.

04 **Seat learners and teachers at the table.** Give them meaningful roles in the selection, procurement, piloting, evaluation, and governance of AI, as actors shaping how it enters education rather than simply recipients of training.

05 **Make AI's epistemic and material conditions visible.** Bring the languages, knowledge systems, labor, energy, water, minerals, and infrastructures behind AI into learning, asking whose knowledge becomes visible, whose is marginalized, who bears its material costs,and who benefits.

06 **Keep futures plural. Treat inevitability as a claim.** Create opportunities for learners to question assumed technological futures, imagine alternatives, and participate in determining what role AI should have in learning and life.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The examples below show different responses already taking shape: protecting space for human development, reconsidering what education should preserve in an AI-rich world, building AI from different epistemic foundations, and giving learners a role in governing the technologies that shape their lives. These are not prescriptions or models for replication, but illustrations of how different actors are creating space to question assumptions, exercise collective choice, and keep AI futures plural.

Readiness Before Access: New York City's Generative AI Moratorium

New York City Public Schools, the largest system in the United States, is asking what student readiness looks like before AI enters the classroom. For the 2026 to 2027 school year, the city introduced a one-year moratorium on student-facing generative AI from 2-K through eighth grade, impacting nearly 600,000 students, while prohibiting companion chatbots in all grades. High school students complete two 45-minute AI literacy modules focused on how AI works, data privacy and bias, and appropriate uses of AI, alongside limited opportunities for supervised use through approved programs and pilots. The pilots were selected in part for their emphasis on keeping students engaged in their own thinking and learning. A Technology in Schools Coalition—including students, educators, parent leaders, elected officials, advocates, union partners, and experts—will assess the policy and provide recommendations for the following year. The mayor and chancellor framed the policy around protecting human connection, relationships with educators, and opportunities for learners to work through difficult problems themselves. Norway adopted a similar age-differentiated approach in June 2026, recommending that students in grades 1–7 generally not use generative AI themselves for schoolwork, while allowing progressively greater use in lower-secondary and upper-secondary education. Together, these examples reflect a broader shift from asking simply how young people should learn to use AI toward asking what needs to be in place for them to engage with it well. They raise questions about what human capacities should develop before and alongside AI use, who decides when learners are ready for different forms of AI interaction—particularly chatbots—and how education systems can learn from and revise their own choices.

Learn more

New York City Mayor's Office. (2026, September 2). *Mayor Mamdani and Chancellor Samuels put students first with nation's broadest generative AI moratorium in schools.* https://www.nyc.gov/mayors-office/news/2026/09/mayor-mamdani-and-chancellor-samuels-put-students-first-with-nat

New York City Public Schools. (2026). *Guidance on artificial intelligence and screen time.* https://www.schools.nyc.gov/about-us/policies/guidance-on-artificial-intelligence

Norwegian Ministry of Education and Research. (2026, June 19). *Kunstig intelligens skal i all hovedsak ikke brukes i barneskolen* [Artificial intelligence should generally not be used in primary school]. Norwegian Government. https://www.regjeringen.no/no/aktuelt/kunstig-intelligens-skal-i-all-hovedsak-ikke-brukes-i-barneskolen/id3166807/

MIT: Re-Asking What a University Education is For

In August 2026, MIT released the report of its Ad Hoc Committee on *AI Use in Teaching, Learning, and Research Training*. The report goes beyond tools' privacy. It opens as a call to action and presses the institution toward deeper questions about the structure, meaning, and value of its education in an era in which AI is playing an unprecedented shaping role. Among its recommendations: every course states an explicit AI use policy, and the institution deepens its investment in its residential human community by treating study groups, office hours, and undergraduate research as infrastructures worth protecting. The example shows a leading global institution actively choosing its future with AI, and the choices that are already underway.

