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Greening curriculum guidance

Teaching and learning for climate action



Greening Education Partnership

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Getting every learner climate-ready

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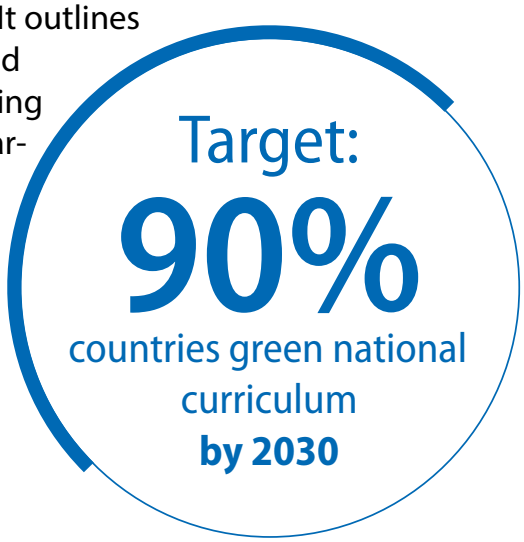
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S H O R T S U M M A R Y

Greening curriculum to get all learners climate-ready

Education is a powerful tool to transform the world and drive long-long-term climate change action.

This Guidance responds to the calls from young people for a holistic approach to climate change and sustainability in the curriculum. It outlines a common language on how quality climate change and sustainability can be reflected in the curriculum by setting expected learning outcomes per age group (from 5-year-olds and up to 18+ age group, including a lifelong learning approach).



This is crucial for accelerating country-level action and ensuring joint monitoring of progress. The objective is to have 90 per cent of all countries include climate change in their curricula by 2030, as established by the Greening Education Partnership.

This Guidance aims to support countries, schools or individual practitioners in reassessing their ongoing practices to adopt a more action-oriented, holistic, scientifically accurate, justice-driven and lifelong learning approach to climate change.

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"Since wars begin in the minds of men and women it is in the minds of men and women that the defences of peace must be constructed"

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Greening curriculum guidance

Teaching and learning for climate action

Foreword

The world faces interconnected challenges, with the climate crisis looming as an existential threat. Addressing these challenges requires an education system that not only acknowledges these realities but actively prepares individuals to navigate them and innovate for a more sustainable future.

The UN Transforming Education Summit in 2022 underscored the imperative for a fundamental transformation across all educational levels to equip learners with the knowledge, skills, and behaviour needed to confront the climate crisis. The Youth Declaration emanating from the Summit articulated the urgent need to prioritize education for sustainable development, particularly climate education, to build resilience, mitigate impacts, and ensure climate justice. Young people overwhelmingly expressed a desire for education that not only imparts knowledge, but which empowers them to take meaningful action on climate change.

Despite this growing awareness, national education systems often fall short of equipping learners to effectively address the climate crisis. One contributing factor is the lack of clear benchmarks for developing curricula that empower individuals as agents of change. We need to define what quality education for climate action truly means.

Recognizing this gap, UNESCO is pleased to have led the development of this greening curriculum guidance, as its contribution to the Greening Education Partnership, and young people from around the world. The publication is part of our efforts to make education the long-term solution to the climate crisis and is complemented by the release of another publication proposing a green school quality standard.

Drawing from the Education for Sustainable Development (ESD) for 2030 framework, this guidance will support countries to integrate climate change as a key curriculum component by 2030. The goal is to embed quality climate change education consistently across all subjects.

This publication offers a flexible framework to support curriculum revision, allowing for context-specific tailoring while achieving educational goals. It is designed to be complemented by other resources that translates the learning outcomes of this guidance for textbook development, transformative pedagogy, and assessment techniques.

Through our global commitment to transforming education, we can ensure that all learning institutions effectively prepare learners to tackle the climate crisis and create solutions needed to build a sustainable future.

Let's work together to green curriculum to make all learners climate-ready!



Stefania Giannini
Assistant Director-General for Education

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List of abbreviations

CCE	Climate Change Education
COP	Conference of the Parties
EE	Environmental Education
ESD	Education for Sustainable Development
GEP	Greening Education Partnership
GCE or GCED	Global Citizenship Education
IDP	Internally Displaced People
ILO	International Labour Organization
IPBES	The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC	International Panel on Climate Change
IUCN	International Union for Conservation of Nature
LDCs	Least Developed Countries
MoE	Ministry of Education
MoNE	Ministry of National Education
NDCs	Nationally Determined Contributions
CSOs	Civil Society Organizations
OECD	Organization for Economic Cooperation and Development
PISA	Programme for International Student Assessment
SDGs	Sustainable Development Goals
SIDS	Small Island Developing States
STEM	Science Technology Engineering and Math
TVET	Technical and Vocational Education and Training
UN	United Nations
UNCED	United Nations Conference on Environment and Development
UNDESA	United Nations Department of Economic and Social Affairs
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization

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Glossary of terms

Adverse effects of climate change: Changes in the physical environment or biota resulting from climate change which have significant deleterious effects on the composition, resilience or productivity of natural and managed ecosystems or on the operation of socio-economic systems or on human health and welfare.

Biodiversity: The variability among living organisms from all sources including terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are a part. This includes variation in genetic, phenotypic, phylogenetic and functional attributes, as well as changes in abundance and distribution over time and space within and among species, biological communities and ecosystems.

Carbon cycle: The carbon cycle is the process that moves carbon between plants, animals, and microbes; minerals in the Earth; and the atmosphere.

Carbon pricing: The cost of the climate and environmental impact of carbon emissions become visible in economic activities by assigning a monetary value/price to carbon emissions.

Circular economy: Circular economy is defined as a current sustainable economic model, in which products and materials are designed in such a way that they can be reused, remanufactured, recycled or recovered (4-R) and thus maintained in the economy for as long as possible, along with the resources of which they are made, and the generation of waste, especially hazardous, is avoided or minimized, and greenhouse gas emissions are prevented or reduced.

Climate change: Climate change means a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods.

Climate mitigation: A human intervention to reduce emissions or enhance the sinks of greenhouse gases.

Climate adaptation: In human systems, the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities. In natural systems, the process of adjustment to actual climate and its effects; human intervention may facilitate adjustment to expected climate and its effects.

Climate resilience: The capacity of social, economic and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure while also maintaining the capacity for adaptation, learning and transformation.

Climate risk: The potential for adverse consequences where something of value is at stake and where the occurrence and degree of an outcome is uncertain. In the context of the assessment of climate impacts, the term risk is often used to refer to the potential for adverse consequences of a climate-related hazard, or of adaptation or mitigation responses to such a hazard, on lives, livelihoods, health and well-being, ecosystems and species, economic, social and cultural assets, services (including ecosystem services) and infrastructure. Risk results from the interaction of vulnerability (of the affected system), its exposure over time (to the hazard), as well as the (climate-related) hazard and the likelihood of its occurrence.

Climate justice: Justice that links development and human rights to achieve a human-centred approach to addressing climate change, safeguarding the rights of the most vulnerable people and sharing the burdens and benefits of climate change and its impacts equitably and fairly.

Climate system: 'Climate system' means the totality of the atmosphere, hydrosphere, biosphere and geosphere and their interactions.

Common but differentiated responsibility: A key principle in the United Nations Framework Convention on Climate Change (UNFCCC) that recognizes the different capabilities and differing responsibilities of individual countries in tackling climate change.

Eco-friendly: Designed to have little or no damaging effect on the environment.

Ecosystem: A dynamic complex of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit.

Education for Sustainable Development (ESD): Education that empowers learners with knowledge, skills, values and attitudes to take informed decisions and take responsible action for environmental integrity, economic viability and a just society empowering people of all genders, for present and future generations, while respecting cultural diversity.

Emissions: 'Emissions' means the release of greenhouse gases and/or their precursors into the atmosphere over a specified area and period of time.

Green economy: Green economy 'is one that results in improved human well-being and social equity, while significantly reducing environmental risk and ecological scarcities'. Green economy is invariably driven by green technology, for which the main objective is to improve the quality of life in a sustainable way for the present and future generation.

Green finance: Green finance focuses on investments that have a positive impact on climate change and the environment, while conventional finance focuses on the traditional investment goal, return maximization, without paying attention to the impact of investments on climate change and the environment.

