LEVERS

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LEARNING FRAMEWORK

Deliverable 1.1

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List of Abbreviations	
AAM	American Alliance of Museums
ABCD	Asset-Based Community Development
AHSS	Arts, Humanities, Social Sciences
CO2	Carbon Dioxide
CSO	Civil Society Organisation
DEAL	Doughnut Economics Action Lab
DEI	Diversity, Equity, Inclusivity
DEIA	Diversity, Equity, Inclusion and Accessibility
EDI	Equity, Diversity, Inclusivity
GDP	Gross Domestic Product
GET	Green Energy Technologies
IDEA	Inclusivity, Diversity, Equity, Accessibility
IPCC	International Panel on Climate Change
KCT	Knowledge Creation Team
LV	Learning Venture
NGO	Non Governmental Organisation
OS	Open Schooling
SJCI	Social Justice Climate Issue
SJSI	Social Justice Science Issue
STEAM	Science, Technology, Engineering, Arts, Mathematics
STEM	Science, Technology, Engineering, Mathematics
YPAR	Youth Participatory Action Research
YPS	Youth Participatory Science

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EXECUTIVE SUMMARY

The LEVERS project (2023-2026) promotes open schooling for innovative science education, with a specific focus on lifelong learning for climate and environmental justice. The project investigates the potential of localised learning ecosystems to support community climate responses in nine countries: Ireland, the UK, Portugal, Belgium, Switzerland, Slovenia, Serbia, Greece, and Cyprus. We are researching the implementation of a transdisciplinary, lifelong-learning approach to science education in these diverse settings across Europe, addressing the complex challenge of the climate and environmental crisis.

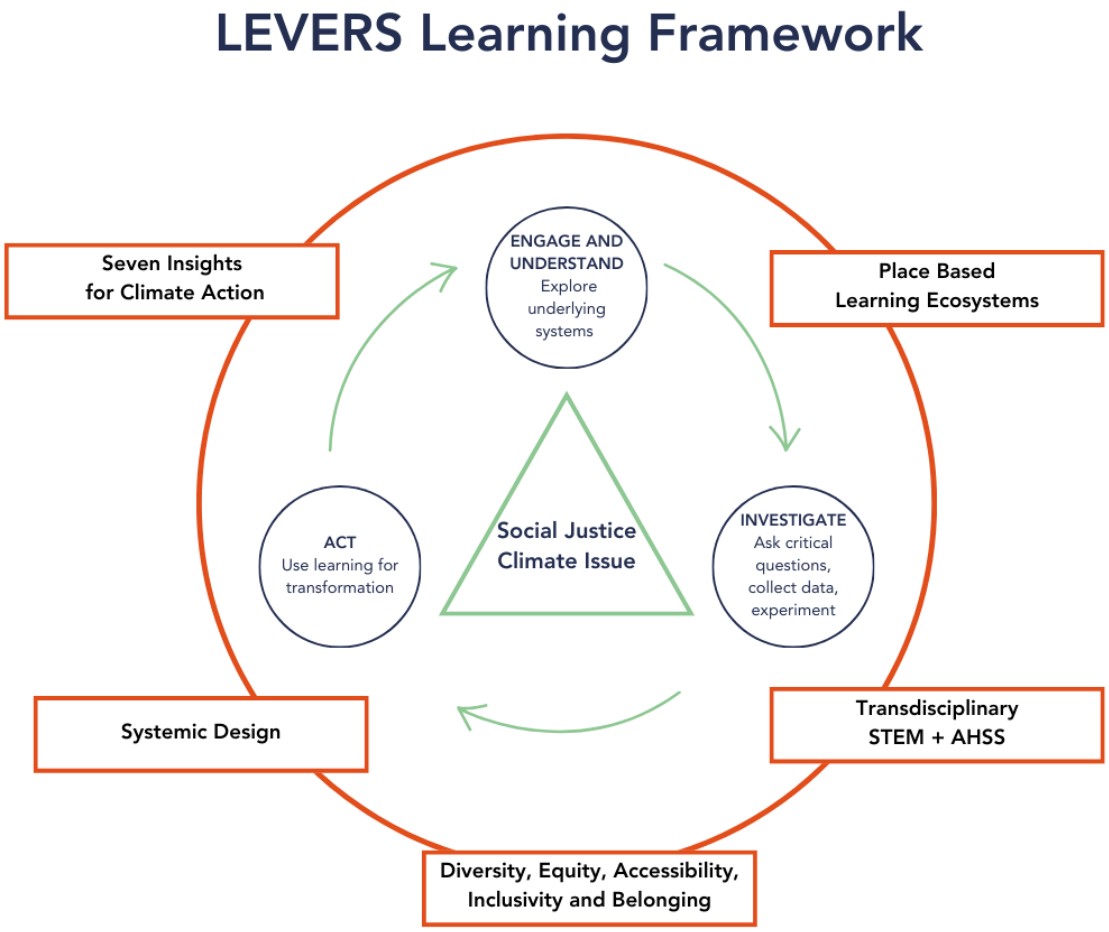
We believe in partnerships and stakeholder involvement to design meaningful learning and to create a pathway to effective climate responses. We recognise the need for new and different approaches to take action to address local climate issues, while being mindful of inequality, and the social justice aspect of the climate crisis. LEVERS believes in cooperation, learning together and future-making for a just, liveable and sustainable planet.

The **LEVERS Learning Framework** is a foundational document for the LEVERS project, providing the building blocks for the design commitments and pedagogical approaches to be embedded in the learning activities to be undertaken by project partners across Europe. It is Deliverable 1.1 of the LEVERS project.

This text aims to be a guide and companion, a source of inspiration and hope for those embarking on journeys that recognise the role that science education has to play in the collective movement towards regenerative, thriving and joyful futures for all terrestrials, human and otherwise.

It does not aim to provide rigid guides for science curricula or training for teachers. Rather, as a mix of theory and practical examples, it provides a starting point for collaborative planning and learning design, highlighting the importance of social justice and equity work in addressing the climate crisis. It calls attention to some of the myriad factors that must be addressed to achieve effective learning for climate action. It reminds us that learning is lifelong, especially in these strange times, and posits that learning creatively in communities is an effective way to foster transformative agency and meaningful change.

It is structured into four foundational learning units. **Chapter 2: Systems of Climate (In)Justice** orients our journey around climate change and sustainability. **Chapter 3: Tools for Transformation** introduces systemic design, the Seven Insights for climate action, and participatory methodologies for stakeholder and learner engagement. The focus in **Chapter 4** is on **Attending to Equity** and covers equitable practices in science education and communication, and ways that critical pedagogies can address issues of social justice. **Chapter 5** outlines some of the proposed **Settings for Regenerative Learning** in the context of the LEVERS project. Finally, **Chapter 6: Project-Based Learning for Climate Justice** brings it all together and proposes LEVERS own Learning Framework as a scaffold for applying the concepts from the above chapters in practice.



LEVERS Learning Framework. Outer wheel represents ongoing commitments throughout the project-based learning cycle, while inner sections are sequential, beginning with ENGAGE & UNDERSTAND, followed by INVESTIGATE and ACT. (Figure 6.7 in this document)

The process of using this document to design and deliver learning programmes in the nine LEVERS project sites will be studied as part of the overall LEVERS evaluation, and reported upon in Deliverable 6.3 of the project, due in January 2026. Elements of this document will be also adapted into online resources, trainings and webinars, to be reported on in Deliverable 4.2 and 4.3: Climate Justice for Educators Professional Learning Series and Guide, due November 2025.

1 OVERVIEW

"It's not only about the things that you do to reduce your own carbon footprint, it's about how you try to bring the whole of society into this transition. Where we think about climate change not as a threat that is going to kill us all, but as something that we are tackling with all of our minds, as a group of people in a society."

-Dr Kris de Meyer, UCL Climate Action Unit (The Climate Curious Podcast by TEDx London, 2020)

Climate change is the defining crisis of our time, and its impacts are unevenly weighted against the world's most vulnerable people (Robinson, 2011). Education needs to provide the scientific knowledge to engender engaged and informed societies, but also to equip learners with the holistic competences to support and motivate them to become courageous thinkers and doers, actively shaping their own futures. LEVERS recognises the need for new and different approaches to support citizens to take meaningful, justice-oriented action on climate change. The project investigates the potential of localised learning ecosystems (Learning Ventures) to support community climate responses in nine countries: Ireland, the UK, Portugal, Belgium, Switzerland, Slovenia, Serbia, Greece, and Cyprus. These Learning Ventures address specific local climate justice concerns by designing and enacting projects with learners of all ages that offer meaningful and transformative real-world learning experiences.
LEVERS believes in cooperation, learning together and future-making for a just, liveable and sustainable planet.

1.1 LEVERS Learning Ventures

LEVERS is establishing cross-sectoral partnerships in nine European countries (Ireland, the United Kingdom, Portugal, Belgium, Switzerland, Slovenia, Serbia, Greece, and Cyprus). These partnerships are called Learning Ventures and will co-design learning interventions for their communities in the form of collaborative climate justice projects.
Coordinated and promoted by different organisations in different locations, the Learning Ventures take on a variety of forms and shapes and tackle localised challenges. LEVERS partners use systemic design principles (see Section 3.2) to create a Learning Venture that serves their own context and draws on their collective strengths, their local environments and the type of intervention that can have the most impact in their location.
Despite local differences, Learning Ventures all follow the same guiding principles:

- An inclusive multi-stakeholder partnership for open schooling on climate justice that fosters the networking, sharing, and applying of science and technology research in lifelong learning settings. The partnerships comprise stakeholders from education (including formal/non-formal); scientific Research and Innovation (R+I); industry, local government, and the community or voluntary sector.
- They are built around the concept of learning ecosystems (Hecht & Crowley, 2020) and promote the idea of education as a whole community endeavour. Such systems consider learning as a continuum, and design for holistic and lifelong learning.
- They promote the inclusion of diverse viewpoints when tackling major challenges facing European society, such as actionable climate education, science literacy, the uptake of science careers, and the gender gap in science at all levels.

- They provide a common purpose and vision for learning, equity, and social change: networks can work at scale to leverage opportunities to realise ambition in ways that may be unattainable for individual organisations.

1.2 Learning Framework

Learning frameworks serve as models informed by research, guiding the design of educational programmes to align learning objectives with educational activities, establish inclusive and motivating environments, and seamlessly integrate assessment strategies into the learning process. Such frameworks offer scaffolded approaches that assist learners in constructing accurate and personally consequential knowledge structures, and guidance on how and when to apply acquired skills and knowledge. In contrast to a traditional emphasis on "instruction," which primarily focuses on content delivery, placing a focus on "learning" invites educators to create structures for ongoing learner development. This approach encourages students to actively contribute as co-producers of knowledge, fostering a collaborative learning environment.

What is the LEVERS Learning Framework?

The LEVERS Learning Framework provides tools for thinking for actors working through a learning ecosystem approach to tackle localised climate justice issues. It specifically aims to support LEVERS Learning Ventures as they aim to embody the following principles to develop a model of justice-oriented climate change education:

- Science learning is a continual process and does not stand alone but is fundamentally linked to other disciplines.
- Education provides opportunities for learners to develop and utilise transformative agency to effect change on local and global environments.
- Science education happens within local learning ecosystems - the settings in which we encounter science learning in our lives: at home, at school, online, in science centres and museums, in community groups, in arts and cultural settings, and more.
- It is urgent that all sectors of society take meaningful climate action, and young people and adult learners can play an active role through the LEVERS project.
- Everybody should work together towards climate justice - which can be understood as "safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly" (Mary Robinson Foundation, 2011).
- LEVERS promotes agency, supporting learning communities to work together towards climate justice.
- The open, collaborative, transdisciplinary and lifelong learning approach to science education promoted by the LEVERS project supports meaningful action towards climate justice.

The LEVERS learning framework is composed of units that address different key concepts - however, there is a lot of overlap between the strands. Each of the units is completed with case studies, references and questions to support the Learning Venture coordinators to reflect on the application of the concepts to their local context.

Each Learning Venture coordinator should work on adapting the learning framework to their own needs by exploring ways that the different elements can be used, considering their partners and their local specific circumstances and context. Some key reflection questions are provided to help navigate this adaptation process. The LEVERS project will also produce additional learning and adaptation materials based on this framework in subsequent Work Packages.

2 SYSTEMS OF CLIMATE (IN)JUSTICE

This unit assumes some prior knowledge on the part of the reader in terms of climate change, and its amplification due to human activity. It provides some recently published resources related to sustainability and climate change, including some educational resources. It also introduces dimensions of climate justice, and offers case studies and examples of ongoing climate action around the world that address climate justice in different ways.

2.1 Climate Change & Sustainability

In 2015, 195 countries agreed as part of the Paris Agreement to limit global warming to well below 2 degrees Celsius by the year 2100, and to pursue efforts to keep it within the safer limit of 1.5 degrees Celcius. If successful, this means that by the year 2100, the average surface temperature of the planet would have risen by no more than 1.5 degrees Celcius since pre-industrial times. Despite the urgent calls from the International Panel on Climate Change (IPCC) as well as other scientists, journalists, activists and other concerned citizens, governments and large corporations have been criticised widely for not taking drastic action to ban fossil fuel extraction and limit emissions of greenhouse gases.

- The UNPD **Climate promise website** gives useful overviews of its key activity areas: adaptation and resilience, carbon markets, circular economy, climate finance, climate security, energy, forests, lands and nature, inclusion, just transition, loss and damage, net zero pathways, transparency, and urban issues.

- **Project Drawdown** draws on world-class network of scientists, researchers, and fellows, and has characterised a set of 93 technologies and practices that together can dramatically reduce concentrations of greenhouse gases in the atmosphere. of resources for climate solutions.

- One section of the Project Drawdown website is **Drawdown stories** which leverages storytelling and engagement as a bridge between science-based climate solutions and everyday people looking to find their roles in stopping climate change.

- Another resource from Project Drawdown is the **Toolkit** to help people to recognise how every job is a climate job.

- To view live updates on the amount of time left to keep warming under 1.5 degrees Celcius – visit the **Climate Clock**

- To view live updates on the amount, in parts-per-million, of carbon dioxide in our planet's atmosphere, visit **Per Million**

- For simple definitions across a range of relevant climate terms, search the **United Nations Development Programme's Climate Promise Climate Dictionary** (This is the link to the English language version but it is also available in Spanish, French, Arabic, Russian, Turkish, Thai and Mongolian.)

- **Climate Learning resources by the STEM Teaching Tools project**, by the University of Washington Institute for Science + Math Education.

- **Future-oriented learning for inclusive science education: teaching and learning resources for secondary education.** (Erduran & Ioannidou, 2023). The resource pack contains materials for science teachers and secondary pupils, and aims to support lessons on climate change that include timely and pressing issues related to science and society, including gender-related issues and green careers.

The **GreenComp Framework** published by the European Commission in 2022 is a reference framework for sustainability competences. It provides a common ground to learners and guidance to educators, advancing a consensual definition of what sustainability as a competence entails. To move towards regenerative, sustainable futures in which humans live in reciprocal relationships with the Earth, LEVERS adopts this multi-species outlook on sustainability as proposed by the GreenComp Framework **"Sustainability means prioritising the needs of all life forms and of the planet by ensuring that human activity does not exceed planetary boundaries."** (p. 12). The GreenComp Framework involves four key competence areas:

- Embodying Sustainability Values
- Embracing Complexity in Sustainability
- Envisioning Sustainable Futures
- Acting for Sustainability

Educators in the EU are encouraged to join the **GreenComp Community** hosted by the European Commission's Education for Climate Coalition. This is an online community of people and organisations using the framework to develop knowledge and skills to live, work and act sustainably. As well as hosting events for the entire network, it also includes country-level groups for EU member states.

2.2 Taking Action Towards Climate Justice

As extreme events including floods, droughts, heatwaves and wildfires impact increasingly greater swathes of society across the globe, the urgent need for climate action is becoming ever more pronounced. While responses have often been considered to be in the realm of the scientific, technological or financial, increased attention is being paid the ways that "climate change impacts people differently, unevenly, and disproportionately as well as redressing the resultant injustices in fair and equitable ways." (Sultana, 2021, p. 118).
A core tenet of climate justice is the integration of social and economic factors into climate solutions. The focus cannot only be on scientific approaches to combatting climate change and environmental degradation, it must also address the social and economic inequalities with which climate issues are so intimately intertwined. This is in part because of the unequal historical (and contemporary) responsibility and burdens that communities bear: countries, industries, and businesses that have become wealthy from activities that emit the most greenhouse gases do not experience the effects of climate change as acutely as the most vulnerable communities who often have contributed the least to the crisis. These countries, industries, and businesses therefore have a responsibility to urgently move towards sustainable practices, and to address the prior damage caused through fair and equitable measures of redress.