Learn more

Massachusetts Institute of Technology, Ad Hoc Committee on AI Use in Teaching, Learning, and Research Training (2026). AI and Education. https://aiandeducation.mit.edu/

Reimagining AI from Indigenous Knowledge Systems: Abundant Intelligences

Abundant Intelligences is an Indigenous-led, Indigenous-majority international research program asking a different question about AI: rather than simply making existing systems more inclusive, what might AI become if its foundations were reimagined through Indigenous knowledge systems? Working through locally rooted research Pods, Indigenous knowledge holders, language keepers, cultural practitioners, students, scientists, artists, and engineers collaboratively imagine, design, and prototype culturally grounded AI. Projects connect AI with Indigenous language revitalization, storytelling, land stewardship, creative practice, and community priorities. The initiative demonstrates that epistemic justice in AI reaches beyond representation in training data; it also concerns who defines intelligence, whose protocols govern technology, and who has the power to shape what AI becomes.

Learn more

Abundant Intelligences
https://abundant-intelligences.net/

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From Users to Actors: Student AI Councils

Student AI councils offer one pathway for moving learners from users to actors in AI governance. At Study Hall School in Lucknow, India, students formed an AI task force to investigate AI's benefits and risks, develop guidelines for responsible use, contribute to school policy, and lead dialogue with peers. Similar models could give learners meaningful roles in testing AI tools, shaping policies, redesigning learning, and informing procurement. The significance reaches beyond AI literacy: participation itself becomes educational, giving young people experience in deliberating about technologies that increasingly shape their learning and lives.

Learn more

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09

MEASURING WHAT MATTERS

What is measured shapes what is learned: Rethinking education metrics for planetary futures.



KEY MESSAGES

- The current architecture of education metrics, including standardized assessments, global rankings, and performance indicators, prioritizes measures that are often misaligned with planetary realities.
- While existing metrics provide insights into system variation and outputs, the overall landscape of education measures needs to be broadened. The challenge is to better assess how, and under what conditions, education enables learners and communities to sustain life, adapt to change, and act with care, extending attention beyond individual achievement and attainment to relational wellbeing and collective capacity within planetary limits.
- Reimagined metrics can inform and contribute to the transformation of education systems and policies by making visible how education contributes to learner wellbeing, sustainable and just societies, and supporting all forms of life on the planet.

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INSIGHT

Data, indicators, and assessment frameworks have become integral to contemporary education governance, providing important tools for monitoring progress, supporting accountability, shaping policy, and enabling comparison across education systems. In doing so, they influence what aspects of education systems are valued and prioritized. The purposes of measurement have shifted over time: from auditing religious fidelity, moral worldviews and political loyalties, to advancing human rights and universal access aligned with global policy commitments, to more recent emphases on human capital formation and individual achievement (Sellar & Lingard, 2014). The challenge today is to ensure that what education systems measure reflects the evolving purposes of education in an era of planetary change. Existing systems not only provide valuable insights into foundational skills (literacy and numeracy), human capital outcomes and overall attainment, they also shape policy attention, resources, and practice. As a result, existing metrics constrain what is institutionally visible and offer only a partial view of education's broader contributions to learner and societal wellbeing, including through developing relational and collective capacities that support life within planetary boundaries (McKenzie, 2021; Benavot et al., 2026).

This is not an argument against measurement. Rather, it is a call to expand and rebalance what is measured and why. Existing measurement frameworks, such as the IEA's TIMSS and OECD's PISA, have enabled forms of accountability, comparison, policy coordination and peer learning across diverse contexts, and have shaped education systems worldwide (Sellar & Lingard, 2014). However, such frameworks tend to privilege individual achievement and attainment, and historically had a narrow focus on basic learning outcomes, overlooking the development of broader skills and capacities that are increasingly called for in the face of multiple crises, including the relational and collective wellbeing aspects essential for individual flourishing, societal health and planetary sustainability (Benavot, McKenzie & MECCE Project Team, 2021; Fischman et al., 2019). As a result, current global metrics provide only a partial view of the important roles of education in society, capturing aspects of performance and output, but providing limited insight into how learning contributes to sustaining life, strengthening communities, and navigating complexity (McKenzie, 2021).