Greenhouse effect: The greenhouse effect is the process through which heat is trapped near Earth's surface by substances known as greenhouse gases (GHGs).

Greenhouse gases: GHGs are those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and re-emit infrared radiation.

Greening education: Rooted in the long-standing efforts on ESD, a communication term to describe a holistic approach to education's response to the climate crisis in response to young people demands for education that empowers them with knowledge, skills and attitudes needed to engage in transformative action on mitigation, adaptation and resilience to climate change, aimed at shaping green, low emission climate-resilient societies.

Greening TVET: Greening TVET refers to the process of incorporating sustainable practices and knowledge into Technical and Vocational Education and Training (TVET) programmes. The concept of greening TVET recognizes the importance of integrating environmental sustainability principles and practices into TVET curricula, teaching methods and training programmes. It aims to prepare individuals for green jobs by incorporating green skills and knowledge to contribute to the transition to a greener economy and promote sustainable development. This includes preparing

individuals for careers in renewable energy, hospitality and tourism, fashion and beauty, green enterprises, waste management, green construction, sustainable agriculture, and other sectors that prioritize environmental responsibility.

Green jobs: Green jobs are jobs that contribute to preserve or restore the environment, be they in traditional sectors, such as manufacturing and construction, or in new, emerging green sectors, such as renewable energy and energy efficiency. Green jobs can be found in sectors like agriculture, education, health, hospitality and tourism if they centre, nurture, and develop our individual and collective capacity to care for others and the environment and to educate ourselves and others about the unsustainability of the status quo.

Green skills: The knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society. The breadth of green skills includes occupational and technical skills used more intensively in green operations, and transferable skills such as decision-making and teamwork. The skills for green transformation needed to drive the systems change demanded by the 1.5-degree target include disruptive thinking, political agency and coalition-building.

Indigenous knowledge: Indigenous knowledge refers to the philosophies (including understandings, values, skills and competences) developed and experienced by societies with long histories of interaction with their natural surroundings.

Just transition: According to the International Labour Organization (ILO), a just transition means greening the economy in a way that is as fair and inclusive as possible to everyone concerned, creating decent work opportunities and leaving no one behind. A Just Transition involves maximizing the social and economic opportunities of climate action, while minimizing and carefully managing any challenges – including through effective social dialogue among all groups impacted, and respect for fundamental labour principles and rights. Ensuring a just transition is important for all countries at all levels of development. It is also important for all economic sectors – by no means limited to energy supply – and in urban and rural areas alike.'

Loss and damage: Harm from (observed) impacts and (projected) risks; often used in the context of political debate under the UNFCCC following the establishment of the Warsaw Mechanism on Loss and Damage in 2013, which is to 'address loss and damage associated with impacts of climate change, including extreme events and slow onset events, in developing countries that are particularly vulnerable to the adverse effects of climate change.'

Nature-based solutions: Nature-based solutions are actions to protect, sustainably manage or restore natural ecosystems, that address societal challenges such as climate change, human health, food and water security and disaster risk reduction.

Pollution: Pollution is the indirect or direct alteration of the biological, thermal, physical, or radioactive properties of any medium in such a way as to create a hazard or potential hazard to human health or to the health, safety or welfare of any living species.

Renewable energy: Renewable energy is energy deriving from sources that do not rely on fuels of which there are only finite stocks. Derived from natural sources that could be replenished at a higher rate than they are consumed, renewable energy does not put the source in danger of getting depleted or vanished.

Reservoir: Reservoir means a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored.

Sink: Sink means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere.

Source: Source means any process or activity which releases a greenhouse gas, an aerosol or a precursor of a greenhouse gas into the atmosphere.

Spiral Curriculum: Spiral Curriculum is a curriculum design in which key concepts are presented repeatedly throughout the curriculum, but with deepening layers of complexity and through enriched applications as the level of age or grade increases.

Sustainable Development: Development that meets the needs of the present development without compromising the ability of future generations to meet their own needs.

Technical and Vocational Education and Training: Technical and vocational education and training (TVET) refers to educational processes that in addition to general education, involve the study of technologies and related sciences, and the acquisition of practical skills, attitudes, knowledge and understanding related to occupations in the various sectors of economic and social life.

Upcycling: Upcycling is a process through which old (discarded) objects or materials are modified to get a second life as they are turned into a new product of higher quality, creativity and value than the original.

Waste: Waste is any substance that is left to be thrown away after primary use and is thought to be worthless, defective and of no use even though it has some environmental, economic, or artistic value.

Water cycle: The hydrological or water cycle consists of precipitation, vapour transport, evaporation, evapotranspiration, infiltration, groundwater flow and runoff.

Section 1

Introduction

This section introduces the context and rationale of this Guidance publication. It highlights the critical role of education in the climate crisis and the need for a holistic approach to address this challenge. It also explains the methodology used, the structure of the Guidance, the intended audiences, and how the Guidance is to be used. Lastly, it discusses the key principles underpinning the design and delivery of greening education in formal, non-formal and informal settings. These key principles form the ideals of a green curriculum, which are based on the whole-institution approach to climate change.

1.1. Context, objective and rationale

Climate change poses an unprecedented challenge to the global community. Its repercussions affect all aspects of sustainable development, including human health and well-being, food security, economic growth, natural resources, and biodiversity. It affects the very survival of human beings and terrestrial and aquatic species. Facing this challenge will require behavioural changes to adapt and respond to immediate crises while also learning to adopt more sustainable practices to reduce greenhouse gas emissions in the longer term. It is a condition that requires urgent international cooperation and coordinated solutions at all levels, including in schooling. There is a growing call for all forms of education and learning to fully enable individuals, as agents of change, to acquire the knowledge, skills, values and attitudes needed to contribute effectively to the green transition of our societies, including career pathways.

The imperative for greening education is conveyed not only by this global crisis but the general failure so far of national education systems to integrate this approach. An analysis of 100 national curriculum frameworks reveals that nearly half (47%) do not mention climate change (UNESCO, 2021, p. 1). Unsurprisingly, only one third of teachers felt able to effectively explain the effects of climate change in their regions (UNESCO, 2021, p. 6) and 70% of the youth surveyed in 2021 could not describe the broad principles of climate change due to a lack of quality in the current way it is taught (UNESCO, 2022, p. 3). Yet, most teachers and students believe that climate change is occurring and view education as necessary in addressing it (Battacharya et al, 2020, p. 7). Clearly, there is an urgent need for greening education.

From the education sector, ESD has been promoted for decades and is enshrined in the Sustainable Development Goal (SDG) 4 on quality education Target 4.7 to ensure all learners acquire the knowledge and skills needed to promote sustainable development. From the environment sector, the United Nations Framework Convention on Climate Change (UNFCCC)[1] (1992), Article 12 of the Paris Agreement (2015), SDG 13 on climate action and its Target 13.3 on improving education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning, and more recently, the COP28 Declaration for the Common Agenda for Education and Climate Change, recognized the essential role of education in addressing climate change.

ESD, CCE and greening education are interrelated and distinct. ESD is an integral element of SDG Target 4.7, through the Education 2030 Framework for Action. It empowers learners of all ages with the knowledge, skills, values and agency to make informed decisions and make responsible actions for environmental integrity, economic viability and a just society (revised 1974 recommendation, Preamble, Definitions). Climate change has long been one of the thematic areas of ESD, and the term CCE has often been associated with understanding of climate change and its implications in the context of subjects such as natural sciences or geography. However, given the growing recognition of the complexity of the climate crisis and its impact across all aspects of our societies, young people are calling for a more holistic approach to education related to climate change; one that helps 'people understand and address the impacts of the climate crisis, empowering them with the knowledge, skills, values and attitudes needed to act as agents of change.' To address this youth demand, and consistent with young people's right to know about and be prepared for climate change, the term 'greening education' has been introduced as a communication term to describe this revised approach to education's response to the climate crisis.