Climate action is the active participation in strategies to address the climate crisis, with the inclusion of considerations of the economic and social factors in climate problem-solving. Climate action can help to relieve the underlying causes of conflict and insecurity, creating a more just and liveable world for everyone. It begins with the acknowledgement that the climate crisis does not affect everyone equally, and that those most at risk are those who have contributed to the creation of this crisis the least.

Young climate activists are becoming increasingly vocal in the climate struggle.
Children and youth today have not contributed as much to anthropogenic climate change compared to previous generations, but will bear the full force of current and future climate change impacts as they advance through their lifetimes. The human rights of today's younger generation are threatened by the decisions of previous generations, and therefore they must have a central role in all climate decision-making and action. It is their future to inherit.

CASE STUDY

For an example of youth climate activists acting to protect their human rights, read about the **Pacific Island Students Fighting Climate Change,** which played a key role in the passing of the **Vanuatu Resolution**.

An example of a science institution championing youth voice in the climate struggle is **the Generation Hope programme** of the National History Museum (UK). This annual programme is developed and delivered in partnership with young climate activists and advocates from around the world. Recent editions have featured climate justice campaigners Mitzi Jonelle Tan and Clover Hogan.

One youth campaigner using the arts and appeal to emotion to spread her message of climate activism is Louise Harris, with her music video **"We Tried"** which reached #4 in the 2023 UK Christmas charts.

It's Not That Radical: Climate Action to Transform Our World by youth climate activist **Mikaela Loach (2023)**

A field guide to climate anxiety: how to keep your cool on a warming planet by Sarah Jaquette Ray

Indigenous and traditional knowledge and practices

Colonialism is another thread with which environmental action is entangled. Colonialism has played an important role in the degradation of the environment, and its persistent impact across the world continues to hinder climate initiatives in several ways. Colonial powers were often made rich upon environmentally harmful industrial projects, but they were also responsible for the suppression of non-Western knowledge and knowledge-making practices that are beneficial to understanding and generating more caring and localised approaches to environmental issues.

In Max Liboiron's 2021 work, "Pollution is Colonialism" the author explores the entanglements between capitalism, colonialism, and environmental science. Liboiron contends that the consequences of environmental contamination echo the power dynamics of colonialism, where certain groups bear the brunt of ecological harm while others benefit from resource extraction and industrial practices. This perspective prompts a critical examination of environmental justice, urging us to recognise pollution as a manifestation of systemic inequalities rooted in historical colonial structures that persist in shaping contemporary environmental challenges, and to consider specifically situated ethical, and relational approaches to science and science education.

Read: **In Conversation with Max Liboiron: Towards an Everyday, Anticolonial Feminist Science (Education) Practice - a chapter in the open access book Reimagining Science Education in the Anthropocene, Volume 2, edited by Sara Tolbert, Maria F.G. Wallace, Marc Higgins and Jesse Bazzul.**

Watch: Max Liboiron discussing anticolonial science as part of Academy for Teachers Master Classes.

Consumption and Economic Models

Capitalism plays a central role in the climate crisis as the pursuit of profit often prioritizes short-term gains over long-term environmental sustainability. The relentless exploitation of natural resources and the reliance on fossil fuels within capitalist systems contribute significantly to greenhouse gas emissions, exacerbating global warming. Additionally, the profit-driven nature of capitalism can hinder the adoption of environmentally friendly practices and policies, creating challenges in addressing the urgent and interconnected issues of climate change.

The concept of **degrowth** specifically re-examines the predominant understanding of economic growth – that it is the only answer for human progress to continue apace. Instead, degrowth proposes a deliberate reduction in consumption and production.

In his 2020 book 'Less is More: How Degrowth Will Save the World', economic anthropologist Jason Hickel advocates for this shift by emphasizing that environmental unsustainability furthers economic inequality. He suggests that by prioritising wellbeing and an equitable redistribution of resources, a way towards a more balanced world both ecologically and societally is possible. Hickel points out that the indicators of happiness or citizens' sense of meaningfulness are not in direct proportion to a nation's wealth. Instead, it is how that wealth is distributed that effects these less-easily quantifiable indicators of a society's cohesiveness.

These social implications are also directly related to a society's interactions with and impact on the environment. Hickel points out that by investing in public services – a direct social good – can also have ecological benefits. He states, "Public services are almost always less intensive than their private equivalents" (Hickel 2020, p. 237-8). He gives the example of the British National Health Service, which "emits only one-third as much CO2 as the American health system", while also providing better and more equitable care. This clearly links societal care and positive ecological outcomes that can be achieved when economic focus is not placed solely on economic growth at the expense of all other living things and the planet.

Doughnut economics is a visual representation of an economic and social sweet spot, first conceptualised by Kate Raworth in her 2017 book '**Doughnut Economics: Seven Ways to Think Like a 21st Century Economist'.** The Doughnut consists of two concentric circles: the inner one represents a social foundation where everyone has access to life's essentials (as outlined in the United Nations Sustainable Development Goals) while the outer ring represents the ecological boundaries that our planet can sustain. Between these two boundaries (the doughnut shape) is the ecologically safe and socially just space within which humanity can survive, a Goldilocks zone of human interaction and inclusive, sustainable, economic growth.

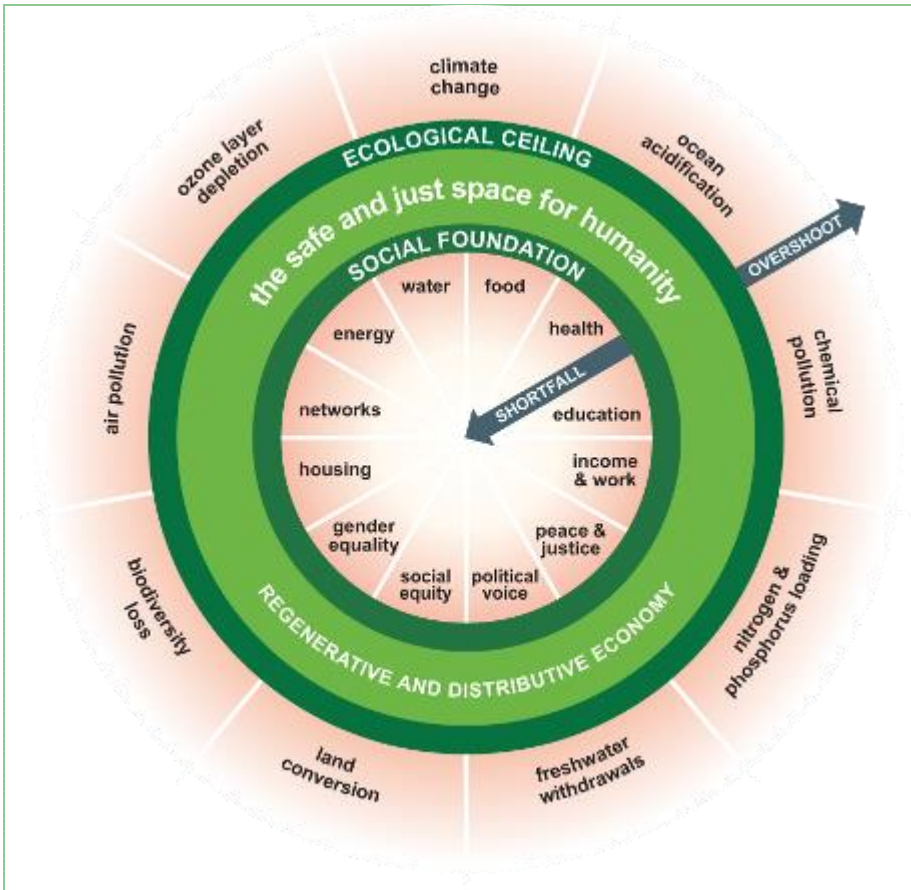


Figure 2.1: Graphic representation of "The Doughnut of social and planetary boundaries." - the safe and just space for humanity nestled between the safe and just social foundation, and Earth's ecological ceiling. Credit: Kate Raworth and Christian Guthier. CC-BY-SA 4.0

Doughnut economics calls for a move away from GDP as a measure for growth towards regenerative and restorative futures, but it is also an economic model which does not rely on the complete rejection of capitalist consumption patterns. Doughnut economics is a suggestion for mitigating the impact of those impulses, as opposed to a direct push against it in the way advocated by proponents of degrowth.

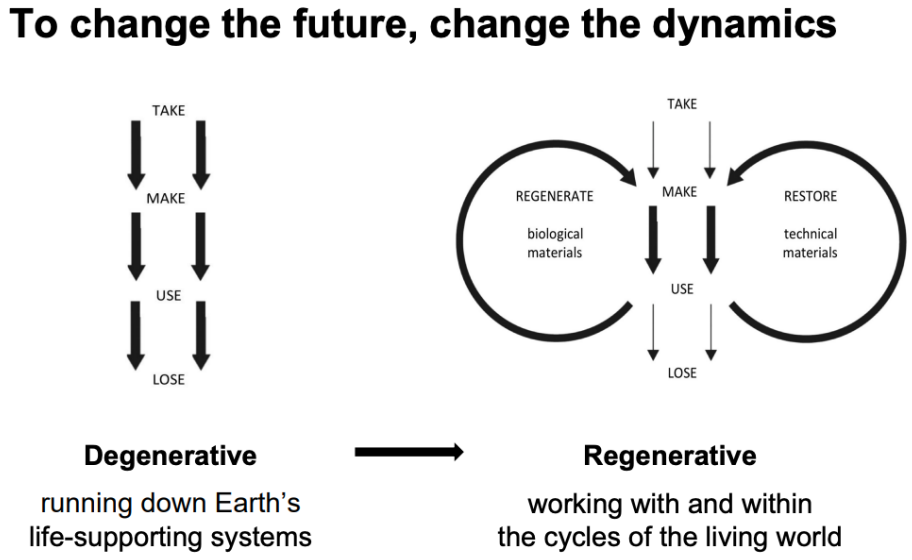


Figure 2.2: From a degenerative to a regenerative and restorative circular economy. Image reproduced from Doughnut Economics Action Lab: https://doughnuteconomics.org/

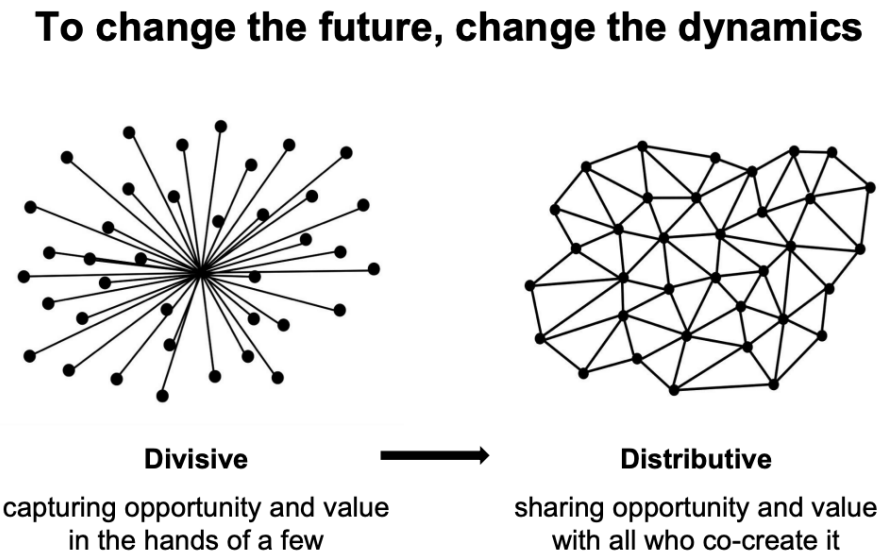


Figure 2.3: From a divisive to a distributed economic model. Image reproduced from Doughnut Economics Action Lab: https://doughnuteconomics.org/

Approaches to embedding lessons and principles from Doughnut Economics across a range of settings can be explored through the **Doughnut Economics Action Lab (DEAL) website** which includes useful resources such as the **Imagination Sundial** workshop outlines and **Doughnut Economics Education: A Teacher's Guide**

READ

Less is More: How Degrowth Will Save the World, by Jason Hickel

CASE STUDY

Amsterdam's municipal government has integrated doughnut economics into its governance, with an eye towards being completely circular in its economy by 2050. This will include a 55% CO2 emission, 50% reduction in new raw material use by 2030, and have 100% circular procurement processes with a 20% reduction in public consumption by 2030 (Reid 2021, Municipality of Amsterdam 2020). Amsterdam Municipality has committed to prioritizing purchasing products and services that are environmentally friendly, durable, and reusable, themselves through the official procurement processes while also encouraging the local producers to move towards goods that also align with circular economics, moving closer towards the Doughnut model.

Amsterdam has been actively supporting collaboration between business sector actors, researchers, and community stakeholders to develop workable solutions that will contribute

to a circular economy. The government has provided funding, facilitated events, and generated platforms for knowledge sharing. These hubs and networks are designed to bring together stakeholders from all sections to accelerate the movement towards a circular economy through Doughnut Economics (Reid 2021).

The initiative focused on closing the loop of resource streams, starting with nine main resource streams: biomass, construction and demolition materials, electronic and electrical waste, end-of-life textiles, plastics, diapers, mattresses, data servers, and metals. These streams were identified because of their high volume and significant environmental impact. Then came the implementation, which occurred in six steps (Cramer 2020a):

1. Collect insights. Meetings with experts, literature reviewed.
2. Brainstorming. Based on the experts' insights, representatives of the value chain of each stream were included in sessions to generate options of closing the loop from a technical, practical, and economic perspective.
3. Consulting the market. Investments were solicited and the conditions under which they could be acted upon, explored.
4. Investor selection. Once market players expressed interest, an independent party judged which would be the best candidate. After the selection process, a consortium was set up to bring the initiative to fruition.
5. Creating the preconditions. For the consortium to work smoothly, a number of preconditions were necessary, and the Amsterdam Municipality Economic Board assisted in cooperation with authorities to generate them. Each initiative needed an appropriate collection and logistics system, guaranteed amounts of waste, specific demand for the recycled material, and quality standards.
6. Action-plan. Generation of a plan of action which included timelines and investment schemes, and the clearly defined functions and responsibilities of each consortium member and other relevant actors.

RELFECTIVE QUESTIONS

- What does a "just transition" mean in your locality?
- Can you identify some organisations who work specifically on topics related to climate justice or just transition?
- How can your Learning Venture make a link between just transition and science education in your locality?

3 TOOLS FOR TRANSFORMATION

This chapter introduces a number of tools and approaches that may be applied by the LEVERS Learning Ventures to collaboratively design locally-relevant approaches to education for climate justice. These include insights from neuroscience and psychology (Section 3.1), systems thinking and systemic design (Section 3.2) and participatory methods for stakeholder involvement (Section 3.3).

3.1 Humans & Climate Action: Seven Insights from Neuroscience & Psychology

The LEVERS project aims to reach diverse learners across communities by engaging them in action for climate justice. This requires tackling polarisation, and finding ways to unite those with opposing points of view around shared goals. To go beyond the bubble or echo-chamber of those already interested in taking climate action, LEVERS draws on insights from project partner UCL Climate Action Unit, and specifically their "Seven Insights from Neuroscience and Psychology" (henceforth "The Seven Insights", see Roberts et al., 2021).

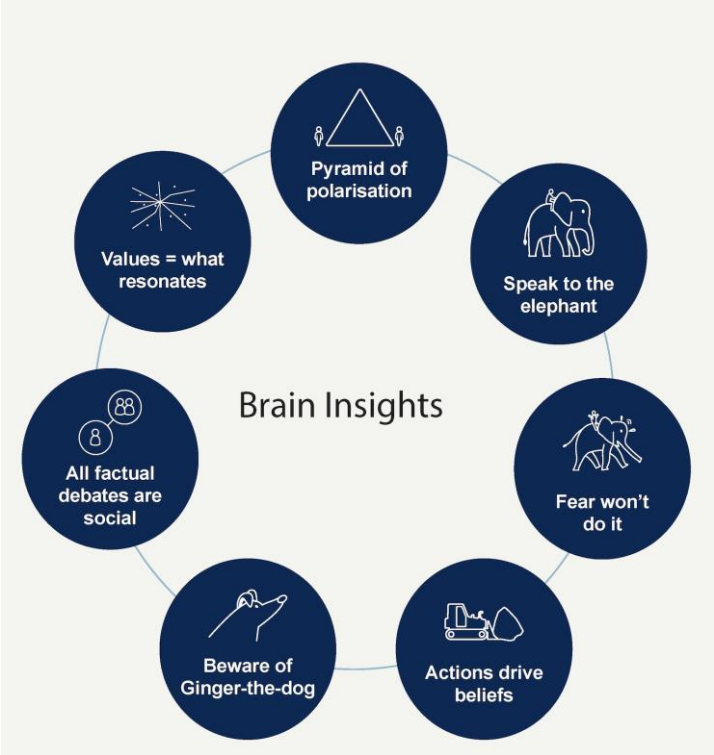
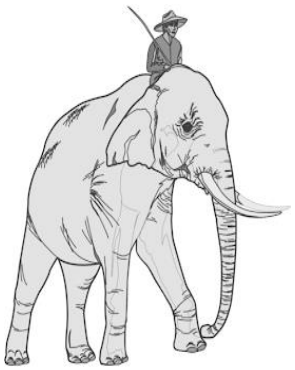


Figure 3.1: The Seven Insights as defined by UCL Climate Action Unit

Insight 1: Speak to the Elephant



Our brains think in two fundamentally different ways: **intuitive thinking (the Elephant)** and **deliberative reasoning (the Rider).**

Intuitive thinking is automatic and shaped by people's lived experiences. Deliberative reasoning, on the other hand, requires focus and effort. It allows us to think through hypothetical or future situations that we might not have direct experience of.