Basic information on education access, participation and completion, as well as international large-scale assessments (ILSAs) such as PISA, have become dominant forces in the global measurement landscape. Designed to enable comparability across education systems, they have produced influential data on provision, attainment, foundational learning and system performance as well as salient inequalities by location, gender, race, ethnicity, and socio-demographic dimensions. But what legitimately counts as the purposes and outcomes of teaching and learning have become narrowly defined. For example, the emphasis on standardized cognitive outcomes and cross-national ranking privileges forms of knowledge that can be measured uniformly across contexts, while rendering other learning aspects less visible within dominant frameworks (Fischman et al., 2019; Sellar & Lingard, 2014). In this sense, what is not measured is not simply absent, but systematically marginalized within policy discourse. It should be possible for assessment frameworks to also render visible more contextualized forms of knowledge and learner experience, even if they are less standardized and comparable with other systems.

Current global metrics have played powerful roles in structuring global and national education agendas, often shaping policy priorities, donor allocations, and reform trajectories in ways that extend beyond their technical function (Benavot & Smith, 2020; Grey & Morris, 2023; Chandir, Gorur, & Blackmore, 2025; Smith & Benavot, 2020). While typically framed as neutral tools of comparison, their influence can narrow the space of what is considered legitimate knowledge, critical skills, and desirable outcomes; often privileging competition, standardization, and comparability over relational, contextual, and interdependent forms of learning.

The dynamics of constructing and disseminating global metrics reflect how indicators are used within global education governance. Existing indicators do not simply monitor progress; they actively shape policy priorities, resource allocation, and public discourse. Their strength emanates from their ability to simplify complex and context-dependent realities into proxy measures that are more easily communicated, even if that means

ignoring lived experience (Benavot et al., 2026). In this way, current education metrics tend to privilege priorities of competition and marketization, over what may be more meaningful or necessary for societal continuation in the face of growing planetary challenges and associated declines in the wellbeing of young people (McGorry et al., 2024). Without reconsideration and redesign, such metrics risk directing attention toward improving "the numbers" rather than the underlying conditions they are intended to represent, reinforcing a tendency to prioritize measurable outputs over more complex and contextually grounded forms of teaching, learning and change (Benavot et al., 2026).

In recent years, efforts are underway to extend and diversify what is measured and for what purposes. Global indicators of climate change education demonstrate how measurement can move beyond self-reported country commitments toward more systematic analysis of curriculum content and policy frameworks. For example, greening curriculum indicator 4.7.1b, added to SDG global indicator 4.7.1 in 2024, provides a structured approach to assessing the integration of environment, sustainability, biodiversity and climate change themes across curricular policies and science and social science curricula (McKenzie, Benavot & Redman, 2024; MECCE Project, 2024). Other developments are extending measurement toward learner capacities. OECD's forthcoming PISA 2029 Climate Literacy assessment, for example, will examine 15-year-old students' climate knowledge, skills, attitudes, and values, including their capacity to understand climate systems, evaluate evidence, engage with diverse perspectives, and exercise agency in envisioning sustainable solutions (OECD, 2026). Such initiatives help create a new evidentiary base that can support country peer learning and evidence-informed policy making. They can also play a critical role in establishing new global baselines and comparability across systems to track changes over time.

Despite these advances, the ongoing challenge remains clear: while indicators and other global data on curriculum or learner achievement provide important signals of intent and of outcomes of certain types, they are limited either in their ability to reflect how education and pedagogy are practiced, or in their scope of cognitive based learning which leaves out the development of capacities for adaptation, relational wellbeing in the face of a changing planet, and resilient collective action. As a result, key dimensions of educational transformation, particularly those that are relational and collective remain relatively invisible in existing measurement architectures.

Such limitations point not to the failure of education measurement, but to the need to reimagine its purposes and the content of the toolkits being utilized. Emerging work on greening education indicators demonstrates how metrics, when thoughtfully designed, can function as new leverage points for system change and act as boundary objects, connecting governance levels, aligning diverse actors, and supporting shared understandings of progress toward sustainability and climate adaptation (McKenzie, Benavot & Redman, 2024; Benavot, McKenzie & MECCE Project Team, 2021). At its best, education measurement becomes a practice of collective sensemaking, enabling systems to learn from themselves and others, and adapt educational aims and outcomes in response to complex and evolving conditions. Well-conceived indicators can serve as powerful levers for policy change when deliberately designed to inform, motivate, and support action (Benavot et al., 2026; Antoninis, Benavot & McKenzie 2025). Drawing on diverse data sources, stakeholder perspectives, and contextual knowledge, collaborative approaches to indicator development can enhance both the relevance and uptake of metrics, positioning them not only as tools for monitoring, but as catalysts for coordination, learning, and transformation.