Children and youth activism is not only an impetus to extend long-standing treatment of ESD to highlight the climate crisis, it is also an end goal: more youth need to be activated to address sustainability in their own lives, to educate others, and to influence public sector decision makers and private sector actors with authority

1 See Article 6 of the UNFCCC for details on the role of education, training and awareness-building for addressing climate change: conveng.pdf (unfccc.int)

to address climate change. The 'Youth demands for quality climate change education' (UNESCO, 2022) report calls for increased investment in education to tackle the climate crisis, interdisciplinary approaches, and the empowering of young people to become agents of change. The Youth Statement on Quality Climate Education (Mock COP, 2023) highlights the need to teach young people to recognize the greater historic responsibility for the climate crisis of governments and corporations in the Global North, and the unequal burden of the climate crisis on already marginalized communities. Other declarations call for inclusive processes, involving those most negatively affected by climate change. The Youth Manifesto for Action on Climate Change (Youth4Climate, 2021) highlights the need for a multi-stakeholder approach involving not only youth but ethnic minorities and indigenous groups. The Manifesto also calls for cross-linkages across sectors, and education that truly empowers learners. The Youth Declaration on Transforming Education (United Nations, 2022) emphasizes inclusive education that engages indigenous people and promotes intergenerational, intercultural and interreligious dialogue. The Global Youth Statement (COY17, 2022), released during COP27, emphasizes the imperative for sustainability practices that foster harmony between nature and humanity, safeguard and replenish biodiversity and ecosystems, coordinate actions across all stakeholders, and promote sustainable economic development. Additionally, there is a growing demand among young people for climate policies that secure their constitutional right to information and preparedness regarding climate change, as evidenced by the UN Committee on the Rights of the Child's General Comment (2023) for the implementation of the UN Convention on the Rights of the Child. This comment urges governments to take decisive action to safeguard the welfare of children amidst the escalating climate crisis.

Four key approaches collectively emerge from these declarations:

- The recognition of the interconnectedness of climate change and the need for a systems-thinking approach to address it.
- The importance of adopting a holistic perspective that recognizes the oneness of all things, rather than a dualistic worldview that sees the world in terms of binary opposition between human beings and nature.
- The recognition of the power of diversity in nature, culture, and knowledge, including recognizing the value of traditional and indigenous knowledge systems.
- The need for a radical rethinking of our economic system, including a rejection of the unlimited growth-centric model and a shift towards a post-growth post-carbon economic system that prioritizes sustainability, equity, and well-being for all.

The task of defining this latest educational approach to climate change with clear learning outcomes is the focus of this Guidance. Greening education aims to highlight the interconnections of the climate crisis to social, economic, and environmental pillars of sustainable development. While climate change is the thematic entry point of greening education, the holistic approach of ESD is the basis for improving the quality and delivery of education responses to the climate crisis and moving learning beyond conventional subject areas and traditional content. Greening education is consistent with, and supports, other transformative education goals, such as twenty-first-century skills, the entire 2030 Agenda and the long-term vision of the UNESCO 'Reimagining Our Futures Together: a new social contract for education' report.

Education systems are particularly well-positioned to equip learners with a foundation of scientific understanding and social and emotional learning related to climate change. This foundation should also include an understanding of how society can respond to climate challenges, integrating a justice-focused approach, fostering constructive coping strategies, and building leadership skills for transformed futures. Education activities taking place in TVET, non-formal education spaces and through lifelong learning, are all ways to link learning with greening societies. In a world where 250 million children and young people between the ages of 6 and 17 are not attending school or have dropped out, non-formal settings, such as community centres, clubs, faith-based organizations, vocational facilities, health institutions and online platforms, among others, also

play an essential role in ESD (UNESCO, 2022). Greening education programmes in non-formal and community-based settings have the potential to reach out-of-school youth and the most vulnerable and marginalized youth populations, especially in countries where school attendance is low.

The Greening Education Partnership was launched at the 2022 UN Transforming Education Summit. The Partnership is a global initiative to support countries in accelerating the implementation of greening education. Key stakeholders, including Member States, UN partners, and civil society organizations (CSOs), collectively committed to engaging in the Partnership and discussed how to create further synergies and impact. The Partnership aims to deliver strong, coordinated, and comprehensive action that supports countries to prepare every learner to tackle climate change and promote sustainable development. Taking a lifelong learning approach from early childhood to adult education, the Partnership encourages countries and key stakeholders to focus on four action areas: Greening Schools, Greening Curriculum, Greening Teacher Training and Education Systems' Capacities, and Greening Communities.

This Greening Curriculum Guidance has been developed under the Greening Curriculum pillar to support its goal – that of doubling the number of Member States that have climate change as a core curriculum component to 90% by 2030.

1.2. How to use the Guidance, structure and intended audiences

The Guidance aims to be a foundational tool for greening education. It is not a curriculum in itself but is aimed at serving as the basis for a review of existing curricula and the integration of climate change across all subjects including the social sciences, natural sciences, humanities and technical education. It is international in that it addresses the global challenge of climate change and needs to be adapted by the reader to regional, national and community contexts, cultures and needs. For example, each locality will have specific climate challenges, ecosystems, energy sources and potential alternatives, and opportunities for community action. The Guidance is complemented by other available resources that go into greater depth on curriculum development processes, transformative pedagogy, assessment techniques, and so on.

This publication offers core topics and learning outcomes for greening education with the main content structured around three key sections:

- General strategies for greening education (Section 2)
- Key concepts, topics, and learning outcomes (Section 3)
- Implementation of the Greening Curriculum Guidance (Section 4).

General strategies for greening education: This section provides a conceptual background for designing greening education strategies, such as transdisciplinary and whole school approaches. This section draws in part on earlier research on ESD and other transformative learning approaches.[2]

Key concepts, topics, and learning outcomes: This section forms the main part of the Guidance and includes key concepts associated with greening education and associated topics. Key ideas and learning outcomes for each topic are presented according to age group (i.e. ages 5-8, 9-12, 13-15, 16-18, 18+). It is intended for all

2 The Greening Education Partnership is developing separate guidance material for whole-institution approach to greening education called 'Green School Quality Standard'.

levels of education, both formal and non-formal, and includes lifelong learning. The Guidance follows a holistic approach with climate change as the entry point to addressing environmental, social and economic aspects of sustainable development.

Implementation of the Guidance: This section recommends how to design and implement a greening curriculum relevant for local contexts based on this Guidance. Topics addressed include education sector planning, curriculum design and designing institution-wide approaches. This section also explores how international synergies can be leveraged and highlights the important roles of youth, policy-makers, communities, and other stakeholders.

The Guidance is intended to:

- Provide a clear understanding of greening education and clarify the desired positive outcomes;
- Promote an understanding of the need for greening education programmes by raising awareness of relevant climate change and sustainable development issues and concerns that impact humans and the living world;
- Provide guidance on how to develop evidence-informed, age- and developmentally-appropriate curricula, teaching and learning materials and programmes that are culturally relevant and locally acceptable to assist policy-makers, educators, and curriculum developers;
- Ultimately, increase educators' preparation and enhance institutional capacity to provide high-quality greening education.

Rather than prescribing detailed recommendations for operationalizing greening education at the country or sub-national levels, the Guidance serves as a framework built upon promising practices and widespread consultations. Its purpose is to aid curriculum developers in crafting and adapting curricula suitable for their specific contexts, as well as to assist programme developers in designing, implementing, and monitoring high-quality greening education initiatives.

1.3. Key principles of greening education

The following principles undergird the design and delivery of greening education in formal, non-formal and informal settings.

Action-oriented

- **Empowering:** It supports learners' empowerment, self-efficacy and agency by improving their analytical, communication, and other skills, and by supporting the acquisition of relevant knowledge and values for sustainable development and addressing climate change.
- **Learner-centred:** The pedagogy (e.g. critical, participatory, problem-oriented, learner-centred and experiential approaches) allows students to actively participate in learning processes, critically engage with personal experiences and their natural environment, and construct their own understanding.
- **Career-related:** It incorporates practices or ideas that can be applied to career choices and workplace practices.
- **Transformative:** It contributes to collective society-wide, local and global efforts to change human behaviour, systems and underlying causes and root drivers of climate change.