Elephant and Rider interact in all of our thinking and decisions, but most of the time, **intuitions come first, reasoning second**. The metaphor captures very well the power imbalance between the two: as a rule of thumb, expect that about 95% of what goes on in our brains sits in the Elephant, with only a few % of our brain processing going to the Rider.

Neither intuitive thinking nor deliberative reasoning are 'right' or 'wrong'. They coexist, and both can lead to good as well as to bad thinking. The more we become knowledgeable about an issue, the more that expertise becomes part of our Elephants.

The profound implication of this is that when engaging with people on climate change it is important to start from their personal, lived experiences. This applies to citizens as well as to professionals within the context of their professional expertise.

READ

The Elephant and Rider metaphor comes from psychologist Jonathan Haidt in his book **The Righteous Mind: Why good people are divided by politics and religion**. The metaphor is similar to Daniel Kahneman's System 1/System 2 description of intuitive thinking and deliberative reasoning in **Thinking, Fast and Slow.**

Insight 2: Ginger-the-Dog: what we think we say is not what other people hear.

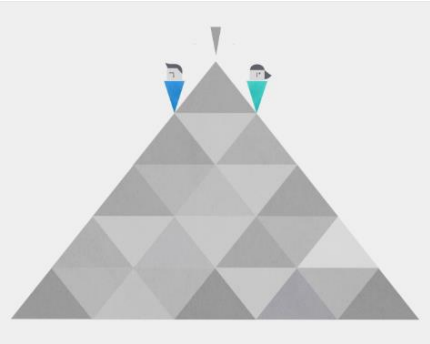
Words and phrases may lack meaning or have opposing meanings to different groups. This often happens across different communities who have started to use words differently. Unhelpful reactions, powerful ones, to the misunderstanding that this creates, are often based on intuitive (Elephant) rather than deliberative (Rider) thinking.

Ginger-the-Dog effects often happen between professional communities. For example, terms like uncertainty and risk have almost diametrically opposed meanings in the physical sciences and in economics. These semantic differences have serious consequences for cross-sectoral communication on climate change and the threats it poses for society.

READ

Ginger-the-Dog - as we apply it to climate change - is a specific instance of a recurring problem throughout history: how language can break down when terms become instilled with different meanings. A recent overview of this is provided in Mark Thompson's 2016 book **Enough Said: What's Gone Wrong with the Language of Politics?** A **Scientific American** popular science article looks at recent evidence on the matter.

Insight 3. Pyramid of polarisation: fragmentation of meaningful climate action



The forming and strengthening of an opinion or worldview can be likened to starting at the top of a pyramid and, tentatively at first, choosing one side. As a loosely held belief becomes more strongly held through self-persuasion, we are moving down the pyramid and progressing ever further from someone who took their first step down the other side.

The more entrenched our views become, the greater the degree of rationalisation our elephant-driving minds will produce.

As concerns about climate change increase, and in the absence of recommendations for actions that people feel are concrete, doable, and meaningful, more and more people will make decisions as to what *they* think the correct course of action is.

These decisions trigger a process of self-persuasion, a descent down the pyramid. Without a sense of plurality and alignment between different views, views on 'climate action' are at risk of splintering into many incompatible and competing interpretations. If this situation is allowed

to fester, this can lead to 'action paralysis' as democratic mandates for decisive policy action might not materialise.

The Analogy of the Pyramid stems from Carol Tavris's and Elliot Aronson's book **Mistakes Were Made (but not by me)**.

How this translates into the polarisation of public opinion on many pressing societal issues is explained in Dr Kris De Meyer's TEDx talk **The Genie of Polarisation.**

How it affects climate change in particular is explored in the podcast **Why there's more to climate action than reducing your carbon footprint.**

Insight 4. All 'factual' debates are profoundly social

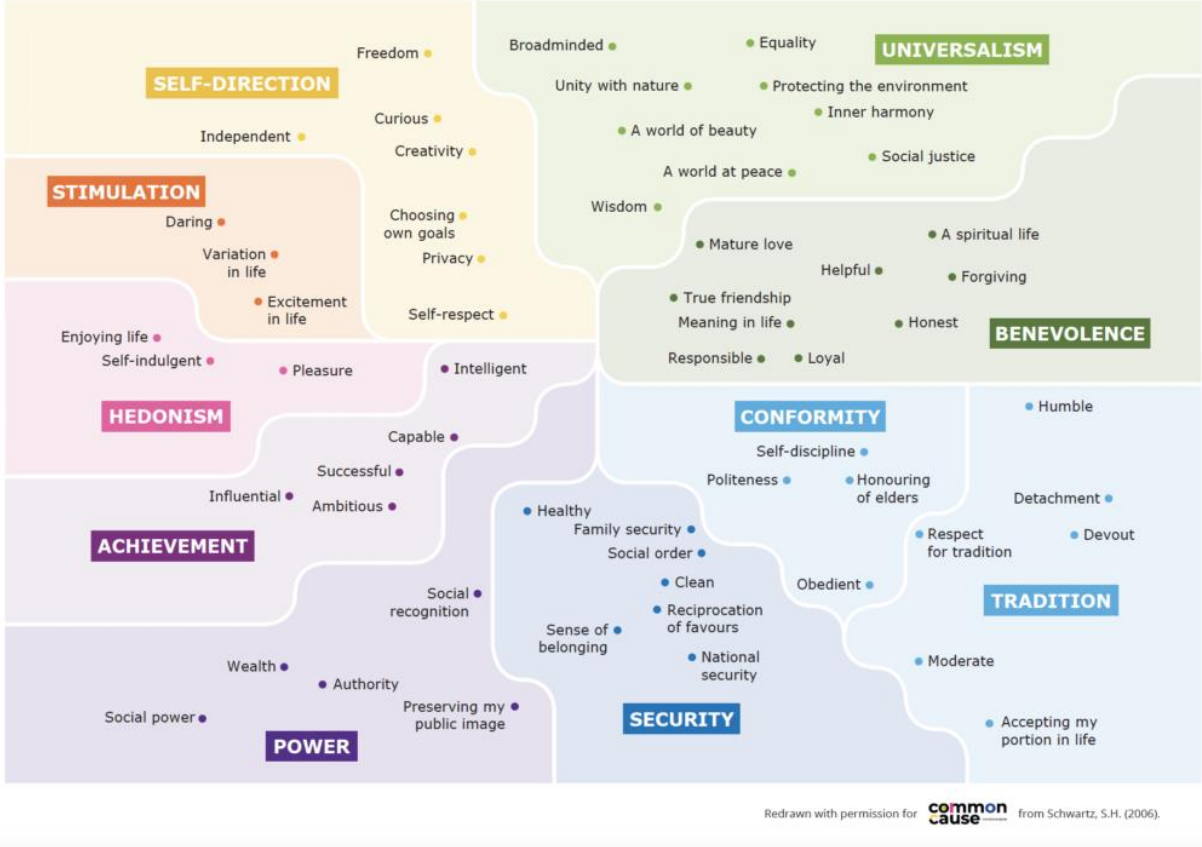
All high-stakes debates in society that are thought to be factual, are actually dominated by social factors. The positions we take in these debates depend on how our brains interpret the intentions and motivations of the people we disagree with ('stupid-crazy-evil' reasoning); whether we trust particular messengers or not; and what people around us think about the same issue.

On the upside, we learn readily from stories about the actions and experiences of other people. We can also empathise with them and truly understand their perspective, rather than succumb to snap judgements.

Social: why our brains are wired to connect by social neuroscientist Matthew Liebermann provides an excellent overview of the main social sides there are to the human brain. The Social Animal by Elliot and Joshua Aronson is a classic textbook in social psychology - yet very readable. 'Stupid-crazy-evil' reasoning in the context of climate change is explored in Kris's article **Sustainability: 'Us' and 'Them' .**

On empathy and engaging in non-judgmental communication, see **Non-Violent Communication by Marshall Rosenberg (video)**

Insight 5. Values help you to understand 'what resonates' with people



'Values' - loosely defined - are answers that people give to the question "What do you care about in life?"

Several frameworks exist that look at how to foster people's pro-environmental values; or how to connect with people who put other values above pro-environmental ones.

From our perspective, values are a shorthand to help understand what resonates with our intuitive, elephant brains. They can help to understand why certain stories and message frames may lead to engagement, while others lead to indifference or even angry rejection.
They can also help to understand why different groups of people can be engaging in the same behaviour for different underlying reasons.

RESOURCE

Much research in the psychology of values traces back to **Schwartz Theory of Basic Human Values**. In the UK, work on how to foster pro-environmental values is led by organisation **The Common Cause Foundation.**

Two organisations with a focus on connecting to different value groups **Cultural Dynamics and Campaign Strategy.** The value segmentation framework of the latter 2 organisations ('Settler – Prospector – Pioneer') is explained in Chris Rose's book **What Makes People Tick.**

Insight 6. Fear won't do it

Is it ever useful to scare the Elephant?

Fear can be an effective motivator of personal change. This will work especially well if a threatening message is accompanied by actions that feel *concrete*, *doable* and *effective*: once you take the action, you should no longer feel fear.

Communications about climate change rarely meet these criteria - yet these are the messages that many instinctively reach for. Whereas fear messaging works for some individuals, it can also create anxiety and hopelessness, numbness and switching off or angry rejection and denial. This means that, as a strategy to drive change across society, fear won't do it: it has too many unintended side effects.

READ

The idea that fear and threat messaging can have adverse effects is prevalent in the work of many psychologists. One entry point is Elliot Aronson's excellent article **Fear, Denial and Sensible Action in the Face of Disasters.**

Insight 7. Actions drive beliefs

The conventional view is that beliefs, understanding, knowledge, awareness and concern lead to action. This is correct - but only when we have strong convictions about a particular issue.

That does not explain where our strong beliefs and convictions come from. Nor does it explain what happens when our opinions are weak, or when we experience difficult choices between different options that matter to us.

In these circumstances the arrow points in the opposite direction: our choices and actions will change our beliefs, understanding and awareness through a process of **self-persuasion**. The more we do about an issue, the more we will start caring about it.

This insight is a major challenge to the conventional approach, which seeks to change beliefs and convictions as a precursor to changes in behaviour.

The idea that actions drive beliefs originated with social psychologists in the 1950s. In 2020, LEVERS contributor Dr Kris De Meyer published an academic paper summarising the evidence, and what it means for **the stories we tell about climate change.**

Dr Kris De Meyer also gave **a TEDx talk** on the same topic. An example of the profound impacts this can have in real life is explored in documentary **Right Between Your Ears**

Insight	Take home messages
Elephant and rider	1. Intuitive thinking is rooted in lived experiences. 2. In our reactions intuitions come first, reasoning second. 3. To connect with people, speak to the Elephant!
Ginger the dog	1. What we think we say is often not what other people hear 2. Ginger the Dog can only be managed, not resolved
Pyramid of polarisation and self-persuasion	1. The pyramid = moving from weak to strong opinions about an issue 2. As concern increases, opinions about what to do about climate change will continue to fragment
All "factual" debates are profoundly social	1. Minds respond to stories about people/characters. 2. We easily learn from the actions of others. 3. Deep disagreements lead to stupid-crazy-evil reasoning
Values	1. Values = answers to the question what do you care about? 2. They help to understand what messages resonate. 3. People can engage in behaviour for different motivations
Fear won't do it	1. At the individual level, fear sometimes drives action. 2. As a strategy to drive to change across society, it backfires
Actions drive beliefs	3. The only reliable form of persuasion is self-persuasion. 4. 'Behaviour change' morphs into 'developing agency'. 5. Action inspires action. 6. Applying this to comms: tell stories of action, of doing

Table 1: Take-home messages from the Seven Insights.

3.2 Systems Thinking & Systemic Design

"A set of things — people, cells, molecules or whatever — interconnected in such a way that they produce their own pattern of behaviour over time."
"A system is an interconnected set of elements that is coherently organised in a way that achieves something (function or purpose)."
Meadows, 2008

Systemic Design: Background

When a challenge has multiple stakeholders and components, with complex interactions between them, it becomes difficult to plot a linear path towards a defined outcome. These kinds of challenges have been termed **'cloud' or 'wicked' problems**: challenges so interdependent that there are no clear right or wrong solutions. In these circumstances levels of uncertainty mean a preferred 'solution' may just be "less bad" than other available options, or that successful approaches rely on testing and iteration to respond to changing levels of knowledge. The climate crisis, with its complex and complicated nature, at global and local levels, is a wicked problem.

Systems thinking developed as a tool to improve responses to these kinds of problems, by taking into account the overall system as well as its individual parts. According to Peter Senge who brought systems thinking to mainstream management thinking through his book *The Fifth Discipline* (1990), its "a framework for seeing interrelationships rather than things, for seeing patterns rather than static snapshots." Though it has roots in the industrial world, and specifically Massachusetts Institute of Technology of the 1960s and 70s, its current influence also tracks back to the pioneering work of environmentalist Donella Meadows whose prescient thinking and book *The Limits to Growth* (1972) remain foundational for current climate response.

Systemic design is an emergent area of design practice which draws on systems thinking and builds on human-centred design and design thinking methodologies. It offers a structured design methodology which resembles familiar design processes with its setting out of sequential activities of (for example) exploring, reframing, creating and catalysing. It differs is in its positioning of a design challenge as a system of interdependencies and causalities rather than a fixed problem field. This is a significant departure from 'traditional' design practice; it introduces a broader field of enquiry and requires the designer to consider different 'locations' and forms of intervention within the system. It invites consideration of factors under-examined in traditional design practices, for example in its close attention to consequences to planet as well as people.

When are Systemic Design approaches relevant?

Systems Thinking and Systemic Design are not relevant to every challenge. **Omidyar Systems Practice Workbook** provides a helpful framework for deciding if systems practice is right for a project, considering the complexity of the challenge, the nature of the problem itself, the social dynamics around it, and the broader context. This framework assumes that an organisation adopts a systemic design approach as a central methodology; in fact, it can make sense to

draw on Systems Thinking and introduce Systemic Design methods in facing any serious or complex problem, even when other methodologies are in play.

Systemic Design methodology and tools
There are several detailed Systemic Design approaches and toolkits available from a wide range of sources. The number and variety of these resources reflect that Systemic Design is not a fixed methodology, it is rather a mindset and a practice. It fits within a controlled sequence or structure and then draws on this wide range of tools as appropriate to the challenge at hand.

The flexibility of approach can make Systematic Design challenging to adopt in traditional organisational environments. However, it is clear and accepted that thinking systemically is essential for our shared future, with 'Embracing Complexity' one of the four core Green Competencies recommended by the European Commission.

The Systemic Design mindset
A Systemic Design mindset is different to the usual approaches an individual or organisation might take to a straightforward challenge. The School of System Change includes the following qualities and activities in their Systemic Practice Wheel:

- Look at patterns
- Understand agency, power and responsibility
- Engage different perspectives
- Work at different levels concurrently
- Hold the whole picture
- Constantly question assumptions
- Embrace complexity by learning and adapting
- Consider timescales

Systemic Design methodology
Though there are many Systemic Design frameworks with varying emphasis, they typically follow a 4-stage structure. For the UK Design Council's Systemic Design Framework the stages are: Explore | Reframe | Create | Catalyse. For the School of Systems Change it is Define | Understand | Design | Deliver. The Systemic Design Toolkit extends to a 7-stage sequence. Irrespective of the favoured toolkit, the goal is a healthier system. This always entails interdependent and sometimes looped processes something like the following:

- Developing a shared goal.
- Defining what a healthy system looks like in the long term, and outlining what part of that system might be a change project within reach of the current effort.
- Understanding system behaviour.
- Standing back, seeing patterns of behaviour not problems, and connecting the dots to speculate about cause and effect.
- Drawing on diverse and multiple viewpoints and perspectives; top-down or expert driven actions are not as effective as those which are participatory.
- Looking for a strategy to unlock (rather than impose) change.