Reimagining education metrics in this context requires a shift from measuring individual learning achievement to also focusing on the understandings and capacities necessary for personal and collective wellbeing in the face of planetary change. Transforming existing metrics involves exploring a broader array of learning in different modalities, at different levels, including forms of learning that are relational and collective. This includes, for example, the ways in which education systems support forms of agency, imagination, and belonging that are enacted within communities and embedded in social and ecological relationships. It also involves understanding how learning contributes to collective capacity for adaptation, resilience, and care — dimensions that extend beyond individual achievement and require attention to the conditions under which people learn, relate, and act together. Assessment could therefore examine how local school communities

identify and respond collectively to locally experienced climate risks, engage community and local knowledge, and connect learning with tangible changes in their social and ecological contexts. Globally defined indicators can be complemented by locally generated and participatory forms of evidence that reflect these differing conditions and priorities.

Other examples of transformed metrics are emerging. Consider, for example, the Inner Development Goals (2023), which point to the importance of qualities such as presence, empathy, and purpose in navigating complexity and enabling collective action. While such dimensions have historically been marginal within formal measurement systems, they are increasingly recognized as central to how individuals and communities respond to uncertainty and change. Or consider the work of the UN's High-Level Expert Group on Beyond GDP, which released its final report in 2026, entitled Counting What Counts: A Compass of Progress for People and Planet. The report proposes a dashboard of 31 indicators organized around four interconnected dimensions: foundational principles (peace, human rights, and respect for the planet); wellbeing (including material conditions, health, education, security, social cohesion, and environmental quality); equity and inclusion (capturing inequalities and disparities across population groups); and sustainability and resilience (linking present outcomes to future wellbeing).

These emerging approaches highlight a more complete and contextually grounded understanding of education and learning not only as ends in themselves but also as means to other ends. These measurement tools help orient education systems toward the conditions required for sustaining life within planetary boundaries. What is measured shapes what is valued, and what is valued, in turn, shapes the trajectories of education systems and societies. Reimagining education metrics is therefore not simply a technical exercise; it is an opportunity to redefine what education is for in an era of planetary change.

09 Pathways for transformation

01 **Broaden what education systems measure**. Complement existing indicators with new measurement approaches, including locally generated and participatory ones, that prioritise relational well-being, collective capacity and community knowledge and ecological experiences.

02 **Design metrics for collective learning and transformation**. Use indicators as tools for reflection, coordination, and shared learning across local, national, regional and global contexts, rather than primarily for ranking, comparison, or sanctioning.

03 **Align education metrics architectures with planetary conditions**. Ensure that data collection and monitoring systems reflect the capacities needed to live within ecological limits and support regenerative futures.

04 **Create innovative measures that focus on youth and adult learning outside of formal education**. Develop measures of non-formal and informal learning that would supplement existing metrics and provide an emergent platform of lifelong and life-wide learning for people and the planet.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illustrate how measurement can make previously overlooked dimensions of education visible and support policy coordination, collective learning, and improvement. They also demonstrate the importance of combining global indicators with contextual and locally generated evidence rather than assuming that all meaningful learning can or should be standardized.