Justice-promoting

- **Based on a human rights approach:** It builds on and promotes an understanding of universal human rights – including the rights of children and young people – and the rights of all persons to health, education, information equality and non-discrimination. Using a human rights-based approach, within education addressing climate change, also involves raising awareness among young people, encouraging them to recognize their own rights, acknowledge and respect the rights of others, and advocate for those whose rights are violated.
- **Based on gender equality:** It addresses the different ways that gender norms can influence inequality, and how these inequalities can affect vulnerabilities to climate change.
- **Based on inter-generational equity:** It develops a notion that ensures the rights and obligations of future generations while maintaining those of the present generation.
- **Based on intra-cultural equity:** It develops a vision of environmental, economic, and social justice and fairness across communities and cultures within the current generation.

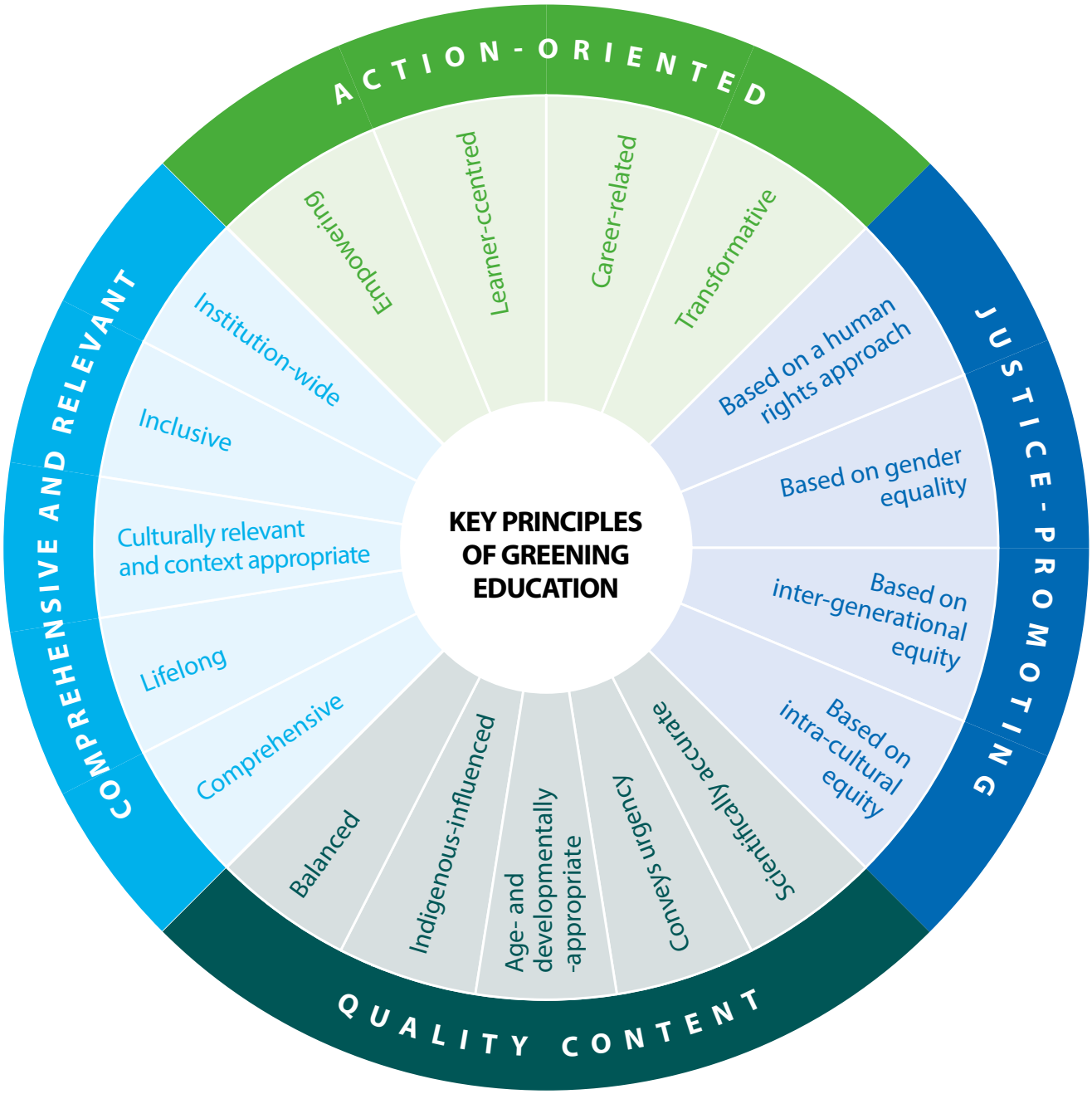
Quality content

- **Scientifically accurate:** The content is based on evidence related to climate change and sustainable development.
- **Conveys urgency:** Greening education stresses the urgency of adequately addressing the growing climate emergency.
- **Age- and developmentally-appropriate:** The content is responsive to the evolving capabilities of the child and young person as they grow.
- **Indigenous-influenced:** Indigenous knowledge and perspectives are incorporated within education, especially from indigenous groups who are locally based.
- **Balanced:** Cognitive, social and emotional, and behavioural learning dimensions are addressed in a balanced manner to ensure a holistic approach to greening education.

Comprehensive and relevant

- **Comprehensive:** It provides opportunities to acquire comprehensive, accurate, evidence-informed and age-appropriate information on sustainable development and climate change over time and throughout a learner's formal, non-formal and informal (e.g. museums and libraries) education, and including TVET.
- **Lifelong:** This is a continuing educational process that starts at an early age, and where new information builds upon previous learning, using a spiral-curriculum approach.
- **Culturally relevant and context appropriate:** It fosters learning outcomes that are relevant to local climate change challenges and solutions, and cultural structures and norms that affect people's choices in addressing sustainable development and climate change.
- **Inclusive:** Greening education involves a range of actors from inside and outside education, including experts, parents, community members and local leaders who bring alternative perspectives, new skills, intergenerational and indigenous knowledge to understand climate challenges and solutions.
- **Institution-wide:** Greening education principles are integrated throughout the learning environment, affecting the organization-wide culture and practices.

Figure 1: Key principles of greening education



1.4. Methodology

The Guidance was developed on the basis of young people's demands, through a process designed to ensure quality, acceptability and ownership at the international level, and with input from experts and practitioners from different regions around the world. At the same time, it should be noted that the Guidance recognizes the diversity of different national and local contexts in which learning takes place, and the authority of governments to determine the content of educational curricula in their country.

This publication is based on a review of evidence and current practices. The authors comprised experts from across the globe, working in the fields of education, climate change, sustainable development, human rights, and gender equality. UNESCO and the Working Group 2 of the Greening Education Partnership also worked with numerous organizations, networks and specialists in reviewing and piloting earlier drafts of the Guidance. These networks included researchers, ministry of education officials, young people, NGO programme implementers and other partners.

In order to gather input from multiple stakeholders, and to assess the use and usefulness of the Guidance among its intended audience, the development process involved text-based reviews and feedback from various curriculum development specialists, three rounds of consultations, including at COP28, with members of the Greening Education Partnership as well as a broader global stakeholder audience. Pilot consultations were conducted also at country or regional level to test the relevance of the draft, engaging stakeholders such as curriculum experts, policy-makers, academia, CSOs, etc. in Algeria, Bahrain, Egypt, El Salvador, Eswatini, Honduras, India, Iraq, Jordan, Lebanon, Lesotho, Libya, Oman, Qatar, Syrian Arab Republic, the State of Palestine, United Arab Emirates and Zimbabwe.

Section 2

General strategies for greening education

This section offers insights into effective approaches for structuring education systems to empower learners in addressing the climate crisis. It discusses conceptual, pedagogical and curricular strategies for greening education, leveraging past experiences in ESD and how climate change is reflected in education curricula, as well as relevant research findings. These insights underpin the development of fundamental concepts, topics, and learning objectives outlined in Section 4. Furthermore, they can inform broader considerations in curriculum design across formal and non-formal education settings, including TVET.

The Guidance is a direct response to youth demands, especially those discussed in "Youth demands for quality climate change education" (UNESCO, 2022), and associated experiences and evidence for designing quality education systems to tackle the climate crisis, with a focus on action The connection points between youth and greening education are multiple. The phenomenon of the youth climate justice movement has resulted in numerous documents calling for broader action to address climate change and climate justice, as noted in the Introduction. Given the transformative agenda of greening education, the fostering of youth leadership and action is a required part of the curriculum. The centrality of youth and other key stakeholders in influencing the design and implementation of greening education is also taken up in Section 4 of the Guidance.