- Identifying the 'leverage points', or locations within the system where change might have impact. This involves creative and evaluative processes rather than a clear right vs wrong.
- Developing the decision making and governance processes needed and adapting to suit.
- Developing, executing and iterating an intervention.
- Traditional design, development and delivery tools can be engaged to develop and execute a plan.
- Feedback loops and iterative approaches then allow for the change to flow through the system, with flexible and adaptive responses assumed.

RESOURCE

Beyond Net Zero: A systemic design approach: New Systemic Design Framework by the Design Council (UK). It is the latest evolution of the double diamond. Developed to help designers solve complex challenges, like the climate crisis, and place people and planet at the heart of design.

LOOPY: A tool for thinking in systems - play with simulations, program by drawing, remix others' simulations.

Systemic Design skills and roles

In their Systemic Design Framework (2021) UK's Design Council describes four roles to be held in a systemic design process, those of *Systems thinker, Leader and storyteller, Designer and maker* and *Connector and convener*. In thinking about the skills needed in a systemic design process it might be helpful to consider these roles and ensuring these skills are available within a team:

- Does the team have the skills to see how everything is interconnected in a bigger picture, and zoom between the micro and the macro and across silos (systems thinking)
- Is the team equipped to communicate what's possible and why it's important, in order to secure buy-in from stakeholders, partners and community (storytelling)
- Can the team build what it needs to make change, with the creative and technical skills to ensure its fit for purpose (designing and making)
- Is there capacity to ensure that spaces where people from different backgrounds come together are created and that good relationships are nurtured and maintained (connecting and convening)

LISTEN

Great Lives BBC Radio 4 Podcast: **Kate Raworth on Donella Meadows**

3.3 Participatory Methods

Citizens and community members often feel like they don't have much control over the decisions that get made by governments and even more so in issues like climate. However, research shows high levels of concern about the climate crisis and a willingness on the part of individuals to contribute to climate action.
Involving community members in working together solutions for climate change adaptation and mitigation through the use of participatory methods in all steps of the process is key. If such an approach is implemented from the very beginning and participants are invited to share their perspectives, opinions and values will also help them mature their views on a certain topic or area. Taking part in these activities also helps builds capacity by generating knowledge and creating networks of relevant actors that can continue to work once the initial project or funding is over.

There are many participatory methods that can apply to many different contexts and needs. There is no 'one-size-fits-all' in participation: these methods should be adapted to each context by experienced facilitators that can support participants achieve effective and better decisions. An experienced facilitator is also key to create a supportive space for discussions to happen, where participants feel safe and empowered to share ideas while at the same time being confident that it will result in concrete results. They will also adapt the chosen tools and methods to serve the needs of the group and reach constructive conclusions and manage unexpected events or outcomes. However, what facilitators lack in experience can be, to a certain extent, compensated by preparation time and more involvement of stakeholder representatives in the preparation and design of the participatory process. Finally, in order to engage in fruitful, meaningful discussions, it's crucial to create a shared understanding of the issue at hand, making sure we minimise 'Ginger-the-Dog' situations. If empowered participants and organisers are capable of sharing ownership of the results, the more likely it is that the outcomes are fully used and integrated in the action plans of the different institutions.

CASE STUDY

Moving from an approach where communities are considered sources of needs and problems, **Asset-Based Community Development (ABCD)** thinks of them as being full of gifts and assets. Each community possesses a set of skills and capacities that if managed correctly can be source of solutions to community problems. Asset Based Community Development's premise is that *communities can drive the development process themselves by identifying and mobilizing existing, but often unrecognised assets*.

Depending on different sources, Asset Based Community Development is divided into 12 principles and five key assets.

ABCD principles:

1. Everyone has unique gifts, and the challenge is to discover and use these contributions (gifts) for the benefit of the community.
2. Relationships Build a Community: see them, make them, and utilize them. An intentional effort to build and nourish relationships is the core of ABCD and of all community building.
3. Citizens at the Centre: it is essential to engage the wider community as actors (citizens) not just as recipients of services (clients).
4. Leaders Involve Others as Active Members of the Community: Leaders from the wider community of voluntary associations, congregations, neighbourhoods, and local business, can engage others from their sector. This "following" is based on trust, influence, and relationship.
5. People Care About Something: agencies and neighbourhood groups often complain about apathy. Apathy is a sign of bad listening. People in communities are motivated to act. The challenge is to discover what their motivation is.
6. Motivation to Act must be identified. People act on certain themes they feel strongly about, such as concerns to address, dreams to realize, and personal talents to contribute. Every community is filled with invisible "motivation for action". Listen for it.
7. Listening Conversation – one-on-one dialogue or small group conversations are ways of discovering motivation and invite participation. Forms, surveys and asset maps can be useful to guide intentional listening and relationship building.
8. Ask, Ask, Ask – asking and inviting are key community-building actions. "Join us. We need you." This is the song of community.
9. Asking Questions Rather Than Giving Answers Invites Stronger Participation. People in communities are usually asked to follow outside expert's answers for their community problems. A more powerful way to engage people is to invite communities to address 'questions' and finding their own answer-- with agencies following up to help.
10. A Citizen-Centered "Inside-Out" Organisation is the Key to Community Engagement: A "citizen-centred" organisation is one where local people control the organisation and set the organisation's agenda.

11. Institutions Have Reached Their Limits in Problem-Solving: all institutions such as government, non-profits, and businesses are stretched thin in their ability to solve community problems. They cannot be successful without engaging the rest of the community in solutions.
12. Institutions as Servants: ***people*** are better than programmes in engaging the wider community. Leaders in institutions have an essential role in community-building as they lead by "stepping back," creating opportunities for citizenship, care, and real democracy.

ABCD key assets:

1. Individuals: At the centre of ABCD are residents of the community that have gifts and
2. Skills. Everyone has assets and gifts. Individual gifts and assets need to be recognised and identified. In community development you cannot do anything with people's needs, only their assets. Deficits or needs are only useful to institutions.
3. Associations: Small informal groups of people, such as clubs, working with a common interest as volunteers are called associations in ABCD and are critical to community mobilization. They don't control anything; they are just coming together around a common interest by their individual choice.
4. Institutions: Paid groups of people who generally are professionals who are structurally organized are called institutions. They include government agencies and private business, as well as schools, etc. They can all be valuable resources. The assets of these institutions help the community capture valuable resources and establish a sense of civic responsibility.
5. Physical Assets: Physical assets such as land, buildings, space, and funds are other assets that can be used.
6. Connections: There must be an exchange between people sharing their assts by bartering, etc. These connections are made by people who are connectors. It takes time to find out about individuals; this is normally done through building relationships with individual by individual.

CASE STUDY

Participatory methods in Climate action: Ten examples of the use of participatory methods in action with different case studies from around the world.

RESOURCE

Participatory Methods A comprehensive database of tools and methods for participation developed by the project Health Cascade.

Action Catalogue: online decision support tool including 57 methods, and is publicly available to search the methods, read thorough the descriptions of what the methods do, their strengths and weaknesses and the societal challenges they can be used to address.

Co-creation Navigator The Co-Creation Navigator provides a guide to navigate the different stages of co-creation, from preparation to execution, and suggests tools and methods for each stage.

MOSAIC Cookbook: Although developed specifically for policy makers implementing co-creation processes in the field of the European Commission missions, this cookbook describes the MOSAIC Methodology implemented during the co-creation process run in the two cities, Gothenburg and Milan offering practical insights and methods that can be used in the context of climate action.

3-minute Summary about ABCD (video)

Experimental participatory methodology brings local pasts to contemporary climate action: Case study of a Danish case study area experiencing cultural and natural environmental changes exacerbated by anthropogenic climate change. It describes and evaluates an experimental methodology that was developed to create and support engagement between the local community and climate action in the case study area.

Reflective questions:

- How might you set up your Learning Venture participatory process? What methodologies will work best with the communities you are engaging with?
- Can you think of the Ginger-the-Dog triggering discussions in your local context/topic?
- In relation to the climate justice topic under consideration in your local context, what might a healthy system look like?

4 ATTENDING TO EQUITY

4.1 Equity, Diversity, Inclusion and Belonging

The way climate change impacts people will vary according to gender as well as other characteristics, such as socioeconomic status, poverty, age, ethnicity, disability, geographic location and health factors.

For LEVERS, **Diversity, Equity, Inclusion and Accessibility (DEIA)** is core to addressing (just) climate action. Ensuring that our events and projects are accessible and inclusive is key. With the field evolving and progressing, laying down a checklist of what to do is not realistic nor will it help us produce real spaces of inclusion for all. In relation to DEIA your work in this area will never get done. It will be more a matter of changing the way we think rather than implementing a ready-made menu.

This chapter will not claim to offer the perfect one-size-fits-all solution to equitable science education or climate change communication. Instead, it provides reflective prompts that will allow you to reconsider how you, your team, your organisation and partners work, and whether DEIA is reflected in your decision-making before starting any LEVERS programmes or projects. We have divided this section of the document into three subsections that include a) the definitions that guide our work, b) our individual responsibility and c) acting on DEIA in institutional contexts.

What do we mean when we talk about DEIA?

Diversity, Equity, Inclusion and Accessibility are often quoted using the acronyms EDI, DEI, IDEA or DEIA, but what do they really mean? Before we start to think on how to act in this area, it is key to have clear definitions of these terms. c has produced definitions for these terms (Merrit, 2017) that will help us set the context and structure our thinking.

- **Diversity** is all the ways that people are different and the same at the individual and group levels. Even when people appear the same, they are different. Organisational diversity requires examining and questioning the makeup of a group to ensure that multiple perspectives are represented. **Why this definition?** AAM definition of diversity moves toward opportunities for groups to continually question whether they have adequate representation to make equitable programmatic, hiring, governance, financial, and other decisions. Any individual will have multiple identities and experiences. What it means to be diverse, in practice, will vary depending on the organization.

- **Equity** is the fair and just treatment of all members of a community. Equity requires commitment to strategic priorities, resources, respect, and civility, as well as ongoing action and assessment of progress toward achieving specified goals. **Why this definition?** Equity is the goal of our work. It requires deliberate attention to more than matters of recruitment, hiring, compensation, promotion, and retention. Equity includes governance, representation, and other indicators of power. It is, collectively, a step toward recognising past exclusion and achieving genuine inclusion. Equity is not the natural state of things. We must deliberately apply time, resources, and consideration

to achieve this goal. In addition, our institutions must develop relationships of trust and understanding.

- **Inclusion** refers to the intentional, ongoing effort to ensure that diverse individuals fully participate in all aspects of organisational work, including decision-making processes. It also refers to the ways that diverse participants are valued as respected members of an organisation and/or community. While a truly "inclusive" group is necessarily diverse, a "diverse" group may or may not be "inclusive." **Why this definition?** We need institutions in which diverse participants are truly integrated and valued as respected members of the organization and/or community, beyond token participation and authority. The measure and success of inclusion must include the perspectives of the disenfranchised.

- **Accessibility** is giving equitable access to everyone along the continuum of human ability and experience. Accessibility encompasses the broader meanings of compliance and refers to how organizations make space for the characteristics that each person brings. **Why this definition?** The definition of accessibility is broadening beyond public accommodations and job opportunities. It's not just about the physical environment: it's about access to and representation in content for all. We must integrate those concerns into the definitions. AAM strives for inclusive design. [2] AAM wants to go beyond compliance.

- **Belonging**, is the last piece in the puzzle, and the one we probably hear least about. This occurs when people feel seen and heard, where they feel safe, and where they feel valued, then they feel they belong to a group. For that to happen equitable and inclusive practices, norms, cultures, and systems need to be in place.

Individual level

Our practice is informed by our own knowledge, personal experience and biases which will frame our worldview and actions. If we want to challenge the current status quo we need to start by questioning ourselves and our beliefs and inner biases. The University of Colorado (Anschutz Medical Campus) Equity Office has developed a structure to help us in this endeavour. It is called E.Q.U.I.T.Y which is an acronym to help you question yourself on how to address EDI in your organisation or project. We have taken these learnings and applied them to our context in LEVERS and in our daily lives:

i. **Educate yourself:**

We can all strive to become more inclusive. If we look at our practice a few years ago we are probably struck by how "not inclusive" we might have been, how our language could have been considered offensive, or how as we progress in our thinking, we become aware of many more important details. So, the only way we can make sure we are being inclusive is to commit yourself to learning.

According to the E.Q.U.I.T.Y framework, there are a few ways that can help you start on your journey:

- Understand your identity and how it interacts *(and impacts)* with society and systems.

- Take stock on what you believe to be true and question it. Often the things we learned in our school and university classes are false and/or are not accurate.
- You cannot go with one simple source; you will need to explore various scholars. Are you learning from scholars that are part of the community in question? If not, ask yourself **why**. If you ask someone for their input or suggestions, that individual is not obligated to provide you answers. This is perfectly okay; do not make this about you.
- Learning is a continuous and evolving process. You will never be done.
- Give credit where it is due and do not take up space by speaking for a community that you are not a part of. Sure, you can share your experience in learning about the topic, but before you do, make sure you are providing the space and opportunity for someone to speak up about their own community.
- If a community is not in the room, ask yourself why and bring it to the conversation and ask if there is a perspective that might be missing. But do not make assumptions about the identities in the room.
- Remind yourself that this is an (ultra) marathon, not a race.

ii. **Question yourself:**

Other than educating yourself, you should also keep questioning what you believe to be true. We have been trained to understand the world, and this is particularly the case for science, based on biased and often incomplete information. By teaching us not to question what we are told and taught, and by reinforcing the same inaccurate messages we will not change the status quo and inequity remains.

iii. **Understand yourself:**

Before you can become an advocate, you need to understand your own identity and privileges and how they can become levers of oppression in different contexts.

Ask yourself, how much space am I taking up in conversations? In the events I am participating in? How much do I know about those I am trying to work with and support? What are my assumptions about marginalised persons and how am I actively contributing to their oppression.

iv. **Transform yourself:**

EDI requires constant, consistent, and intentional engagement with yourself and others. Transformation is not easy. It is the result of:

- Remaining present when you are uncomfortable;
- Accepting that you are part of the problem so you can work to change it;
- Learning how to empathise with others' experiences that are different to yours;
- Making mistakes and correcting your behaviours;
- Educating yourself and those around you *(it is not the burden of the oppressed to teach you)*; and
- Showing up with thoughtful action that matches your words.

v. **Yes, and?**

Dialogue is key to advancing however sometimes we do it in a way that is not constructive.

Often, we are tempted to jump and start our answer with a, ***"BUT..."*** and make our point. Although it is important to challenge others to consider new points of view, we might all benefit from reframing how we respond to others. And rather than starting with *but* it might be better to consider starting our sentence with "*yes and*". This very simple act can help us bring empathy and a more open mind to discussions. There are a multiplicity of truths that coexist. *Fluidity* in thought and understanding is something to appreciate; it allows us to intentionally engage with others and with ourselves.

Sociologist Patricia Hill Collins coined the concept **matrix of domination** in her *book* Black Feminist Thought to describe four interrelated domains that organize power relations in society, a paradigm that explains issues of oppression that deal with race, class, and gender.
Matrix of oppression in this case it is the one from the University of Colorado.
E.Q.U.I.T.Y. The University of Colorado has developed a framework around 6 key principles of "allyship" for their students to follow.

Organisational level

Questions linked to DEIA are systemic so there is a limit to what we can do as individuals. While doing our individual work we cannot take full responsibility or change things on our own. Taking collective action and acting at the organisational level will help us put pressure on the systems and challenge the status quo. There are many ways to enable organisations to navigate the complexity of DEIA challenges. Many existing frameworks help us structure the way organisations question the way they do things at different levels: how they establish partnerships, how their staff or governance bodies reflect diversity or the benefits and burdens of different decisions or activities. These are only a few examples of elements that need to be discussed.

Diversci is a community of practice of informal and non-formal science engagement practitioners and researchers. They structure their work on Equity, Diversity and Inclusion around five pillars: Access, Content, Partners, Staff and Strategy.
The different pillars as structured as follows:

- **Access:** An accessible space provides services and facilities that are welcoming and easy for everyone to use. This involves understanding and respecting the diverse array of human abilities and experiences to dismantle barriers - be they physical,

digital, sensory, cognitive, financial, or attitudinal - and welcoming visitors on their own terms.