Greening Curriculum Indicator: Changing What the SDGs Measure

The **Greening Curriculum Indicator** (GCI) represents an important shift in what the international community recognizes and monitors as global educational progress. Developed through a collaboration between the Monitoring and Evaluating Climate Communication and Education (MECCE) Project and UNESCO (the ESD section, the Global Education Monitoring Report, and the Institute for Statistics), the GCI emerged in response to a decision by the SDG4 High-Level Steering Committee to track country efforts to address one of seven Global Initiatives launched at the 2022 UN Transforming Education Summit*: Greening Education - to get every learner climate ready*. After addressing questions raised by technical experts and country representatives, the GCI was formally adopted in 2024 by members of the UN Inter-Agency and Expert Group on Sustainable Development Goal Indicators as SDG global indicator 4.7.1b. Its inclusion means that the integration of environment, sustainability, climate change, and biodiversity into national curricula is now a visible feature of the framework used to monitor global progress on education. The indicator examines two kinds of official documents: national curriculum frameworks and science and social science curricula for grades 3, 6, and 9. Initial estimates covering 110 countries indicate that approximately 85% of national curriculum frameworks contain some greening content, although its depth and distribution vary significantly across grades and knowledge domains. The GCI demonstrates how collaborative research can reshape global policy priorities and make previously overlooked dimensions of education internationally visible. Because it examines intended curricula rather than classroom practice or learners' experiences, it also illustrates why global indicators must be complemented by other forms of evidence that provide more in-depth and contextually relevant information.

Learn more

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Global Knowledge Index: Reorienting Measurement toward Interdependence

The 2025 *Global Knowledge Index* (GKI), produced by UNDP in partnership with the Mohammed bin Rashid Al Maktoum Knowledge Foundation, assesses knowledge systems across 195 countries. Its revised education framework seeks to move beyond an exclusive focus on individual achievement and national economic competitiveness by giving greater attention to sustainability, wellbeing, resilience, diverse forms of knowledge, and interdependence. New and revised measures include green curriculum intentions and student wellbeing in pre-university education, as well as sciences–humanities parity, international research collaboration, and

greening research in higher education. Together, these measures recognize that education shapes how learners relate to one another and the natural environment and that responding to planetary challenges requires knowledge from across disciplines and societies. The GKI illustrates how an established global index can be broadened to reflect changing understandings of educational purpose, while also demonstrating the continuing need to complement internationally comparable indicators with contextual and locally generated evidence.

Learn more

United Nations Development Programme & Mohammed bin Rashid Al Maktoum Knowledge Foundation. (2025). *Global Knowledge Index 2025*. https://www.undp.org/arab-states/publications/global-knowledge-index-2025

Chile's National Environmental Certification System for Educational Establishments: Localizing Metrics for Socio-Ecological Transformation

The National Environmental Certification System for Educational Establishments (SNCAE) in Chile represents a shift from standardized cognitive benchmarking toward holistic, locally grounded education metrics. Established in 2003 through an agreement involving the Ministry of the Environment, the Ministry of Education, the National Forestry Corporation and the Chilean Association of Municipalities, SNCAE is a voluntary public certification program. Rather than treating sustainability as a detached, "green housekeeping" compliance exercise, the framework establishes measurement tools designed to orient school toward life sustenance, community cohesion, and a just socio-ecological transition.

The SNCAE offers public certification at three levels (Basic, Intermediate and Excellent) and evaluates schools across three key domains: *Curricular-Pedagogical* (are environmental dimensions included across statutory management instruments, interdisciplinary lesson plans, outdoor education, and family participation); *Management* (energy efficiency, water conservation, solid-waste management, biodiversity protection, and climate change disaster-risk reduction) and *Relations with the Surroundings* (do schools develop local socio-environmental risks and build collaborations with neighboring communities, municipalities, and local organizations). The assessment process is organized internally by local school Environmental Committees composed of principals, teachers, parents, and students. Subsequently the evidence is reviewed regionally by a dedicated committee that validates qualitative and contextual indicators before granting public certification. Basic and intermediate certification are valid for two years and excellence for four, after which the school submits a revalidation report covering the actions taken since the last certification. By March 2025, the initiative reported 2,450 active certified educational institutions (about one-fifth of all schools), with nearly 60% reaching the Excellence level. Ultimately, SNCAE demonstrates how a state-supported framework can successfully merge structured public evaluation with participatory, context-specific evidence to make visible small-scale and meaningful educational transformation.