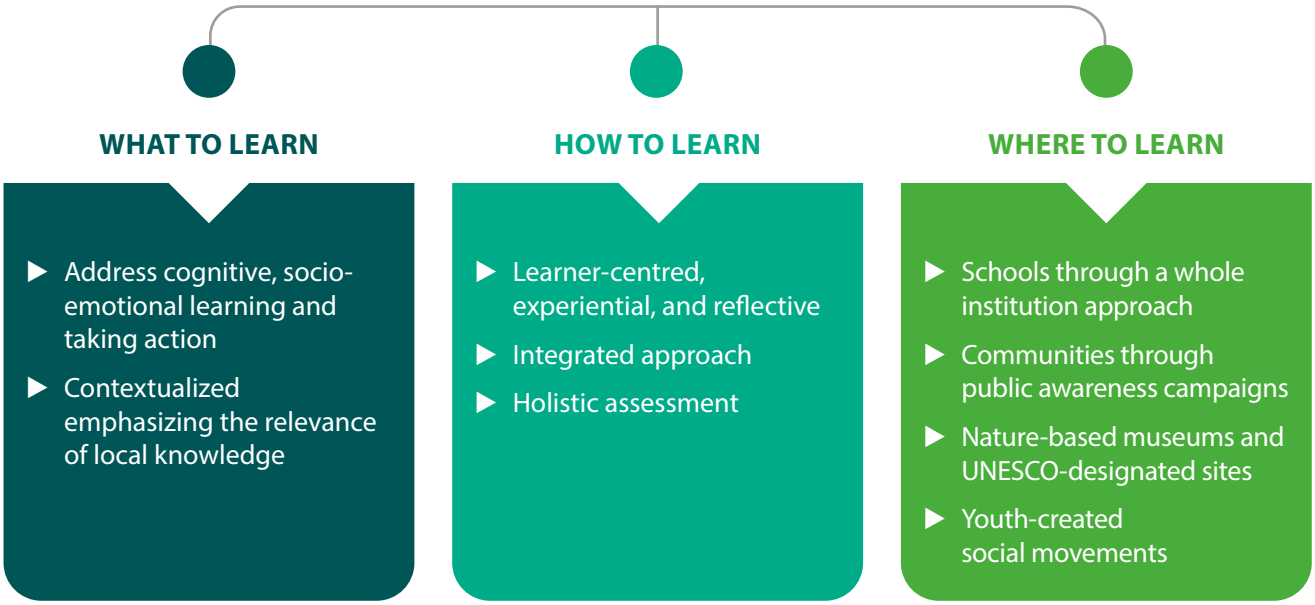
Youth demands can be summarized through answers to three critical questions:

a) What should we learn to get climate-ready?

b) How should we learn to get climate-ready?

c) Where should we learn to get climate-ready?

Figure 2: Strategies for getting every learner climate ready



What should we learn to get climate-ready?

This question refers to the content of the curriculum and concerns the essential knowledge, skills, values and attitudes necessary for individuals to take action.

2.1. Greening education should address cognitive, social and emotional learning and taking action.

While knowledge about climate change, mitigation and adaptations is crucial for understanding the current situation and its implications, it alone is insufficient to drive sustainable behaviours. Youth agency, for instance, is not only tied to knowledge but also to values and commitment to addressing climate change.

A comprehensive review of countries' focuses on CCE through analysing their Nationally Determined Contributions (NDCs) to the UNFCCC Secretariat showed that the focus is primarily on content knowledge and with a scientific focus (McKenzie, 2021, UNESCO, 2019). Similarly, a meta-review of 40 of the 49 articles by Monroe et al (2019), found that programmes described were designed to improve only knowledge about climate change. Despite possessing scientific knowledge about climate change and its consequences, findings from the OECD's PISA for Science and 2018 survey indicate that 15-year-olds are not automatically inclined to take action. Additionally, analysis of OECD data indicates that while students with an environmental sense of purpose are more likely to engage in environmental actions, a significant proportion of students do not actively participate in such activities (Borgonovi et al., 2022; Echazarra, 2018). Moreover, longitudinal studies suggest that over the course of a year-long climate change intervention, students' knowledge of sustainability may increase while their motivational beliefs and attitudes towards sustainability decline (Scharenberg et al., 2021). Further evidence from research highlights that a young person's sense of efficacy, and their engagement in social groups with norms supporting the acceptance of climate change, are strong predictors of pro-climate mitigation behaviours, while knowledge of climate change and certainty of climate science are identified as weak to moderate predictors of pro-climate mitigation behaviours (Busch et al., 2019).

Given these insights, prioritizing the development of learners' sense of efficacy towards climate action emerges as a pivotal educational objective. Research indicates that delving deeper into the sociopolitical and psychosocial dimensions of climate change is crucial for cultivating green life skills such as empathy, reasoning, evidence-based decision-making, and effective communication (Bouman et al., 2020; Karpudewan & Roth, 2018; Monroe et al., 2019). These skills are closely associated with a sense of personal responsibility and can effectively motivate pro-environmental behaviours. Moreover, it is essential to integrate the development of green life skills with a broader understanding of social and economic systems, thereby bridging these domains with the traditionally scientific focus of climate change. This integrated approach not only fosters a more holistic understanding of climate change but also paves the way for more critical approaches to green life skills development (Kwauk & Casey, 2022, p. 9).

Table 1 illustrates ways in which ESD learning objectives can promote critical reflection, analysis and problem-solving to address structural change.

Table 1: Traditional teaching versus transformational ESD learning

Traditional ESD teaching		Transformational ESD learning
Passing on content knowledge	▶	Fostering understanding and analysis of the roots of the climate crisis
Teaching attitudes and values	▶	Encouraging values clarification and critical reflection based on lived experience
Seeing people only as the source of the climate change problem	▶	Seeing people as facilitators of change
One-way transmission of information	▶	Dialogue and negotiation on the implications of the information for action
Behaving as an expert – formal & authoritarian	▶	Acting as a partner – informal & egalitarian
Changing personal behaviour	▶	More focus on structural and institutional changes

Source: Adapted from Tilbury, 2011, p.25

Semenza et al. (2008) developed stages of learner development, both cognitive and behavioural, in relation to climate change. See Table 2 below.

Table 2: Stages of learner development in relation to climate change

Stages	Examples
Pre-contemplation	Does not believe in climate change or the usefulness of behaviour change
Contemplation	Believes in climate change but no action considered
Preparation	Steps considered but no behaviour change yet
Action	Minimal individual attempts but sees limitations and difficulties
Maintenance	Maintains several actions
Termination	Maintains the low-carbon lifestyle and identifies with ideology

Source: Adapted from Semenza et al 2008. Public perception of climate change: voluntary mitigation and barriers to behavior change. American journal of preventive medicine, Vol. 35, No. 5, p.479-487.

Indeed, education must address the complex emotions that young people experience regarding climate change. Some educational approaches have inadvertently led to negative effects on students' attitudes towards pro-sustainability actions, resulting in feelings of eco-anxiety and hopelessness (Leger-Goodes et al., 2022; Ojala & Lakew, 2017). This highlights the importance of a balanced approach. While it's crucial for learners to

comprehend climate-related changes, this knowledge should serve as a catalyst for positive attitudinal and behavioural shifts. Learning environments should not instil a sense of powerlessness and impending doom in students. Instead, education should foster both concern and hope (Stevenson & Peterson, 2016). Pessimism undermines efforts to mitigate climate change. The next section on pedagogy will delve into strategies for effectively addressing these emotional aspects within educational contexts.

2.2. Greening education should be contextualized.

A key point coming from the literature is that the climate change learning content needs to be relevant and contextualized for students through the exploration of local issues. Hence, while topics and concepts may be broad and global in achieving students' understanding of the extent of climate change impacts, engagement of young people is seen as best achieved through the effects of climate change they see around them either directly or indirectly. Mafongoya & Ajayi (2017) contend that knowledge of local land and people is increasingly important for climate adaptation strategies. Dietz et al. (2020) argue that climate resilience-building needs an understanding of social structure, personality, culture as well as micro-level individual decision-making. For this reason, whenever possible, learning outcomes proposed should be applied and grounded in the local economic, social, and ecological context so that it can be implemented in relation to actual conditions and existing values. Such local examples can be followed by regional, national, international, and global cases.