- **Content:** How we display, say, and do things mirrors the values we hold. Creating inclusive exhibitions, programming, communication and research can strengthen the reach and impact of our science engagement practices. This involves developing guidelines, such as universal design principles, inclusive research design and language practices, as well as participatory formats that inform content development and delivery methods.
- **Partners:** Community and organisational partnerships are essential to advancing equity, diversity and inclusion. Continually seeking out and sharing knowledge and expertise among people with different perspectives, experiences and abilities can catalyse lasting and meaningful (ex)changes. Key to these partnerships is that they are of, by and for the community.
- **Staff:** As inclusive employers, our staff are representative of local communities and able to be themselves and thrive at their jobs. Achieving this requires equitable recruitment practices, the building and support of diverse teams, training in inclusive management and developing evaluation procedures to track and communicate progress.
- **Strategy:** Placing equity and inclusion at the heart of your strategy sends a strong message of commitment. Setting clear strategic priorities for overcoming structural inequalities provides the guideposts for cultivating awareness and positive change across all areas of your organisation and decision-making levels. It also sets the bar for your institution's accountability, both internally and externally.

For each of the pillars, the framework offers ideal objectives, indicators and resources to navigate to make desirable changes.

The **Equity Compass** (YESTEM project team, 2021) is one of the main outcomes of the YESTEM project, an international research-practice partnership focused on understanding and supporting equitable practice in informal STEM learning. It is a reflective framework that helps practitioners reflect on their current practice and develop more equitable ones. The compass is structured around 4 objectives: Challenging the status quo, working with, and valuing minoritised communities, embedding equity, and extending equity. These four objectives are divided into eight dimensions each designed to apply a different lens to improve equitable experiences.

Both the Equity Compass and Diversci offer guided steps to deploy them. Organisations will find exercises and self-evaluation tools to benchmark their current practice and take steps to make it more equitable.

READ

Emily Dawson's book and zine **Equity, Exclusion and Everyday Science Learning** explores how some people are excluded from science education and science communication.

WATCH

Dr. Elizabeth Rasakoala **keynote at Ecsite conference** 2016 where she challenges science engagement professionals to create a truly inclusive, colourful and gender balanced science centres and science museum field.

Nina Simon **keynote at Ecsite conference** 2017 based on 'The Art of Relevance', exploring ways museums and science centres can re-invent themselves to really matter to the communities they serve.

LEARN

Workshop with Dr Jon Chase on Justice, Equity, Diversity & Inclusion in Science Communication (video - from the EU-funded GlobalSCAPE project).

4.2 Critical Pedagogy & Justice-Oriented Science Pedagogy

Critical Pedagogy and Praxis

Developed by revolutionary Brazilian educational theorist Paulo Freire in his seminal 1970 publication "Pedagogy of the Oppressed" (Freire, 1970), critical pedagogy is an approach to education that emphasises the development of critical thinking skills and consciousness about issues of social justice. It encourages all those involved in the education project at hand (learners, educators and other stakeholders) to use this critical consciousness to question societal norms and existing power structures, and to act to change them. It seeks to increase awareness of sociopolitical issues and promotes engagement in dialogue and active efforts to address societal inequalities.

A key concept in critical pedagogy is "praxis" - a term which encompasses ongoing interaction between reflection and action. Freire posits that the words used in a dialogic learning setting must contain both dimensions, as "there is no transformation without action" (p. 60). Without action, words can become "idle chatter" or "blah" (p. 60); however, without reflection, action can become activism as "action for action's sake", making dialogue impossible.

This is relevant in the context of LEVERS as the central commitment is one of reflective and considered meaningful action in relation to climate change. Adopting critical pedagogy in

teaching and learning within LEVERS calls for **reflection on the (in)justice dimension of climate change, and a subsequent commitment to action.**

The theoretical underpinning of LEVERS also incorporates the ideas of expansive learning and transformative agency developed by Engeström, Sannino and co-authors (e.g. Engeström, 1998, Engeström & Sannino, 2010, Sannino, 2016). **Expansive learning** emphasises **collaborative and transformative processes through which groups of learners actively participate in reshaping their understanding and practices** through reflection on historical and present-day activity systems, and subsequent actions. The Merriam-Webster Dictionary defines agency as 'the capacity, condition, or state of acting or of exerting power' (Engeström et al., 2022). **Transformative agency** (Sannino, 2016) emphasises the **capacity of individuals to contribute to and lead meaningful and transformative changes** in their working and learning contexts, fostering a sense of empowerment and ownership. In particular, it focuses on the individual's capacity to act not just to reproduce or maintain the existing state of affairs, but to challenge and transform it – it always asks "Agency for what?" (Engeström et al., 2022)

LEVERS also recognises the need to move away from traditional views of science-as-progress, and economic growth and globalisation as the ultimate goals for a "modern" society, and instead to adopt a post-objectivist critical stance. Such a stance acknowledges that all learning environments include dimensions such as historical power differentials, colonialism, capitalism, culturally situated interests, and political and ideological positions and serve to either maintain the status quo and (re)produce inequities or disrupt historical and ongoing injustices and redress them (Esmonde & Booker, 2016). Projects within LEVERS aim to support learners to engage with science in ways that are meaningful to them, and that are mindful of complex histories and previous injustices. To incorporate these insights without slipping into relativism, LEVERS adopts a "**transformative activist stance**" (Stetsenko, 2014) – one which **"embraces social action and agency based in political imagination, vision, and commitment to social transformation"** (p. 183).

By utilising learning design that fosters learners' autonomy and active participation in their own learning through **project-based learning** that involves cycles of dialogue, reflection and action (see Section 6), LEVERS supports transformative learner agency. This approach recognises learners of all ages in the LEVERS project as co-creators of knowledge, empowering them to shape their learning experiences. By promoting **critical thinking, dialogue, and sociopolitical consciousness**, LEVERS aims to cultivate individuals who can engage with the world thoughtfully and contribute to positive climate action and societal change, fostering a sense of responsibility among learners to transform their future for the better. Creating an appropriate setting for such a co-creation of knowledge may require an adjustment of traditional educational practices towards **more democratic learner-led approaches**, or a shift from classroom-based-instruction to **community or place-based learning**.

Critical eco-pedagogy

To reach a level of critical eco-pedagogy in LEVERS, the selected environmental issues will be tackled by integrating ecological awareness and sustainability into the project-based learning activities. While it is essential for learners to **make sense of the scientific dimensions of the environmental issues** at hand (suitable for the educational level in question, and aligned with

the curriculum where appropriate), a critical eco-pedagogy lens will also incorporate **critical thinking about the interconnectedness of humans as part of the natural world, and our relationships with humans and non-human entities** – one another, other species, our planetary environment, and past and future generations. It will prompt learners to **use systems thinking to explore the root causes** of selected environmental injustices, fostering a deep understanding of ecological systems that include Indigenous and local knowledge and historical contexts, sustainability, and social justice. Critical eco-pedagogy encourages learners to **analyse the environmental impact of human actions**, inspiring a **sense of responsibility and ethical stewardship**. By connecting learning in LEVERS programmes to real-world ecological and sociopolitical issues, a process of reflection and action will embolden all involved stakeholders to become informed advocates for environmental preservation and agents of positive change in their communities.

'Braiding Sweetgrass' by Robin Wall Kimmerer (Potawatomi) is a powerful book blending Indigenous wisdom, scientific knowledge, and personal reflections. It explores the interconnectedness between nature and humanity, emphasizing the importance of reciprocity and a harmonious relationship with the Earth. The book challenges conventional perspectives on the environment, offering a perspective that encourages a deeper, more sustainable connection to the natural world.

Corn Tastes Better - An episode of the Emergence Podcast in which Robin Wall Kimmerer narrates her own feature written for Emergence Magazine (read it here)

Ecopedagogy for Beginners: Putting Climate Change Education Into Action (paid course on FutureLearn)

Justice-centred science pedagogy

To apply these ideas of critical, agentive and transformative learning specifically to a science education context, we turn to the **justice-centred science pedagogy** presented by Daniel Morales-Doyle (2017). As well as critical pedagogy, this draws on **culturally-relevant pedagogy** – an approach to teaching that recognises and incorporates students' diverse cultural backgrounds, experiences, and perspectives into the learning process. Culturally-relevant pedagogy aims to create an inclusive and empowering educational environment by bridging the gap between students' cultural identities and the curriculum, fostering meaningful connection to the subject matter. Culturally-relevant instruction should **draw on everyday experiences, learner interests and identities.**

Within justice-centred science pedagogy, rigorous science learning happens through the critical exploration of **Social Justice Science Issues (SJSI) - issues of relevance and consequence to the learners, which have a social justice component as well as a scientific component.** Morales-Doyle (2017) presents the example of high-school students learning advanced chemistry through an authentic investigation of soil quality in the vicinty of their school, which is situated close to a heavily industrialised zone. Learners are positioned as expert knowledge holders who use their **critical science agency** (Basu et al., 2009) to **merge scientific and other forms of knowledge and practice to address instances of injustice, and to take action on critical issues in their local communities.**

In designing learning environments with justice-centred science pedagogy in mind, LEVERS also aims to promote learners' "**rightful presence**". Rightful presence (Calabrese Barton & Tan, 2020) is an emerging framework for equity-oriented STEM education. It goes beyond equity through access and inclusion and recognises the potential for traditional educational practices to reproduce systemic injustices. Designing for learners' rightful presence asks educators to partner with minoritised learners, and not just welcome them into spaces with pre-defined rules and roles for success, but rather to expand what counts as science learning, and to let them become the authors of their own learning and becoming, in other words **"transformative intellectuals"** (Morales-Doyle, 2017).

CASE STUDY

Green Energy Technologies (GET) in the City Project (Calabrese-Barton & Tan, 2010)

In the summer of 2007, 20 students ages 10-14, from **the Green Energy Technologies** (GET) in the City Project set out to discover the ways in which a downtown neighbourhood exhibited the Urban Heat Island (UHI) effect, compared to that of a wooded park beside a lake. The students were intimately involved in the development of the project, bringing their own experiences of sun-beaten jungle gyms, playgrounds, and parking lots to the conversation, while also eschewing the traditional "build a model" lesson plan. The students also democratically chose the locations for their comparison, demonstrating their understanding of UHI, land cover, and their own neighbourhoods and communities.

Students built upon their classroom-based experiments to develop three data generating strands: temperature recording, landscape recording, and comparison of built areas to green space. Fourth and fifth strands, interviews with residents and workers and photographs of design aspects of the area, were added after a small number of students expressed interest in conversations with people they encountered in these areas about the human experience of the UHI effect.

The students' enthusiasm for video recording became apparent throughout the course of the project and thus, the three short documentaries were born: Where Da Heat Go?; We're Hot What About You?; and We Be Burnin'. Supplementing these documentaries with field notes, interviews, and student produced artifacts, researchers, Calabrese Barton and Tan used critical ethnography to approach their research questions: 1) How do students express their

agency with and in science in informal community-based learning environments? 2) What is the relationship, if any, between learning science and acquiring or fostering agency in science?

What they found was youth actively participated in activities that allowed them to challenge the traditional roles of educator and student and gave them a voice in ways that are not widely available to students in classroom settings. In all of the documentaries, the students are clearly the UHI knowledge holders and they were effectively empowered to position themselves as experts and communicators. This empowerment is twofold—firstly, the students were confident in their own knowledge and the role as experts, and secondly, in their ability to take action on the basis of their expertise.

CASE STUDY

Addressing Inequity through Community Environmental Education

A study by Griswold et al. (2022) describes an environmental education initiative for adults that involved community residents learning to monitor local air quality using low-cost air sensors. The project was based in a Chicago neighbourhood with a disproportionate share of environmental burdens, which pose a threat to health, economic resiliency and vitality, and community strength and wellbeing.

The authors note that while there are many reports on the kinds of community science projects that adult learners engage in, little is known about the learning processes involved in these types of projects. This study aimed to address this gap, by examining the learning of 14 adult volunteers involved in the initiative.

They found that as the participants learned about air monitoring, they developed new skills related to science and technology, and adapted existing skills to a new context. They also reported increased awareness and connection with their local environment.

In addition to individual learning, the volunteers learned in community—as they built confidence and skills in using low-cost air sensors, they widened the circle, drew other community members into the project, and acted as educators, teaching the new recruits about air monitoring and local air quality. Together, the community participants devised strategies for improving community air quality and health, making community-wide action to facilitate change seem possible. The findings indicate the potential for equitable education for sustainability through community environmental justice projects, and demonstrate the mobilisation of critical science agency towards collective wellbeing.

: CASE STUDY

U.S. researchers Bradford et al. (2023) co-designed a project with teachers, students, and experts, in which social justice would be incorporated into science education for middle schoolers. The resulting module was an examination of the racial trends inherent in the health effects of those suffering from asthma caused by particulate matter in the air. Using data visualization and interactive models, the students were able to compare the distribution of pollutants to the cases of asthma and identify trends in their own neighbourhoods, working together to hypothesize and explore possible causes of these trends.

The team had two research questions: 1) What perceptions do science educators have about integrating social justice into their curriculum? 2) In what ways do the co-designed materials and teaching practices affect the level of uptake of social justice into science learning? These questions were framed using social justice science pedagogy, which emphasizes that science instruction must be contextualized and intimately involved in challenging systems of oppression, while simultaneously allowing students to be the key drivers of transformation and holders of their own expertise.

To address these questions, the researchers employed several data-gathering techniques. They conducted interviews with teachers and students at two different schools with differing student demographics. The researchers were also able to track students' responses through a web-based programme and identify the frequency with which the students' responses referenced race or socioeconomics before and after participating in the unit. Using these datasets in combination with digital artefacts from the co-creation process (Google docs, emails, etc.), the researchers were able to recognise that while both teachers were looking for ways in which to centre social justice in their teaching, they had different reasons for doing so. One teacher saw social justice as a way to introduce students to important aspects of scientific enquiry and to achieve certain learning standards. By identifying evidence to support theories or arguments, the students were also engaging with state-mandated education standards that look to integrate fact-based, scientific reasoning into learning outcomes. The other teacher interviewed saw the integration of social justice into science education as a way to address racism in science and to further incorporate race-related issues into science education. This unit was complimentary to the one the students had already completed on the Tuskegee Syphilis Study and brought the students awareness about the interplay of race and science into the present day.

These two perspectives demonstrates that curricula which are critically aware of social justice issues and use them as tools for science education can offer diverse ways in which to broaden participation in science while also demonstrating the discipline's role in bringing injustice to light and providing solutions.

Throughout the project, it is clear that context is exceptionally important. While both educators were effectively teaching the same material, one felt significant pressure to adhere to the state-mandated standards and avoid using the words "race" and "racism," while the other had a supportive administration and colleagues who were interested in the possibilities of a more creative and socially conscious science curriculum. However, the authors found that both groups of students were already thinking about the ways in which

location dictates the experiences of climate change and therefore were, in many ways, already prepared for these discussions, even when issues of race and socioeconomics were not expressly addressed.

: CASE STUDY

¡Plo-NO! Santa Ana! LeadFree Santa Ana! (Orange County Environmental Justice, Jóvenes Cultivando Cambios, and UC Irvine partnership)

In 2017, an investigative reporter from ThinkProgressive, Yvette Cabrera, identified the high levels of lead (Pb) in Santa Ana, a small city in the greater Los Angeles area. The nascent Orange County Environmental Justice took up the issue, asking what exactly the the source was for these high levels. They reached out to the University of California Irvine (UCI) and another community-based youth collective, Jóvenes Cultivando Cambios. Together, this partnership increased the testing areas and found that the highest concentrations of Pb were in the historic downtown.

With the help of historian, Dr Juan Manuel Rubio, the group embarked on a parallel historical research project that included archival trips, examinations of aerial photographs dating back to the 1930s, maps, and governmental documents. All of this data was digitised and collated using GIS software to create a georeferenced map, which was then compared to the soil maps. What the team identified was that the high levels of lead from the 1920s to the 1970s was likely to have stemmed from the high level of car traffic in the downtown area. The use of unleaded gasoline until the 1970s was extremely high and the 101 Highway ran right through Santa Ana, the primary artery connecting Los Angeles and San Diego.

Throughout the 20th Century, lead science was heavily influenced by industry and this has had significant effects on policy. However, leaded gasoline was phased out beginning in 1986 and Pb in household paint has been banned since 1978. Nonetheless, 81% of the housing stock in Santa Ana was built prior to this ban. Today, the most polluted places in Santa Ana are primarily lower-income, Latinx, and renter-occupied. This research challenged the official narratives around lead poisoning which had previously focused upon poor construction techniques and the ingestion of lead through cheap toys, etc.