Learn more

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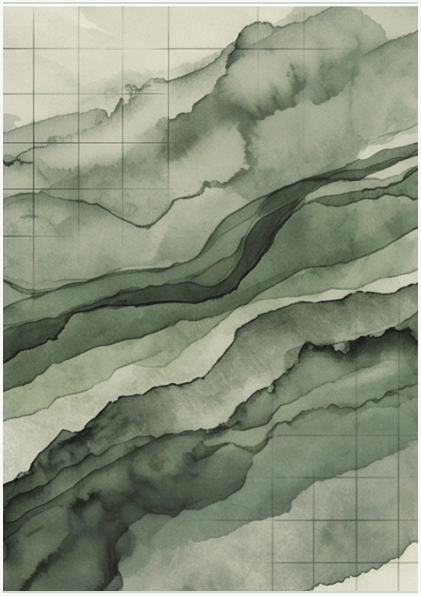
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10

LEARNING TO TRANSFORM TOGETHER

Planetary futures depend on transforming the systems and conditions through which societies learn.



KEY MESSAGES

- Educational transformation unfolds across interconnected scales and depths—from everyday practices, technologies, and institutions to the purposes, knowledge systems, and worldviews that shape them. Change in any one dimension can enable, constrain, or redirect change in others.
- Educational transformation cannot be fully predicted, controlled, or reduced to a single pathway. It depends on creating conditions for collective discernment, experimentation, contestation, reflection, reciprocal learning, and adaptation as contexts change.
- People and relationships transform educational systems. What change becomes possible depends on agency, voice, shared decision-making, and enabling conditions, including protected spaces for freedom of expression, adequate financial and human resources, and supportive working conditions.

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INSIGHT

Planetary crises are commonly understood as failures of energy, economic, food, health, ecological, social, and political systems. Yet they also expose the limits of how societies organize knowledge, coordinate collective action, and imagine possible futures (Meadows, 2008). Scientific understanding about climate change, biodiversity loss, and ecological degradation continues to expand, while the capacity to translate that knowledge into coordinated action remains limited. This paradox is increasingly recognized as one of the defining challenges of planetary crises (Glavovic et al., 2022). The widening gap between knowledge and action raises a fundamental question about collective learning: how societies interpret changing conditions, deliberate across differences, coordinate actions, and adapt over time. However, this gap is not primarily a failure of information. It is produced by how power and material interests shape which knowledges are acted upon: economic arrangements that reward extraction and short-term returns, actors with a stake in delaying change, unequal influence over public decision-making, and institutions designed to reproduce existing practices. This gap is also shaped by institutional inertia, conflicting interests, cultural assumptions, and the emotional and relational conditions that influence whether people engage with or retreat from what is known.

Bridging knowledge and action requires more than additional information. Learning can reproduce or even strengthen existing assumptions and harmful arrangements, but it can also become a force for transformation. Its transformative potential lies in bringing those assumptions into question and reshaping how problems, purposes, and possibilities are understood through reflection, dialogue, and action, including attention to the power relations that shape whose knowledge counts and whose realities become visible (Bateson, 1972; Freire, 1970; Quijano, 2000). What distinguishes transformative learning from critical questioning alone is not its radicalism but its responsibility and accountability: transformative learning examines its own assumptions, remains open to evidence and to those affected, and can be revised through exchange across different visions of what education for planetary futures requires. This kind of transformative learning builds collective capacity to question what is taken for granted, negotiate different understandings, and change what becomes imaginable and possible for collective action.

For such transformative learning to become consequential, the systems and conditions through which societies learn must also change. Practices and institutional arrangements matter, but so do the incentives, power relations, feedback processes, and underlying logics that organize them (Faul & Savage, 2023; McCowan, 2023, 2025; Meadows, 2008; Sterling, 2001, 2024). Reforms can alter visible practices while leaving deeper logics intact. Worldviews, purposes, policies, and practices shape one another recursively. Worldviews inform educational purposes; purposes shape policies and institutional arrangements; and these organize everyday practice. Yet change also travels in the other direction: new practices can expose the limits of existing policies, institutional experimentation can unsettle established purposes, and both can reshape how education itself is understood. Transformation is therefore less a sequence of reforms than an ongoing reorganization of relationships across different parts and depths of the system.

Established cultural norms, institutional logics, and incentives can absorb or redirect change, while new relationships and practices can open previously difficult-to-imagine possibilities. Transformation may involve simultaneous processes of decline, transition, and emergence as established arrangements lose legitimacy or capacity and locally grounded alternatives develop through relationships and collective action. Transformation therefore involves creating new possibilities while unlearning inherited assumptions and responsibly releasing practices and arrangements that no longer serve planetary futures, with care for those affected by their decline (Machado de Oliveira, 2021; Silova et al., 2025).