There is growing literature showing indigenous knowledge as being particularly valuable in this regard (UNESCO & MECCE, 2022; UNESCO, 2023 a, p. 23). Indigenous ways of knowing have also offered an avenue for addressing decoloniality. Gwekwerewe and Shumba (2021) propose an approach in the context of tackling the colonial elements of the curriculum in Zambia and Zimbabwe. They use the Afrocentric Ubuntu philosophy as a basis and lens through which to transform learning in the direction of thinking sustainably and taking action for climate change. Singh proposes three transdisciplinary 'metaconcepts' (balance/imbalance; planetary boundaries/limits; complexity) as starting points from which to uncover and reveal processes, relationships, and outcomes in our socio-ecological systems that typically remain out of sight and out of mind (Iyengar & Kwauk, 2021, p. 326).

How should we learn to get climate-ready?

This question addresses the process of learning and how to structure learning experiences that effectively enable learners to take action. There are specific methodologies and pedagogical approaches that are most suitable for imparting knowledge on climate change and effective approaches to integrating greening education into the curricula to provide a holistic understanding of the climate crisis.

2.3. Learner-centred, experiential, and reflective ways of learning are critical.

Existing literature on ESD and climate change includes theoretical and empirical treatment of pedagogy. Approaches include learner-centred, active, critical, reflective, and collaborative practices. These approaches draw upon years of research on learner-centred and transformative approaches in other fields, now applied to ESD. They have been further developed in the multidisciplinary curriculum approach that is required for ensuring that education effectively enables learners to acquire knowledge, skills and attitudes necessary for tackling the climate crisis. A study across 18 countries on the learning impacts of ESD revealed that pedagogies have had as much of a transformative impact on primary and secondary education as the sustainability content (Laurie et al., 2016). Learning outcomes that encompass all three domains of learning (cognitive, socio-emotional, and behavioural) will require the use of pedagogies that aim to ensure that learners take action to address climate change. Taking action is not only essential for addressing the climate crisis but for protecting learners from feelings of helplessness.

A set of core pedagogical approaches that can be considered as 'good practices' are presented below.

Learner-centredness. This approach considers learners as autonomous and emphasizes their active construction of knowledge rather than being the recipients of a passive transfer of knowledge. Thus, students' prior knowledge and experiences are the starting points for the learning process, with educators facilitating such processes (UNESCO, 2018). Learner-centredness is valued by students themselves, who have been shown

in cross-national studies to want more responsibility in their learning, such as by suggesting topics and the focus of lessons (Tibbitts et al, 2023). Learner-centred approaches are linked with inquiry-based learning, which allows learners to develop their own knowledge and to generate conclusions based on this knowledge (Porter, Weaver, & Raptis, 2012).

Active/participatory/experiential learning. Hands-on experiences are necessary to bridge the gap between knowledge and action and fulfil the behavioural domain for ESD learning, which was shown to be under-represented in previous ESD research (UNESCO, 2019). Experiential learning encompasses the process of active engagement and discovery with reflection and mental engagement (Kolb 1984, as quoted in Tibbitts et al, 2023). Role-plays and simulations that mimic reality are often used in environmental education materials to involve students in understanding other perspectives, project what might happen in the future, and increase interest and enjoyment in learning. The use of the creative arts, storytelling and games can introduce an expressive dimension to learning. The interventions described in many articles include teaching methods such as debates, small group work, case study analysis, hands-on labs and field trips.

This approach is linked with place-based and **project-based approaches**, which provide fertile ground for the development of pro-sustainability skills when students' involvement in planning and participation is not reduced to a minor component. Teachers use pedagogical methods to engage students in authentic problem-solutions-based contexts. There is convincing evidence suggesting that well-managed place-based approaches are transformative for students in terms of pro-sustainability learning outcomes (UNESCO, 2019).

Critical pedagogy is considered essential for the integration of sustainable development into education. This pedagogy encourages learners to critically assess current situations, clarify their own values to challenge prevailing norms and political decisions, question how society affects the process, and propose possible solutions. All variations of critical theories that occur have a common thread, which is to critique the current system and advocate change in the future to achieve social justice. *Transformative learning* is linked with critical pedagogy. Change is the goal of this type of education: not forced change, but natural changes in the student's own thoughts and actions. These modifications, in turn, generate changes in the learner's own lifestyle, in their school, and in their community, and can ultimately impact global change (Hofman, 2015). Transformative learning is well-aligned with principles of sustainability education given its potential to transform mindsets and behaviours towards sustainability. *Reflexive and critical thinking* are important aspects when considering education's role in climate change (Hofman, 2015). For reflection to occur, learners must be exposed to different perspectives (Chiba et al., 2021) and have the ability to arrive at different outcomes or solutions. Reflective thinking is a key element of pedagogies necessary for transformative education. It requires active, persistent, and careful consideration of beliefs and knowledge, assumptions, and subsequent conclusions. Such reflective thinking can lead to reflective action.

Problem-based learning. In this approach, learning is organized around problems. These serve as the basis for learning processes, and placing weight on the formulation of a question rather than an answer. The formulation of problems also allows the learning content to be related to the context and points to project-based work to address the identified problem (Tibbitts et al, 2023).

Collaborative learning. Collaborative learning goes beyond group work in a classroom. It requires participants to agree on the strategy they want to use to achieve a common goal. In co-engaged environments, learners and educators devise and address solutions together (UNESCO, 2018). The community, parents, or other educational stakeholders are also invited to participate and nurture learning environments. In that way, learners work together with other community members in the search for common solutions (Tibbitts et al, 2023).

Use of media and new technologies. Several interventions used some form of visual imagery to capture interest and reach their audiences. In Türkiye, pre-service teachers who watched a documentary (An Inconvenient Truth) as part of a unit on climate change demonstrated significant learning gains when compared

to a control group who did not watch the film (Mutlu & Tokcan 2013). Similarly, an animated educational video shown to 10- and 11-year-old students in India helped increase attention and responses to global warming content (Vethanayagam & Hemalatha 2010). In other cases, simple drawings or cartoons were used to convey information about global warming (Oluk & Özalp 2007; Reinfried, Aeschbacher, & Rottermann 2012). Extended reality, or XR technologies, which are immersive and interactive may provide new opportunities for learners to be educated about environmental issues. Visualizing can help people experience environmental problems and consider how to transform the way we use our land. Visual methods such as photovoice have not often been used as a way to communicate findings or promote community empowerment with regard to rapid environmental change (Vitous & Zarger, 2021). As artificial intelligence becomes further integrated into teaching and learning practices, there may be interesting applications to climate change education.

Social media haves a bearing on the information, beliefs and perspectives of young people. In relation to climate change, students by and large are exposed to its impacts through social media platforms, television, the internet, and film (Parry et al., 20221; Rousell & Cutter-McKenzie-Knowles, 2020). More than half of Gen Z (51%) and nearly half of Gen Alpha (44%) rely on social media platforms for their education on sustainability issues, surpassing the influence of traditional schooling. For many these constitute their only sources of information (Lambert, 2023, p. 31). Social media algorithms tend to prioritize content that elicits strong emotional reactions or aligns with users' existing beliefs, potentially creating echo chambers and reinforcing biases. Given the substantial influence of social media on young people's perceptions of climate change, there is a compelling argument for integrating a critical analysis of social media sources and their portrayal of climate change within the curriculum.