Where residents are concerned about their immigration status or if they cannot communicate comfortably in English, it is less likely that there will be inquiries to local authorities about Pb exposure in the neighbourhood. They are also less likely to discuss their experiences with public health officials, limiting their sources for advice on prevention or medical attention after Pb exposure. Furthermore, the majority of these households are based in rented accommodation and will not have the same ability to modify the property or structure as those families who are homeowners. The results of the community-academic partnership's study align with the extensive literature that already had identified low-income communities and communities of colour as being disproportionately impacted by Pb contamination and exposure. The researchers further align their work with previous findings that identify race and class, not only as social signifiers, but also as indicators of negative health outcomes, primarily as products or biproducts of individual and systemic racism.

Watch a webinar of this case study featuring LEVERS Expert Advisor Dr Kelley Lê

HERE

LEVERS engages educators working at many different levels of formal and non-formal education, some who identify as purely science teachers, others who wear many hats and may work more adjacent to science or sustainability. As noted by Morales-Doyle and Frausto (2021), "*Unfortunately, the enforcement of disciplinary boundaries has mostly kept critical pedagogy and YPAR out of science classrooms and science teachers out of conversations about knowledge democracy and learning for social transformation.*" (p. 61). In response to this, they present their model of **Youth Participatory Science (YPS)** [see Figure 6.3], which we propose as a practical tool for educators to adopt to tackle issues of climate justice within the LEVERS project. Embedding the concepts from the LEVERS Learning Framework into a localised YPS approach will allow for the development of action projects that promote democracy and rightful presence, take responsive action to champion justice and equity, and accentuate lifelong learning. Like ABCD (Section 3.3), YPS foregrounds the "*brilliance, strength, and aspirations of young people and their communities even as [they] investigate real problems that people identify*" (p. 67).

YPS is outlined below Section 6.1 alongside other related frameworks for project-based learning. There you will also find a series of scaffolding questions for educators to begin a social-justice science inquiry cycle, or a challenge-based learning cycle with a social justice orientation.

4.3 Transdisciplinarity, Imagination & Possibility

The role of art and humanities in tackling the climate crisis cannot be in doubt. In the face of such a complex challenge, we humans can no longer work within disciplinary silos. Climate responses must be transdisciplinary, and educators must work with a range of emotions alongside data and evidence. Artists and creative practitioners play important roles in LEVERS, inviting us to move beyond the world as it currently is, and supporting participants and learners alike to imagine different possibilities for a sustainable future. Research shows that working in community on creative, collective climate action projects can change mindsets towards more positive emotions and reduce climate anxiety (Hurley & Roche, 2023; Stoknes, 2015).

LEVERS promotes the development of learning programmes that incorporate **transdisciplinarity, imagination and emotions** into climate justice projects, and create space for artistic exploration as well as scientific study.

CASE STUDY

Corca Dhuibne Inbuanaithe A Creative Imagining was a creative climate action project based on the Dingle Peninsula in Co. Kerry, Ireland which involved a creative artist Lisa Fingleton working with ten farm families over the course of a year between January 2022 and January 2023. Read about the initiative **here.**

RESOURCE

Arts-based methods for climate education: Julia Bentz's open access book **'Creative Approaches to Climate and Peace Education - an educator's guide to using storytelling and art'** is a valuable resource which centres regenerative themes: "Learning as a Journey, "Hope and Imagination," "Many Meanings of Peace," "Healing Trauma and Creating Resilience," "Connection and Community,"

WATCH

From What Is to What If: why the next 10 years needs to feel like a revolution of the imagination. During his keynote address at the Ecsite Conference 2023, Rob Hopkins, founder of the Transition movement, shared his insights about the importance of nurturing the imagination in organisations and movements for change.

WATCH

As part of the Climateeurope2 project, LEVERS partner organisation CPN delivered **a webinar on the use of art and science towards climate action**. The webinar brings together artists and scientists, as well as those working at the intersection of the two, to explore the potential for their collaboration and to reflect on how interdisciplinary approaches can yield new insights and solutions to enhance public awareness of climate change challenges.

LEARN

konS ≡ PARK - Academy for contemporary investigative art: is a network of creative hubs in Slovenia that uses peer learning to support young people and the public to change their understanding of science, technology and art and develop attitudes that help understand the dynamics of contemporary society. **Stella Verde's work** is an interesting example. A second example is the development, together with artists of the mybot ∑igma system for peer-to-peer learning in non-formal science education that leverages the power of artificial intelligence. Read more **here**.

Moving beyond the anthropocentric ideas of human relationships with nature or technology, artist Špela Petrič's work PL'AI explores playful interactions between plants and an AI robot, positing the idea that the act of play is at the heart of self-knowing.

READ

Learning to live with Climate change: From Anxiety to Transformation book by Blanche Verlie (2021, open access)

All We Can Save: Truth, Courage, and Solutions for the Climate Crisis (2021, Johnson & Wilkinson (Eds.)), and the associated **All We Can Save Project**

CASE STUDY

Introducing ideas of human-plant-machine communication in a youth learning programme, LEVERS partner Kersnikova runs a three-hour workshop for learners aged between 9 and 15 years entitled **DigiVrt (Digital Garden).**
DigiVrt asks how humans can help with getting the right amount of water to our plants? The DigiVrt mechatronic watering system, has been designed so that a mini-garden will never dry out or drown.
When the Kersnikova team designed the DigiVrt mechatronic watering system, they thought about the possibilities of mechanics and electronics in plant care. Using a 3D modelling tool, learners in this workshop design self-sustaining ecosystems that enable small gardens in urban dwellings.
First they learn about mechatronics - assembling a frame for a humidor and a water bottle, and connecting the electrical components so that they do not come into contact with water. Then comes the programming and getting to grips with the code - based on the biology of different plants and their needs for successful growth, they program the Arduino microcontroller to send a watering signal when the plant needs water. At the end of the workshop, they plant the frame with all the necessary mechatronics on the plant. Then all they have to worry about is the water supply in the bottle, and the DigiVrt takes care of the rest.

4.4 Place-Based Learning

While rooted in science education, science communication and public engagement, the approaches outlined in the previous sections dovetail and overlap with the well-established field of place-based education. Place-based education is a powerful local approach to education for environmental justice and climate action. According to Sobel (2004), "place-based education is the process of using the local community and environment as a starting point" (p. 4). By rooting learning experiences in contexts that are immediately relevant to participants, the climate crisis becomes more immediately relevant and the responses more empowering. Place-based learning is rooted in six principles:

a. Local to global context: Using local issues or learning experiences as a model that can then be scaled up and applied to global challenges and connections.

b. Learner centred: Ensuring that learning is directly and personally relevant to the learners.
c. Inquiry-based: Learning follows the scientific method – observation, questions, hypotheses, and data collection – to understand economic, ecological, and socio-political environments.
d. Design thinking: Students are given (or identify) a problem, the constraints, and a solution, and are then empowered to take action to improve their community. These problems are approached through the framework of design thinking which contains four stages: Define, Generate, Create, and Evaluate
e. Community as classroom: The learning ecosystem extends beyond the classroom including local knowledge, experiences, and places.
f. Interdisciplinary: Teaching occurs across the traditional bounds of discipline and in an integrated, project-based manner.

The **Eco-Capabilities project**, led by Prof Nicola Walshe (UCL), a research project exploring how the wellbeing of children living in areas of high deprivation were supported by working with artists in familiar outdoor places.

The Eco-Capabilities project is featured in the article: **'The heart of the forest is here'**: Reframing children's disempowered relationships with once-familiar places through Eco-Capabilities. In Encountering Ideas of Place in Education.

5 SETTINGS FOR REGENERATIVE LEARNING

5.1 Open Schooling

Open Schooling (OS) is a term promoted by the European Union that refers to schools as agents of wellbeing. Through cooperation with enterprises, universities, and local communities, students work with real-life problems to develop the competences that they need to ensure sustainable life and desirable futures (Okada & Gray, 2023).

OS is an approach in which purposeful collaborations are built between schools and their wider communities. It offers students the opportunity to learn together in the real world and widens their horizons to learn from people other than their teachers.

Families, experts and other stakeholders collaborate with teachers and students to address relevant local challenges, contribute to community development, and promote an active global citizenship attitude. (**Make it Open, 2022**).

The emphasis in OS is on identifying locally relevant issues or challenges and to work with other stakeholders from the local community to explore or solve these – see this **video** from the Open Science Hub project.

Open learning and open schooling are broad terms which describe learning which is 'open' in terms of timing, location, teaching roles, instructional methods, modes of access, and any other factors related to learning processes. Most schools already do some level of open learning, through excursions and trips, site visits and remote learning.

OS Together is an informal network of EU funded projects around Open Schooling. they have a **shared newsletter**, **social media handles** and an **email address**. They organise regular meet-ups to foster collaboration and inspire professionals with open schooling methodologies.

The Open Schooling Navigator is a tool developed by the EU funded project Make it Open to guide educators in finding learning scenarios for open schooling. The tool has an advanced search function to narrow down the learning materials according to the educators needs.

The **Teacher Training Innovation Toolkit on Open Schooling** developed by the EU funded project PHERECLOS is a handbook for teachers and teachers in training to develop open schooling activities to be integrated in a school-based context.

Research results from the Fedora project can be useful to inform OS design and practice, in particular the focus on future-oriented concepts and elements. The **Fedora Project Handbook** contains a number of recommendations for OS based on these findings (p. 17):

- Use futures thinking to cross, connect and contextualise 21st century skills.
- Incorporate future concepts and elements in science curricula.

- Incorporate futures thinking in science teacher education programs.
- Understand and address the personal, gendered, cultural, religious, socioeconomic and political dimensions of futures thinking and related beliefs.
- Foster the development of future-scaffolding skills

- Elicit students' scientific and technological images of the future.
- Address ongoing and emerging trends in science and technology.
- Highlight the role of human agency in the development of science and technology and in sociotechnical change.
- Address and embrace complexity and uncertainty.

- Embrace emerging teaching using interdisciplinary projects.
- Practise different types of futures thinking.
- Deconstruct spacetime rituals in science classrooms.
- Guide the students to manage tensions and overcome polarizations.
- Use collective group work to open up to alternative futures.

The Fedora project website also provides a useful **list of resources and references** including book recommendations, videos and articles.

5.2 Learning Ecosystems

Drawing inspiration from the realm of evolutionary biology, specifically Bronfenbrenner's 1979 work, the notion of learning ecosystems offers a departure from the conventional belief that education rests solely on the shoulders of individual entities such as schools. Instead, it posits that schools are integral components of more intricate systems, where interconnected relationships unfold among various entities—such as families, communities, non-formal learning organisations, and schools. Different entities within this educational ecosystem assume distinct roles in relation to individual learners, and these roles evolve over time. Similar to how an ecosystem relies on its surroundings, broader influences like national educational policies can also impact the learning ecosystem.

Every individual is situated within a unique learning ecosystem that shapes their lifelong learning journey in diverse ways. In the context of STEM education, for instance, a young person might encounter STEM through family visits to museums, develop an interest in engineering through meaningful projects at a youth club, consume STEM-related media during leisure time, or engage in climate activism through local voluntary organisations. The nature of a student's learning ecosystem can vary significantly depending on geographic location, as well as their own family situation, their social and cultural norms, and their science capital (Archer et al., 2015).

A learning ecosystem, as implied by its name, constitutes a network or system comprising individuals and organisations connected through symbiotic relationships based on shared interests, technology, resources, skills, and tools. A learning ecosystem as an intentional collaborative network aims to innovate and co-create opportunities that enhance learning

within their communities. Key to learning ecosystems is the inclusion of "non-traditional" learners and educators, whose expertise plays a pivotal role in crafting new learning solutions and pathways for community-based, lifelong learning. Each individual within the community serves as a node in this network, possessing unique knowledge, skills, and experiences. As these experiences transform into learning opportunities for others, they foster and consolidate connections within the community.

Learning ecosystems could encompass various elements, including after-school programs, science centres, galleries, museums, libraries, archives and other cultural and creative institutions, as well as informal social or home-based experiences. These converge to offer a rich tapestry of learning opportunities. While some learning pathways may evolve organically, others can be deliberately designed and organised with the explicit goal of empowering learners to acquire competencies in specific disciplines – this is demonstrated in the case of the STEM ecosystems throughout the United States and worldwide participating in the **STEM Learning Ecosystems Network**.

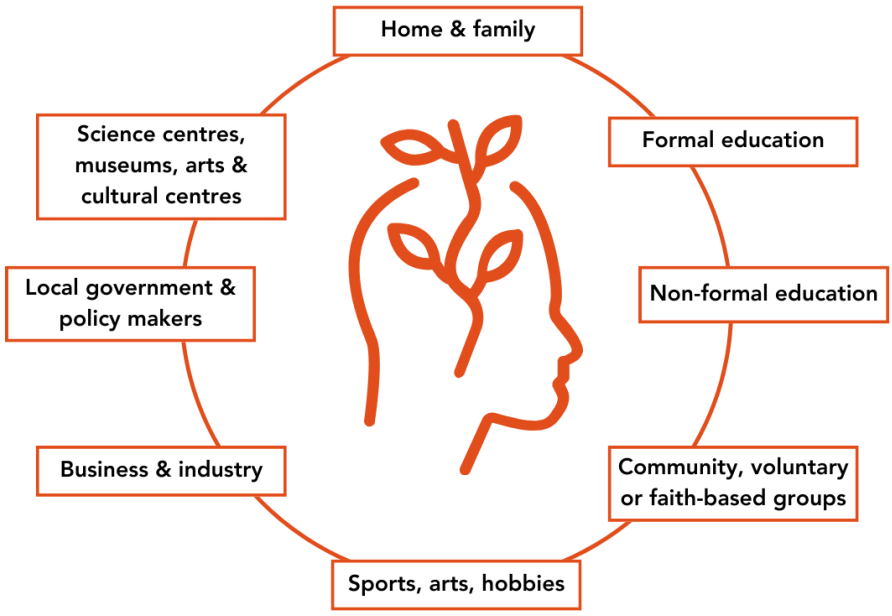


Figure 5.1: Sample STEM Learning Ecosystem.

Just as the environments in which learning ecosystems are diverse and varied, so too are the stakeholders who engage with it. **Stakeholders** are those individuals or groups who have an interest in the development and results of the learning ecosystem. The ways in which those interests manifest and the ways in which the stakeholders engage with the learning ecosystem are multitudinous. Stakeholders can refer to those groups or individuals who collaborate in the design and construction of the ecosystem; they can provide funds or other material resources; but they are also the learners, learning providers, and community members within which the learning ecosystem is embedded.

Within learning ecosystems, playlists or pathways can be useful way to conceptualize the learning journey. A learning pathway represents a route taken by a learner in which they engage with the learning opportunities offered by the community and progressively build upon these experiences in order to gain knowledge and skills. They differ from traditional, formal

education curricula by focusing on a specific learning goal, skill acquisition, or industry experience. Learning pathways offer a more curated approach, that are designed to engage the specific learner in a more natural and integrated learning experience and are often intended to help communities address specific problems and challenges.
A successful Learning Ecosystem will co-create the learning pathways with the community and maintain a shared responsibility for learning outcomes. The community cannot be treated as a passive recipient of knowledge but instead must act as an active collaborator and the hub around which the spokes of learning, wellbeing, and developmental outcomes are arranged and supported. Sensitive and mutually productive engagement of both the learning providers and the learners within a community is at the heart of successful Learning Ecosystems. Within the LEVERS project, the Learning Venture acts as drivers for a local learning ecosystem, and the members work with the community to ensure continuity across the various learning settings, so that the climate action projects undertaken by learners in various educational and community organisations have a level of coherence and continuity, and learning can be celebrated through common achievements towards a shared climate and environmental justice goal that is meaningful within the locality.

RESOURCE

The **WISE Learning Ecosystems Living Lab** is an initiative of the Qatar Foundation, which promotes a place-based and collective design approach to mobilse practitioners, experts, policymakers and innovators as a global community of practice and thought-leadership that will support the design of key components of Learning Ecosystems in different regional contexts. Their website contains a useful set of articles by global leaders such as the series **"Bringing Learning Ecosystems to Life: What does it take?"**
In 2022, the WISE Learning Ecosystems Living Lab published a playbook entitled "Designing Learning Ecosystems" to provide readers with tools to plan and work on practical steps to create learning ecosystems within their own communities and contexts. This playbook is a foundational resource for the LEVERS project, and can be accessed **here**.

5.3 Lifelong Learning

"the life situations that call for lifelong learning are undergoing transformation, and the vision of lifelong learning must therefore be transformed as well, that is, extended, broadened and deepened"

Paul Bélanger: *Self-construction and Social Transformation: Lifelong, Lifewide and Life-deep Learning* (2015), p.243-244

Beyond providing skills, knowledge and competences for climate action, lifelong learning empowers learners of all ages and contributes to societal transformation. Adult education is crucial not only to support individual learners but also key for social cohesion and to build resilience among communities (EAEA, 2020). Learning Ventures will bring together members of the community united around a common goal of improving education and lifelong learning in their localities.