These transitions are also shaped by historically constituted relations of power that influence whose knowledge is recognized, whose interests carry weight, and whose ways of knowing are marginalized (Quijano, 2000). What emerges, what is sustained, and what is allowed to decline depend on whose knowledge and ideas receive recognition and support, whose interests and losses are taken seriously, how the interests of future generations and the more-than-human world enter decision-making, who controls resources and institutional authority, and who participates in deciding what comes next. Systems transformation is therefore not only a question of how change happens, but of who has the power to shape its direction.

Educational systems are constituted, sustained, and transformed by the people and relationships within them. Educators working across all levels, from early childhood to higher to higher and adult education, and across formal, non-formal, community-based, and digital or hybrid settings, bring essential knowledge of learners, institutions, communities, and everyday practice to processes of change. This includes teachers, teaching assistants, faculty in tenured and contingent positions, technical and vocational instructors, community and youth educators, and the support staff who make learning possible. Their capacity to shape transformation depends on secure employment, professional autonomy, academic freedom, collective voice, supportive working conditions, and meaningful participation in decision-making. Teacher unions and other organizations of educators and researchers can extend this agency through social dialogue and collective action. Adequate staffing, time, resources, professional learning, safe and climate-resilient learning environments, and sustained public financing provide the material conditions through which transformation can take root. Learners, families, communities, and knowledge holders must likewise participate meaningfully in decisions affecting their lives, institutions, and futures.

Participation, in turn, raises questions of knowledge and authority. Transforming educational systems requires learning with multiple ways of knowing, relating, and organizing, including those grounded in Indigenous, local, and relational knowledge traditions and relationships with land and the more-than-human world (de la Cadena & Blaser, 2018; Escobar, 2018). Crucially, this means respecting the authority of communities and knowledge holders to determine how their knowledge is represented, shared, and used.

Ultimately, transforming education means changing the social, institutional, and ecological relationships and conditions through which societies learn. Doing so can expand collective capacity to imagine, negotiate, and sustain more peaceful, just, and regenerative planetary futures. Education is therefore not simply another sector requiring reform; it is part of the collective infrastructure through which societies navigate uncertainty, negotiate difference, and shape what futures become possible.

10 Pathways for transformation

There is no single pathway to transformation. The entry points below offer possibilities for governments, educational institutions, communities, funders, and civil society to begin reshaping the systems through which societies learn.

01 **Reconsider educational paradigms and purposes.** Create participatory processes for examining the values, worldviews, and assumptions that shape education and for redefining its purposes in relation to social justice, collective wellbeing, and ecological responsibility.

02 **Respond critically to openings for change.** Periods of crisis, institutional change, policy reform, leadership transition, and technological disruption can unsettle established assumptions, but they can also reinforce existing inequalities. Use these moments for inclusive deliberation about educational purposes, responsibilities, and possibilities, and to identify, connect, and support emerging alternatives.

03 **Create enduring spaces for collective learning.** Support sustained collaboration among educators, learners, policymakers, Indigenous communities, other knowledge holders, researchers, and civil society. Establish feedback processes through which their knowledge and experiences inform institutional decisions, while changes in governance, policy, and practice create conditions for deeper learning and collective action. Respect different forms of knowledge and authority while enabling experience and evidence to inform continuous institutional learning.

04 **Support contextual experimentation and reciprocal learning.** Invest in place-responsive innovation, continuous reflection, adaptive feedback, and exchange across contexts. Enable approaches to develop through experience and refinement without requiring them to converge on a single standardized model.

05 **Align incentives and enabling conditions with long-term purposes.** Redesign funding, assessment, accountability, and governance to support long-term educational purposes and planetary wellbeing rather than privileging short-term performance. Protect professional autonomy, academic freedom, and collective voice, and ensure adequate staffing, supportive working conditions, and the time and resources required for sustained transformation.