Diversity and intersectionality. There are at least two dimensions of diversity to consider when for developing an effective curriculum to that appreciates education's role to address the climate crisis. The first is the design of curriculum that can ensure the engagement and success of students with a range of diversities, including ability levels, language background, gender, race, class, etc. This is a necessity for all educational programming. Second, there may be other learner backgrounds to consider. For example, student cultures, identities, and individual experiences in relation to climate change may influence their interests and ability to engage (Battacharya et al, 2020, p. 11). Miller (2018) says that "there is still a large failure to uncover harmful discourses that exclude marginalized learners from equitable engagement in sustainability work" (as quoted in Grewal et al, 2022, p. 58). Special efforts should be made to support the well-being of students who may be experiencing climate change impacts disproportionately higher than others. This relates to the climate justice key concept in this Guidance, which sees the interconnectedness between inequality and the experience of climate change. There is a potential for transformative learning experience for the empowerment of those students who are members of Black, indigenous or other groups experiencing oppression or disadvantage (Grewal et al, 2022, p. 19). For example, Kwauk & Wyss (2022) developed a curricular framework that encompasses not only climate justice but also gender inequality, with a focus on personal and social transformation.

2.4. Diverse aspects of climate change should be taught across subjects.

Debates regarding which approach is most effective in developing students' climate literacy and action-oriented competences in a given context often center on whether a discipline-based approach or an integrated, or cross-disciplinary approach is most effective. Contemporary literature and the opinions expressed by young people tend to favor the latter, emphasizing the benefits of an integrated approach (Lambert, 2023; UNESCO, 2022). As addressed earlier in this Guidance, greening education requires integrative and interdisciplinary courses in

which subject-specific boundaries tend to disappear to show how complex problems are solved holistically in schools as they are in reality (Sterling & Huckle, 2014). Although this approach is aimed towards formal schooling, the principles are also relevant for nonformal education and TVET.

However, there exists a disparity between these aspirations and the current state of greening education in many school environments. While youth have been mobilizing, motivated by multiple injustices inherent in the causes and impacts of climate change, "education systems lag behind, preoccupied with the 'what' and 'how' of climate change, rather than engaging it as a social issue in which students themselves are implicated" (Karsgaard & Davidson, 2021, p. 1). If climate change is taught, it is most likely within science classrooms (earth science, environmental science or biology), at the secondary school level and rarely involves more than one week of instructional time each year (Battcharya et al, 2020; UNESCO & MECCE, 2022; UNESCO, 2024). Current climate-focused instruction primarily revolves around core disciplinary concepts, such as greenhouse effect, carbon cycle, and impacts of the global climate crisis on resource availability, biodiversity, weather patterns, and ocean. During their instruction, teachers generally de-emphasize the political aspects regarding the global climate crisis (Bhattacharya et al, 2020). Another way of understanding these results is that most of the existing curriculum is "'about'" rather than "'for'" sustainable development. Thus, there is a gap between the interdisciplinary approaches advocated for by UNESCO and other ESD advocates and what is actually taking place in formal education.

For education to be truly transformative in terms of the behaviour of individuals and impacts on society, it needs to be holistically treated, including both the social and natural science disciplines and, moreover, to be multidisciplinary, interdisciplinary, or transdisciplinary (Monroe et al, 2019). Education needs to encompass the ecological, social and economic dimensions, and enable a "diverse range of articulations" that allow for critical reflection and application in one's own environment. This is the perspective presented in Section 3 of the Guidance.

In addition to gaps in conceptual knowledge, teachers may have to deal with what might be conflicting ideas, beliefs and views that students encounter and are exposed to outside of schools, such as on social media. Climate change also challenges many people's worldview because any climate mitigation regime will have economic and political implications. For this reason, teachers may prefer to teach aspects of climate change with what is referred to as a 'balanced approach' where both sides of the debate around the causes of climate change are presented and students are left to make up their own minds. The concern with this approach is that it is not in line with the established scientific consensus (IPCC, 2022) and students may not have the critical thinking skills or critical digital media literacy skills to weigh misrepresentative climate data (Field et al., 2019). Educators will need to work with learners on communicating science-based approaches to climate change, but also sustainability actions related to efforts in the political and economic domains.

Dealing with misconceptions and misinformation. Concepts related to Earth's climate system and climate change are complex and present many challenges to both teachers and students. Studies show that certain alternative conceptions about climate change and the natural processes inherent to this phenomenon persist (Choi et al., 2010). For example, both students and teachers underestimate the impact of the Earth's changing climate and perceive uncertainty in climate data as a lack of information about it (Bhattacharya et al, 2020, p. 1). The existing literature on how to communicate climate change and dispel misinformation converges on several conclusions: First, *providing information* about climate change, in particular explanations of why it occurs, can enhance people's acceptance of science. Some of the successful ESD programmes tackled climate misconceptions by simplifying information, providing relevant examples, and using vivid illustrations (Monroe et al, 2019, pp. 14-15). Second, *highlighting the scientific consensus* can be an effective means to counter misinformation and raise public acceptance. Third, *culturally aligned messages and messengers, such as scientists,*

are more likely to be successful. Finally, climate misinformation is best defanged, *through a process known as inoculation, before it is encountered*, although debunking techniques can also be successful (Lewandowsky, 2021). Each of these strategies is enhanced through reflection and discussion in the learning environment.

2.5. Assessment of learners' progress should also be holistic.

In some traditional education contexts, learning about sustainability might be focused on the gaining of knowledge and related theories. However, expected learning outcomes should cover the cognitive, social and emotional, and behavioural learning domains, calling for a wider scope of assessment. Areas of learner development that might be assessed are:

- Understanding of content, remembering basic factual material
- Skills in asking critical questions, analysing problems, and designing new solutions to problems.
- Clarifying one's own values and understanding the perspectives or points of view of others.
- Motivation or interest to live sustainably and address climate change, both through individual behaviour and through collective action for system change
- Envisioning more positive and sustainable futures
- Application and action.

Learner assessment should therefore reflect the multifaceted goals intended for students and the diverse pedagogical methods used (individual work, small group work, project work, discussion, and so on). Given the broader goal of contributing to quality education, any assessment measures that are set up should ensure that it is being implemented equitably.

Classroom-based assessment. ESD encompasses not only knowledge and intellectual skills acquisition, but also socioemotional dispositions, such as a motivation to 'make a difference' and skills such as being aware of one's values, the capacity to express one's thoughts, and the ability to work as part of a team. Skills related to specific actions, such as expressing one's point of view using facts and working as part of a team, can be assessed through 'naturalistic' products, such as the written work of learners, plans of action and project-related work, as well as the observation of learner behaviours.

Techniques for assessing learning objectives are closely linked with the ways in which the teaching and learning processes themselves are organized. Whenever possible, the teacher should not simply give a mark, but include constructive comments that note the strengths of the students' work as well as areas for improvement. Box 1 presents some examples of learning activities that can be measured in relation to the development of ESD competences.

Box 1. Examples of learning activities for measuring ESD competencies

- essays and reports
- tests
- storytelling
- observations of student behaviour
- project-based work
- examples of student work, such as maps
- student journaling
- artistic forms of expression, including creative writing, visual arts
- participation in simulations and role plays
- participation in debates, moot/mock courts, governance bodies.

Large-scale assessment. Within the formal schooling sector, there may be national, subject-specific exams that might include content linked with climate change. Although these forms of assessment will not provide complex and holistic data on the implementation and results of the critical competencies for addressing the climate crisis, they can offer insight into how well students are learning the material. This data can also be disaggregated according to gender, ethnicity and/or location to better understand if successful engagement with these critical competencies is taking place across all learner groups.

Where should we learn to get climate-ready?

This is a question about how learning institutions and communities can be transformed to be effective learning environments on climate change.

2.6. Schools and learning institutions are important learning environments for climate change and young people should have more say in decision-making on climate actions.

Transforming education reality to achieve sustainable development requires more than isolated teaching and learning efforts, as important as these are. It needs the integration of greening education principles into all dimensions of a learning institution, such as curriculum, pedagogy, structures, organization, and ethics, which affect each other and must be viewed as a coherent whole (Sterling & Huckle, 2014; UNESCO, 2021). A holistic approach to the institution involves rethinking school governance, teaching content and methodology, campus and facilities management, as well as cooperation with partners and communities at large. The institution itself becomes and functions as a model for learners.

The Green School Quality Standard publication of the Greening Education Partnership (forthcoming, UNESCO) provides detailed recommendations for whole-institution approaches to implement this Guidance.