Key Concepts
The concept of lifelong learning, describing learning "from cradle to grave", gained popularity in the EU in the early 2000s, when European Commission issued the Memorandum on Lifelong Learning. The document put lifelong learning in a holistic perspective, focusing on building knowledge-based societies and fostering active citizenship.

Within the continuum of lifelong learning, adult learning and education refers to a range of formal, non-formal and informal learning activities that are taken up by adults after they have left their initial education and training. Its understanding differs across Europe and consequently in the countries represented by the LEVERS consortium: in Serbia adult learning might be mostly defined as vocational education and training, while in Ireland it might predominantly refer to community education.
In this context, it might seem difficult to find a shared understanding of the key concepts that underpin lifelong learning and adult learning. That said, there have been several initiatives recently that might be helpful to explore for the partners of LEVERS who are establishing their Learning Ventures.

In recent years, the concept of **life skills** has been gaining popularity. EAEA's project Life Skills for Europe defines life skills as "*a constituent part of capabilities for life and work in a particular social, cultural and environmental context. The types of life skills emerge as a response to the needs of the individual in real life situations.*" *They range from literacy capabilities to digital, health or environmental ones. The key element of the life skills approach is that they are interlinked: a learner might be following a course that's explicitly on improving reading or language skills but will also discuss environmental issues. The life skills approach also implies that learning should stay relevant to adults' personal and professional lives, which is particularly important in a project like LEVERS, that also raises questions that are important in the local community.*

Skills for Life are now one of the actions of the European Skills Agenda, adopted by the EU in 2020.

Recycling Design, *run by* DOF Allerød Fritidsskole in Denmark, brought together migrant and Danish-born women around a shared interest in needlework. While seemingly focusing on handicraft, it also helped participants improve their language and interpersonal skills. It also gave room for learners to suggest activities themselves: while discussing how Danish government works in one of the classes, learners suggested organizing a visit to the Parliament and prepared the visit themselves.

Another issue linked to the relevance of learning is the question of **the learner's voice**. Learner voice is about "empowering learners by providing appropriate ways of listening to their concerns, interests and needs in order to develop educational experiences better suited to those individuals." (Walker and Logan 2008), as per AONTAS. By focusing on learners' needs and including them in how a course is planned, delivered and evaluated, learning providers can foster a culture of respect and community, and build learners' self-confidence.

Different approaches in Europe have been used to foster learner voice, from inviting learners to become learning ambassadors and make their voice heard at the policy level, to more classroom-based practices, for example by encouraging the use of different tools in the classroom to focus on the individual journey of each learner.

My Story - My Agenda, Sweden

Eight folk high schools in Sweden have developed a project which brings forward the participants' own experiences and stories to advance Agenda 2030. In **co-creation between participants and educators,** the schools explore new methods and tools for telling and owning one's own story and intend to create new paths to engagement; large and small, individual and joint.

RESOURCE

Toolkits for practitioners

- **The Guidelines and recommendations on change-oriented adult education** bring together adult learning theory and practice, with a focus on learner voice and participatory method, in an easy-to-read format.
- The results of the Life Skills for Europe project include a set of **good practices**, **tools**, a **learning framework** and an **awareness-raising toolkit**.
- **EAEA podcast Beyond Learning** is about stories of learning, and stories of change. We meet with learners, educators and community organisers to ask them why learning should be at the heart of a greener future, and how it has already shaped their lives and communities.
- The **Electronic Platform for Adult Learning** in Europe produces a series of podcasts that discuss different issues in adult learning and education, from digital skills to democratic engagement.
- **Introduction to adult learning in Europe** is an online course that gives a broad perspective on how adult learning is understood in Europe.
- **Together for change -online course** introduces the concept of change-oriented adult education and the role it can play to further democracy and foster inclusion in our society.
- **EAEA concept paper on Adult Learning and Green Transition** gives an EU and global policy background, looking at green and adult learning agendas within the context of multiple crises. It closes with a set of good practices that encourage learning for the green transition.
- **Let's get our hands dirty! Greening Adult Learning and Education**. EAEA background report (2021) contextualises adult learning and education from the broader activist perspective. It includes a green glossary with key definitions and concepts.
- **ELM: Lifelong Learning Magazine** looks at topical issues in lifelong learning with a journalistic perspective. The latest edition focuses on sustainable future and looks at grassroots lifelong learning initiatives from across Europe.

6 PROJECT-BASED LEARNING FOR CLIMATE JUSTICE

6.1 Frameworks for justice-oriented project-based learning

Project-based learning allows for active, inquiry-based learning and the real-life application of knowledge – moving from learning about something, to creating, acting, doing and sharing. In this section, we will explore ways that the concepts explored in this document might be combined to develop project-based learning opportunities for climate justice projects within a learning ecosystem.

There are numerous approaches and frameworks for equitable, project-based learning in science, STEM, and STEAM, with various orientations and theoretical underpinnings. A number of these have served as the inspiration for the LEVERS Learning Framework and are introduced here to support the move towards place-based, justice oriented and transdisciplinary challenge-based learning, which includes science learning as a major component.

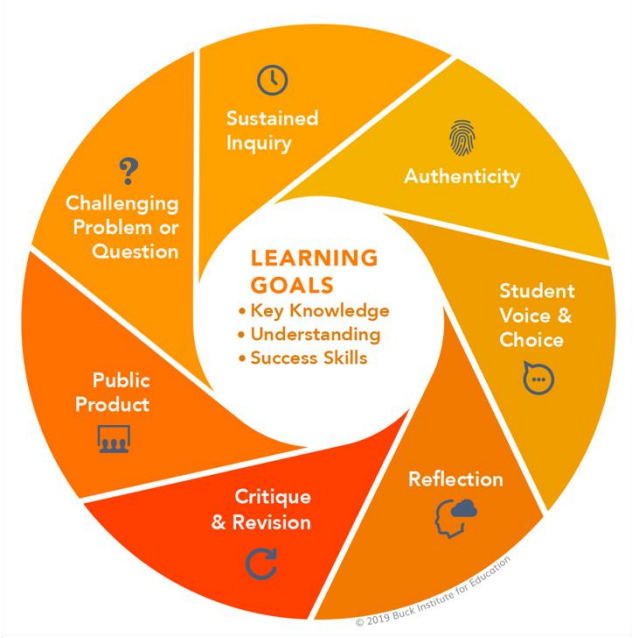


Figure 6.1: Gold-standard project based learning: www.pblworks.org

Project-based learning has been iteratively developed in recent years, and the framework presented in Fig. 6.1 contains the major features of a project-based learning cycle. All of the frameworks in this section suggest cyclical phases of instruction and development, and remind us of the importance of student voice, authenticity, iteration, reflection and outward communication to share learning.

Figure 6.2: Challenge-based learning https://www.challengebasedlearning.org/framework/

Challenge-based learning (Fig 6.2) provides a simple framework and set of guiding questions to move from big ideas to an essential question and challenge that can be investigated and acted upon.

RESOURCE

Challenge Based Learning

- ENGAGE phase: Learning programme should provide enough inspiration and structure to move from a big idea (abstract) to a concrete, actionable, relevant challenge through collaborative questioning.
- INVESTIGATE phase: Learning programme should support learners to develop contextualized learning experiences and conduct rigorous, content and concept-based research to create a foundation for actionable and sustainable solutions. They should generate guiding questions related to the challenge, and generate and use guiding activities/resources to answer the guiding questions and work towards innovative, insightful, and realistic solutions. Examples of guiding resources include workshops and presentations from local experts, online content and courses, databases, textbooks, and social networks. Examples of guiding activities include simulations, experiments, projects, problem sets, research, and games.
- After answering the guiding questions and identifying insights, the learners analyse the accumulated data and identify themes.
- The INVESTIGATE phase concludes with reports and presentations demonstrating that the learners have successfully addressed all the guiding questions and developed clear conclusions, setting the foundation for the solution.
- ACT phase: Initially, learners develop a range of solution concepts (campaigns, products, changes to the local environment, arts-based interventions, or other activities). They develop prototypes, experiment and test potential evidence-based

solutions or responses to the challenge. Finally, they implement their ideas by sharing them with an authentic audience and evaluating and reflecting on their outcomes.

- Throughout the project or challenge, all stakeholders document their experiences using text, audio, video, and imagery (drawing / digital art / photography). These provide source material for collective reflections on the process.

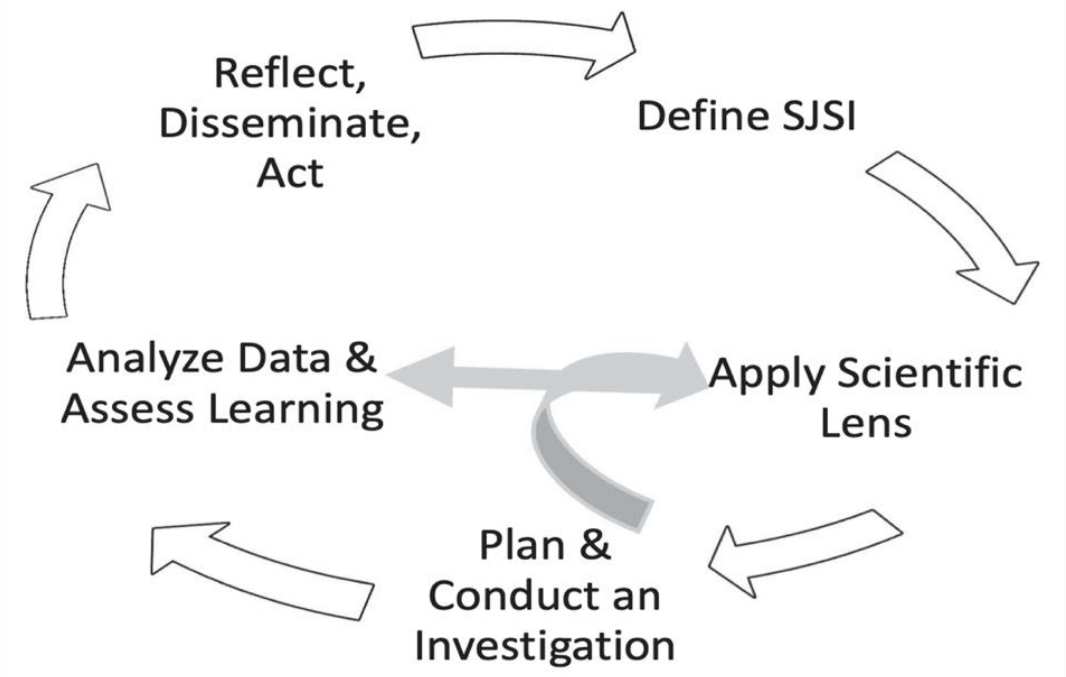


Figure 6.3: Inquiry cycle for Youth Participatory Science taken from Morales-Doyle and Frausto (2021).

Youth Participatory Science (Fig 6.3.) builds on traditional inquiry-based science learning (Bybee, 2006) but introduces a critical component, and reminds us to identify a local "social justice science issue (SJSI)" as the challenge or learning context for the inquiry cycle.

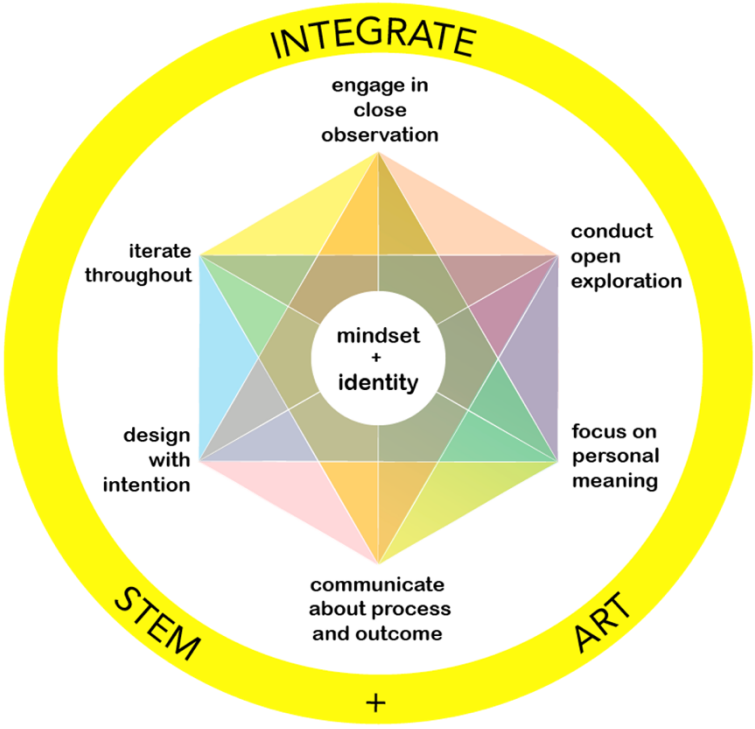


Figure 6.4: STEAM practices that promote student engagement in meaningful work, from the Fostering STEAM project (https://fosteringsteam.org/steam-practices/)

The STEAM practices from the Fostering STEAM project (Fig. 6.4) and the STEMS^2 framework (Fig. 6.5) remind us to introduce a transdisciplinary lens to the investigation stages, introducing the arts, and social sciences. LEVERS recommends an even broader integration which incorporates the Arts, Humanities and Social Sciences (AHSS) alongside the STEM disciplines. The STEMS^2 framework (Fig. 6.5), developed by O'Neill et al. (2023) for use in Hawai'i draws further on community knowledge and sense of place to foster student engagement and achievement via real-world application of interdisciplinary content knowledge that supports the social-emotional development required for community and civic engagement in addition to promoting skills related to college and career readiness.

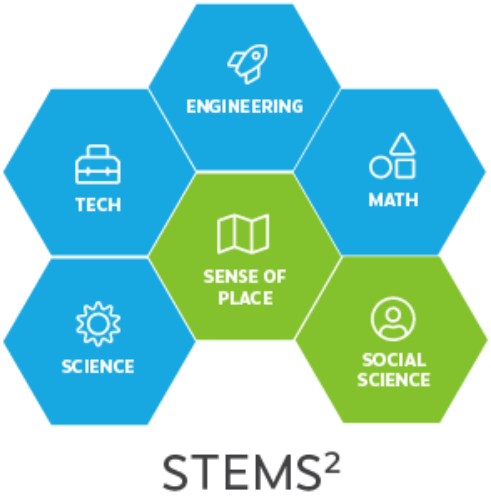


Figure 6.5: The STEMS² framework, developed for use in communities in Hawai'i: https://coe.hawaii.edu/stems2/about/

LEVERS project-based learning will take place in diverse contexts across Europe, each with unique challenges and opportunities. To further the teaching and learning of science towards social justice in LEVERS, the planned projects may attend to any of the intersecting equity projects outlined by Bell (2019) as relevant:

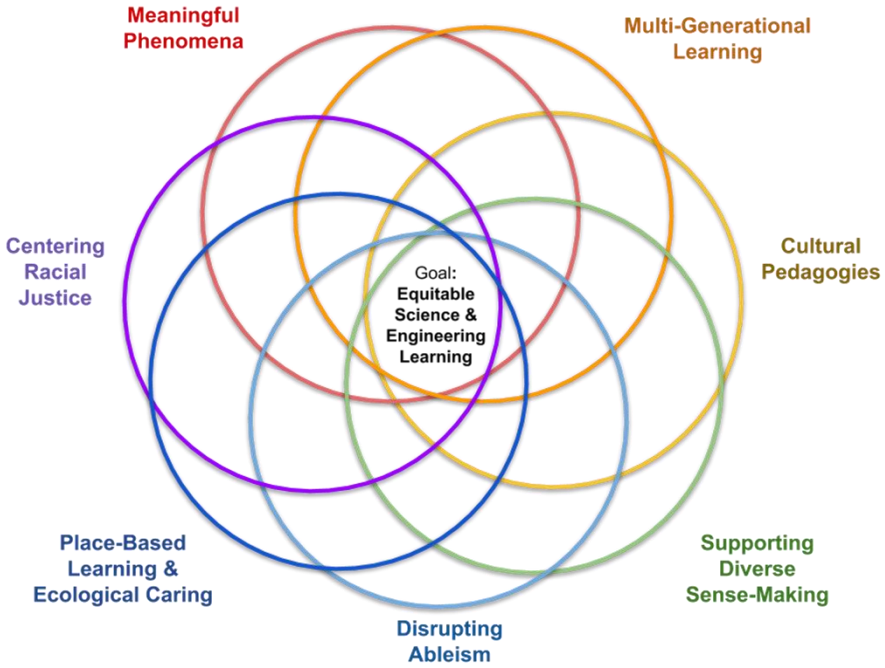


Figure 6.6: Intersecting equity projects to guide the teaching and learning of science towards social justice (Bell, 2019).