ILLUSTRATIVE PATHWAYS IN PRACTICE

The following examples illustrate how educational transformation can emerge when purposes, relationships, knowledge, governance, and practices are reconsidered together. Rather than offering models for replication, they illustrate contextually grounded possibilities for learning systems organized around reciprocity, responsibility, collective action, and ecological wellbeing.

Building Long-Term Wellbeing into the System: Wales's Future Generations Framework

Responsibility to those yet to come becomes systemic when it is embedded in institutional purposes and public decision-making. Wales's *Well-being of Future Generations Act 2015* places a legal duty on specified public bodies to pursue seven interconnected wellbeing goals, including resilience, health, equality, cohesive communities, cultural vitality, and global responsibility. Education is explicit within this framework: the "A Prosperous Wales" goal includes developing a skilled and well-educated population, positioning education as integral to the country's long-term wellbeing. The Act requires public bodies to consider long-term consequences, prevent future harm, integrate policy areas, collaborate across institutions, and involve people affected by their decisions. A Future Generations Commissioner supports this work. The framework demonstrates how governance can connect education with wider social, cultural, economic, and ecological priorities while shifting institutional attention beyond short-term performance. It invites education systems to consider how decisions about curriculum, assessment, infrastructure, technology, staffing, and funding will affect learners, communities, and ecosystems across generations.

Learn more

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University of the Forest: Indigenous-Led Learning for Regenerative Futures

The University of the Forest is a Huni Kui centre of knowledge and intergenerational learning on the banks of the Envira River in Acre, in the Brazilian Amazon. Rooted in Huni Kui customary laws, oral traditions, and relational sciences and technologies, learning is organized around responsibilities to communities, the forest, and human and more-than-human beings. Huni Kui leaders have worked in collaboration with the Gesturing Towards Decolonial Futures collective to develop an international digital campus organized around five interconnected faculties: Respect, Reverence, Reciprocity, Responsibility, and Regeneration. Rather than transferring Indigenous knowledge into conventional universities, the initiative invites institutions and learners to reconsider assumptions of separation, superiority, control, and extraction and to develop relationships grounded in accountability and repair.

It demonstrates how educational transformation can extend beyond adding new content to encompass changes in educational purpose, authority, relationships, and understandings of who teaches, who learns, whose knowledge carries responsibility, and to whom education is accountable.

Learn more

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Reimagining Higher Education: Alternative Institutional Pathways

Higher education institutions and learning communities in different contexts are experimenting with educational purposes, structures, and practices oriented toward social and ecological regeneration. Gaia University International uses transformative action learning to connect learner-designed community projects with mentoring, peer learning, regenerative design, and critical reflection. Universidad Intercultural de las Nacionalidades y Pueblos Indígenas Amawtay Wasi, a public, intercultural, and community-based university in Ecuador, centres Indigenous knowledge systems, territorial relationships, and learning in, with, and for communities. Black Mountains College in Wales brings together arts, ecology, systems thinking, practical land-based education, and community resilience. These initiatives demonstrate contextually distinct ways of reconsidering educational purpose and institutional form: where learning happens, who directs it, whose knowledge carries authority, how learning is demonstrated, and how institutions relate to communities, territories, and the living world. Together, they show how systemic transformation can grow through institutions willing to reorganize learning around participation, reciprocity, ecological responsibility, and action.

Learn more

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Connecting Technology, Ancestral Knowledge, and Territorial Learning: Equipe da Bà

In the Mẽbêngôkre-Kayapó territory of the Brazilian Amazon, Equipe da Bà brings together ancestral knowledge, intergenerational learning, and contemporary conservation technologies. In 2024, more than 40 Mẽbêngôkre participants from 13 villages combined forest-based learning with the use of trail

cameras, nature photography, and drones. Elders shared knowledge of medicinal plants, animal tracks, and culturally significant places, while young participants developed monitoring skills and gained experience as guides in an intercultural ecotourism program. The initiative shows how transformation can unfold across interconnected dimensions: learning strengthens relationships between generations; technology supports territorial monitoring; Indigenous knowledge guides its use; and community organizations connect education with cultural continuity, livelihoods, and forest protection. Rather than treating tradition and innovation as opposites, Equipe da Bà brings them together in support of community priorities.

Learn more

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