In particular, all LEVERS projects should be rooted in meaningful phenomena, involve place-based learning and ecological caring. Adopting a learning ecosystem approach which connects school projects with community-based projects may allow for multi-generational learning and culturally-responsive pedagogies. Further information on these intersecting equity edges can be found in the open-access resource **STEM Teaching Tools #71** which also offers the following reflection questions:

- We use "equity projects" to signal key initiatives where intentional action is needed. What projects do your students and communities furthest from educational justice need?
- Are there groups in your context who you can engage in self-reflection, planning, and action with—and learn to navigate resistance to enacting change?

Place-based, justice oriented and transdisciplinary challenge-based learning, which includes science learning as a major component can support learning as a transformative, activist project (Bevan, 2020) —allowing learners to participate in science within their communities, for the benefit of themselves and their communities (Ballard et al., 2023). Learners should understand and re-interpret big ideas through a local lens, engage critically with the sociopolitical and scientific structures, and utilise science as a tool of or for change. The education they participate in through the LEVERS project should position them as topic experts, allowing them to take appropriate action for climate and environmental justice, and to educate and motivate others towards transformation (Calabrese-Barton & Tan, 2010).

The frameworks presented in Figures 6.1 - 6.6, as well as the pedagogical commitments and design approaches outlined throughout this document have been used to generate the LEVERS learning framework (Fig. 6.7). The inner wheel reflects the learner journey and represents the challenge-based approach to tackling a locally relevant social justice climate issue. This cycle requires active, inquiry-based learning, critical engagement with the topic, and action for transformation. The outer wheel reflects the design features put in place by the local Learning Venture who are working together using the Seven Insights for Climate Action. Learning projects offer opportunities for place-based learning connected across local multi-stakeholder networks, and exposure to transdisciplinary approaches to problem-solving that draw on expertise from STEM disciplines as well as Arts, Humanities and Social Sciences. The range and spread of projects and opportunities for lifelong learning foreground DEAI and take a systems-level perspective, promoting the idea that the climate crisis must be tackled systemically, collectively, and optimistically.

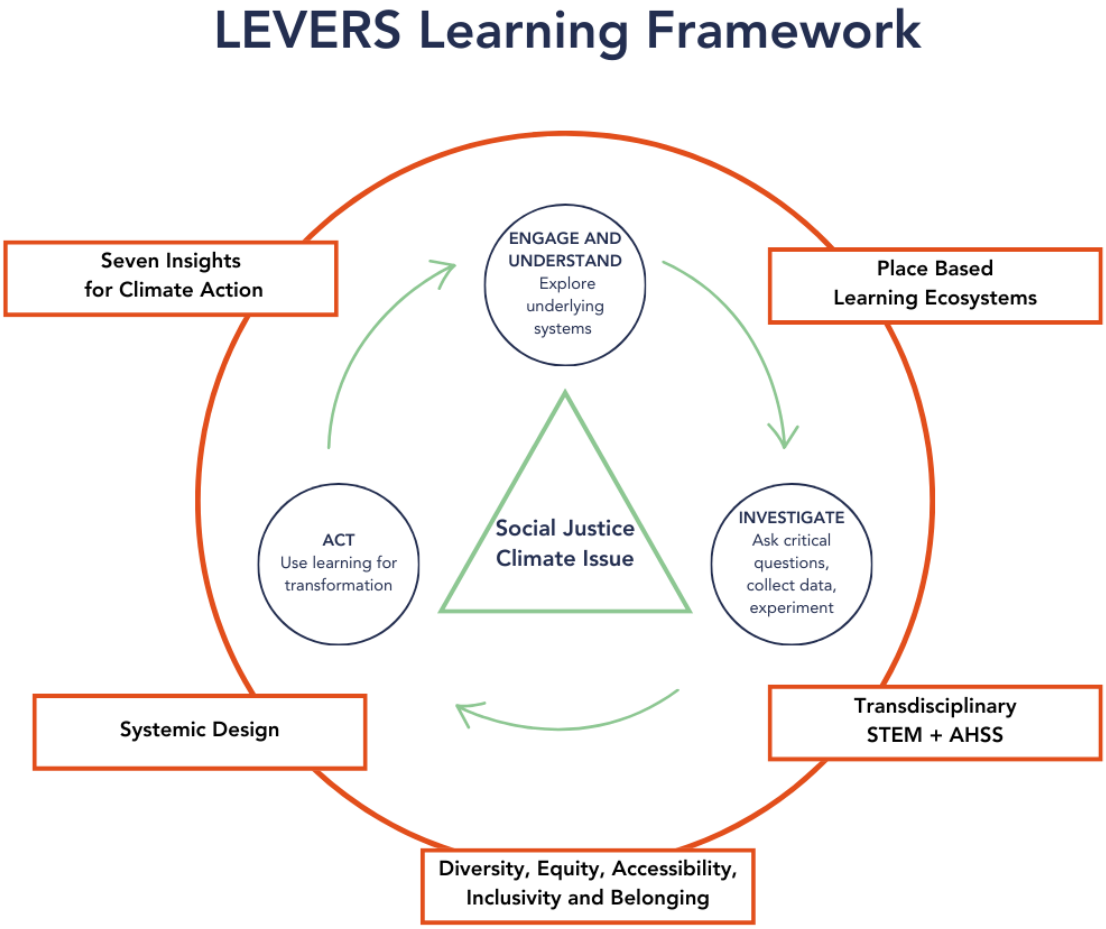


Figure 6.7: LEVERS Learning Framework. Outer wheel represents ongoing commitments throughout the project-based learning cycle, while inner sections are sequential, beginning with ENGAGE & UNDERSTAND, followed by INVESTIGATE and ACT.

6.2 Localised Knowledge Creation

The initial role of the LEVERS Learning Venture is to identify one or more learning settings to run project-based learning in (e.g., primary, secondary, adult, non-formal, community) – an educational institution or organisation willing to participate in the co-design and delivery of the LEVERS project, and to collaborate and interact with other local initiatives that are undertaking LEVERS projects.

Furthermore, the central issue - a specific, local climate or environmental issue – must be identified. Extending the language of YPS, rather than "social justice science issue (SJSI)", we will henceforth refer to this as the "social justice climate issue (SJCI)" Decision-making and the order of activities will vary depending on how the work of the Learning Venture has been framed:

- Option 1: start with a thematic focus, build a project around it (e.g. biodiversity loss)
- Option 2: start with an identified local challenge affecting potential participants, build a learning project around it (e.g. housing issues and urban heat islands)
- Option 3: start with an umbrella focus and a target community, use participatory methods & systemic design to identify SJCI, build a learning project around it (e.g. climate action > narrowing down to air quality following community identification of the issue)

Once the target community and SJCI topic have been identified, to develop critical, justice-oriented localised project-based interventions, each LEVERS Learning Venture will identify local relevant experts to work together to co-design initial content to engage learners and to provide a knowledge base. We will henceforth refer to this group as a Knowledge Creation Team (KCT) as it may be a slightly wider group than a Learning Venture.

The KCT should be comprised of Learning Venture members, relevant local experts and community gatekeepers. It should represent diverse expertise and types of knowledge. This group will collaboratively analyse, envision, and design a shared practice to support the implementation of a LEVERS project in their community.

A KCT may include the following (non-exhaustive) list of stakeholder profiles:

- LEVERS partner + Learning Venture members
- Researchers from any relevant disciplines – e.g. climate sciences, geography, environmental humanities, the arts, political science, law, economics, education, psychology etc.
- Business and industry
- Local government officials
- Teachers and school leaders from all school levels (primary, secondary, adult)
- Community leaders, youth workers
- Local social justice & inclusion experts e.g. NGOs/CSOs

The LEVERS partner should provide clear indication that participants in the KCT events will take part in the co-design of local climate action projects that their community can participate in and outline the planned learning contexts for these projects. The KCT will work with the "big idea" or SJCI for their community, and using the Seven Insights for Climate Action (Section 3.1), concepts of systemic design (Section 3.2) and participatory methods (Section 3.3), co-design one or more projects or learning interventions that are:

- **Relevant.** It should be a personally meaningful project of significance to the KCT

members and to specific communities of learners who will undertake them.

- **Pragmatic**. The design needs to be responsive to a real situation, i.e. the SJCI. However, what is created through the project can be as conjectural, speculative or real as the participants decide (don't rule out imaginative responses!)
- **Disruptive**. The approach should strategically and generatively disrupt dominant assumptions in a justice-centred way (restorative, transformative, procedural).
- **Agentic**. The approach should support individual and collective agency and action for world-building.

The projects should approach education as living a desired, just future. These four commitments (relevant, pragmatic, disruptive, agentic) are inspired by the **CLIMATE & ENVIRONMENTAL JUSTICE IN EDUCATION GRADUATE SEMINAR from the University of Washington (Bell, 2023).**

6.3 Knowledge Creation Phases

The following is a (non-exhaustive) list of suggested activities for a KCT, which may be used in combination over multiple sessions with the participatory methods outlined in Section 3.3

Engage Phase

- Values sharing exercise for participants to share experience, emotions and hopes for the community they represent. Example activity: invite participants to fill out persona outlines, representing themselves and/or the people they work with: what they think (head), what they feel (heart), what they do now (hands). How might these change through participation in climate action projects? [Suggested time: 1 hour]

- LEVERS partners share key overarching principles from this document: e.g. systems thinking, the Seven Insights, critical pedagogy & social justice, place-based learning, asset-based community development, doughnut economics, etc. HOW: Short presentation & short activity/inspiring story for each section, interactive workshop considering how these principles are/are not already happening in local area [Suggested time: 1-2 hours]

- Knowledge & skills share: researcher/scientist presentations on climate + environmental topic; followed by lightning talks from all participants on their work / interest in the topic, interactive stakeholder map creation exercise [Suggested time: 1-2 hours]

- Social justice climate issue identification and systems thinking workshop - first pass analysis of relevant community needs & assets, paying particular attention to social justice and inclusion [Suggested time: 1-2 hours]

- Place based and arts-based methods workshop. Engage local artists to lead embodied learning in and from place. [Suggested time: 1-2 hours]

Ideation Phase

Building on the learnings from the above section and facilitated by LEVERS partner, the KCT should use participatory methods and a systemic design approach in combination with the Seven Insights to design and develop content for learning programmes for identified

community participants. This should provide learners with context and inspiration, opportunities for critical engagement with social justice climate issues, and any tools or resources they might need to make change in their surroundings. These might include access to scientific researchers or public officials, access to data or public policies, access to arts materials or public spaces. Remember: designs should be **relevant, pragmatic, disruptive, agentic.**

The following are a series of key questions to apply to the emergent designs:

Critical Pedagogy:

- Key question: Does the learning programme support socio-political awareness, and promote critical thinking and dialogue?
- Key Question: are learners & educators engaged in a process of reflection on the (in)justice dimension of climate change? Is there a subsequent follow through on a commitment to action?

Expansive Learning & Transformative Agency:

- Key question: Do learners & educators work collaboratively to interrogate historical and present-day activity systems?
- Key question: Do individuals (learners/educators) have the capacity to contribute to and lead meaningful and transformative changes?
- Key question: Does the learning programme embrace social action and agency based in political imagination, vision, and commitment to social transformation?

Critical eco-pedagogy

- Key question: Do learners have access to appropriate content to make sense of the scientific dimensions of the environmental issues at hand?
- Key question: Do learners have the opportunity for critical thinking about the interconnectedness of humans as part of the natural world, and our relationships with humans and non-human entities? What methodologies might you use to offer learners these opportunities?
- Key question: Do learners have the opportunity to use systems thinking to explore the root causes of selected environmental injustices? What methodologies might you use to offer learners these opportunities?
- Key question: Do learners have the opportunity to analyse the environmental impact of human actions? What methodologies might you use to offer learners these opportunities? How might you assess any increased sense of responsibility and ethical stewardship among learners?

Social justice science pedagogy

- Key question: How might educators better understand the interests, identities and everyday experiences of learners, and work to incorporate them into LEVERS projects?
- Key question: How might LEVERS projects allow learners to merge scientific and other forms of knowledge and practice? How can rigorous science learning be maintained? Can learners take what they learn through classroom-based, curriculum aligned science education, and apply it within a LEVERS project? [Note this may be skills and practices of science, rather than concepts - e.g. collecting data, making observations, undertaking research]

Rightful Presence

- Key question: Does the LEVERS project create some spaces in which learners have

autonomy to direct their own exploration of the climate crisis and to create responses which draw on their existing identities, cultural experiences and relationship with science? Can educators facilitate rather than direct this type of learning? [Note, this may be easier to facilitate in a community or out-of-school setting than within a formal education setting.]

Transdisciplinarity, Imagination & Possibility

- Key question: Have you created space for transdisciplinarity, imagination & possibility in your Learning Venture or Knowledge Creation team? If not, how might you do that? Could you invite artists or Indigenous practitioners to lead a session?
- Key question: Does the LEVERS project you are developing offer opportunities for multiple disciplinary investigations of climate justice?
- Key question: How might educators and schools organise participation in a LEVERS project that allows for transdisciplinary approaches?
- Key question: Does the project and the overall approach work with positive emotions and push for collective optimism?

Place-based education

- Key question: How do learners encounter place in their LEVERS project? Are there opportunities for them to see or encounter their place differently?

Open Schooling

- Key question: what features of Open Schooling are present in your learning designs? Are there opportunities for students to learn from one another, their families, wider communities and relevant stakeholders? Are there opportunities for students to learn outside of the classroom and to share their expertise beyond the school walls?
- Key question: is Open Schooling embraced as a pathway for whole-school approaches to climate action? If yes, how might this be shared beyond your Learning Venture to influence educational policy and practice related to climate change education?

Learning Ecosystem

- Key question: How are learning pathways and linked learning opportunities communicated to learners within your learning ecosystem?
- Key question: How can interested individuals and organisations beyond your initial learning ecosystem become part of your local network, and contribute their expertise to support local learning and development? Can you create opportunities to grow your learning ecosystem?

Action Phase

Learning designs created by the Learning Ventures and their extended collaborators should be applied in the selected learning environments. An important feature of the overall LEVERS project design is the coherence and communication between the various sites of learning, promoting a continuum of lifelong learning across a community for climate justice. The Learning Venture can work with the Seven Insights by sharing positive stories of climate action, and demonstrating ways that different organisations and institutions in a geographical region can cooperate to tackle issues of climate justice in their locality. They may do this by organising public events, arranging exchange visits between schools and other participating organisations, sharing stories and content using traditional or digital media, and showcasing LEVERS projects in talks, presentations and conferences.

Impact evaluation will be carried out in each Learning Venture location as part of the overall LEVERS project, while assessment of student or participant learning in each location should be developed and undertaken locally. Research data will not be collected from learners, but educators and other stakeholders will be contributors to the overall evaluation process.

Educators in each setting should take the lead on curricular alignment and designing relevant and rigorous assessment of the learning interventions - this will be more relevant for educators in formal settings but those in community and informal learning settings should also aim to develop approaches to capture participants' learning. The features of the LEVERS Learning Framework (Figure 6.7) can be used as a basis for assessment design, along with relevant curricular frameworks. It is suggested that educators plan for a range of assessment to capture different types of learning, multiple assessments over time to capture snapshots of the learning journey, and assessments across levels of complexity to identify student progress. Assessments should explore students' ability to know and understand concepts, and to relate and transfer ideas to new contexts to solve problems.

As community-level projects start out in each location, they will be experimental and exploratory, and learner assessments should be used the alongside overall project evaluation to examine the features of the learning intervention design, and the effectiveness of its implementation in each setting. Ideally, the timing of the Learning Venture projects should leave time for at least two iterations of each intervention, so that an iterative design-based research model can be applied, with evaluation of the first iteration informing changes and improvements for the second.

Evaluation dimensions include:

- Application of the Seven Insights for Climate Action
- Application of systemic design
- Transdisciplinarity
- Diversity, equity, accessibility, inclusion and belonging
- Relationships within the Learning Venture, KCT and wider learning ecosystem
- Collaboration and coherence of climate action projects across the learning ecosystem
- Knowledge creation and project-based learning approaches
- Logistical and operational aspects of the overall project
- Impact on local stakeholders
- Transferable learnings

The evaluation research in LEVERS is led by partner TCD and the findings, due to be published in 2026, will provide an insight into the distributed, learning ecosystem approach to education and lifelong learning for climate justice in nine European locations, and will support policy recommendations related to (science) education and climate action.

The foundational units (Chapters 2-5) and applied unit (Chapter 6) of this document will be adapted into webinars and online trainings for educators, due to be launched in 2025.

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