In essence, the success of any climate change effort in an institution will be the result of concerted efforts by multiple stakeholder groups. School or institutional management is expected to take the lead in motivating and supporting these efforts, as well as in creating the appropriate climate for its implementation. From a classroom perspective, instructional leadership calls on teachers to lead children and young people towards a better understanding of climate change through discovery, learning and growth. In an atmosphere of uncertainty, the leadership abilities among managers and teachers can make the difference between a successful programme

and a failed one. To implement the greening curriculum effectively, teachers must feel supported by a legal framework, the school management and local authorities, and have access to training and resources. This is not meant to be the effort or the responsibility of any individual teacher, but rather should be a joint effort whereby all educators support each other and share experiences of implementing the programme.

In the school setting, students have an essential role to play in building support for greening education. Student councils, other student groups and individual youth leaders should be actively encouraged to provide input on the design, monitoring and evaluation of these programmes or initiate dialogues with parents and other community members about the importance of addressing climate change in their lives. Young people's perceptions and behaviours are greatly influenced by family and community values, social norms, and conditions. Therefore, the cooperation and support of parents, families, and other community actors needs to be sought from the outset and regularly reinforced.

Vaughter (2016) describes schools that function in this action-oriented way as being 'living labs' where students acquire various hands-on skills when working within the local community and with others from the school's broader eco-system. In this way the curriculum, whether formal or informal, engages and involves learners in mitigation and adaptation practices that can empower individuals, mobilize others, and catalyse collective actions. Local CSOs serve as a valuable resource for schools and teachers to turn to for more information, or to invite as guest speakers on topics that reinforce or complement the curriculum. Some CSOs also have community-based environmental programmes in place. Although this approach has schools in mind, these can also apply to any organization involved in greening education.

A whole institution's support for greening education cannot be ad hoc or piecemeal, however. While schools may sponsor environment clubs or 'Environment Day'-like events aimed at broadening students' understanding of climate change, the literature indicates that such activities do not have a significant influence on students' dispositions compared to the enhanced awareness and learning arising from their involvement in climate-change workshops, purposeful learning experiences and campaigns (Akrofi et al., 2019). To ensure that CCE is more transformative and action-oriented, educators need to give students opportunities to influence their schools and communities. In the school setting, youth agency and leadership should be encouraged so that they can develop and implement their own vision for addressing climate change within and outside of the school setting. Youth participation in the envisioning of education's role in the climate crisis is taken up again in Section 4 of this Guidance.

2.7. Greening education within and with the community adds meaning and brings change.

Transformative education encompasses not only formal education, but also the non-formal and informal sectors. There is no limit to the places and ways that one can continue to learn about sustainability and climate change. Greening education can take place at nature-based museums, such as zoos, aquariums, and nature centres. UNESCO-designated sites can be harnessed towards a better understanding of the complex and dynamic relationships between people and their natural environment, to elaborate and promote innovative educational content and learning activities. Governments and non-state actors can engage in public awareness campaigns, illustrated in Box 2 below. A USA study found that weathercasters are well positioned to educate their publics

about the relationships between weather, climate and climate change; moreover, viewers of a public education programme that focused on climate change as part of the weather report, were more likely to hold science-based beliefs about climate change (Zhao et al, 2014).

Box 2. Example of public awareness campaigns for climate change

Outside of school, countries often turn to public awareness campaigns to educate communities and improve climate-responsible behaviour. In **Bolivia (Plurinational State of)**, campaigns such as 'Your Plate, Your Planet' aim to promote sustainable food choices. In **India**, a 16-coach train called the Science Express Climate Action Special acts as a mobile climate change science exhibition. The train has travelled more than 160,000 kilometres and reached more than 20 million people.

Source: GEMR, 2023.

Within youth-created social movement organizations, such as *Fridays for the Future*, youth engage in various forms of informal learning, often mediated through local face-to-face and social media groups. Many youths with pro-environmental attitudes use social media platforms to engage in interest-driven learning and activism and on social media sites to learn and discuss environmental issues and engage in and coordinate actions in their local communities (Field, 2021). For some youth, social media platforms create unparalleled opportunities to facilitate relationships where they can join a group or discuss ideas with like-minded peers or coordinate actions around environmental or social issues they are facing (Andersson & Öhman, 2016). Relational agency represents a shift from a personal to a collective sense of agency, important for the collective action and advocacy for policy change.

Examples of community-based projects are varied, including the understanding of climate impacts according to location, such as the impacts of climate change on coastlines, islands, and cities. Climate 'vulnerability mapping' might take place globally as well as within regions or countries, and these different manifestations of climate change can be used to link climate change with health education. Other examples may include interacting with scientists at a nearby laboratory to explore weather and climate on a local mountain and collecting data (Hallar, McCubbin, & Wright, 2011) and implementing an energy conservation project in their own school (Leigh, 2009). Similarly, decision-makers in coastal USA were engaged in increasing resilience to climate change in their communities, not a fictitious location (Cone et al., 2012), and extension professionals in Australia learned how to apply their new skills to develop climate risk management strategies for business owners in their areas (George et al., 2009). Vukić et al. (2021) have also identified community involvement and the mobilization of different social sectors as influential in the ways in which sustainable development has been taught in schools. Field (2017) argues for schools to become more responsive to disruptive challenges in the 21st century by adopting community as curriculum, with a focus on knowledge production becoming a participatory process that is practised with and among community members trying to solve local problems. Learning experiences may also involve first-hand exposure to people who are currently experiencing climate change (Stapleton, 2019) and interaction with scientists who study climate change (Hallar, McCubbin, & Wright, 2011; Pruneau et al., 2003). Box 3 presents an example of a Plan International curriculum that involves youth in analysing how different population groups in their country are disproportionately affected by climate change and how to influence change in culturally sensitive ways.

Box 3. Plan International's Youth Leadership in Climate Policy Curriculum

In Plan International's Youth Leadership in Climate Policy curriculum (Pettee & Kwauk, 2021), adolescent learners are guided through a stakeholder mapping activity to better understand how different population groups in their country may be differently affected by climate change and/or differently impacted by and/or engaged in climate decision-making, depending on their location on two intersecting continuums of vulnerability and power. Such an exercise introduces learners not only to the concept of power and its fluidity, but also to how power can be held by and/or extended over certain populations in ways that can be empowering or harmful. Learners are then guided through an exercise to reflect on culturally appropriate ways of engaging with climate decision-makers in their home countries and of communicating key messages that can build trust and a coalition of actors committed to addressing underlying issues of climate justice that learners identified earlier in the curriculum.

Source: Kwauk, C. and Casey, O., 2022, p.11. Available under CC BY 4.0

Such strategies appear to help motivate students to learn more and empower them to take action. In addition, programmes may link actions to climate change by conveying the connections that personal behaviours have to carbon emissions or adaptation efforts (Monroe et al, 2019, p. 16).

Critical competencies that enable individuals to address the climate crisis can be infused within training in eco-focused businesses as well as within the vocational training of the informal labour force. Such training can be linked with increased opportunities for environmental vocations, i.e. jobs that could help set a better course for communities (Iyengar & Kwauk, 2021).

Section 3

Key concepts, topics, and learning outcomes

In this section, key concepts and associated topics and learning outcomes are presented as a menu of potential inputs to guide the addition or strengthening of greening curriculum across all subjects and the life of educational institutions. They are illustrative of what might be included in greening curriculum and intended to stimulate national discussion and contextualization in the national/local contexts and priorities. These complex contexts include considerations that are environmental, economic and societal, with greening curriculum calling attention to both challenges and priorities for change to mitigate, adapt and build resilience to climate change.

The content of Section 3 might be used as the inspiration for:

- Discussion among stakeholders about the vision of greening curriculum.
- The elaboration of greening curriculum competences across all ages and subjects.
- A mapping study of the presence of greening curriculum themes in existing curriculum.
- The identification of curriculum gaps and opportunities for strengthening existing curriculum and developing new ones.

Readers aiming to prepare a syllabus or learning materials for a particular age group might read through the learning objectives suggested for the age group across the key concepts, taking note of the suggestions in the prior and subsequent age groups since there may be useful suggestions there.

It may be that this work will be preceded by the adoption of a framework of competences, such as those that have been developed as the ESD Framework for sustainability (see Annex). The subsequent choice of ingredients for the greening curriculum effort might then be influenced by understanding both these competences as well as the status of greening education in existing curriculum, taking note of context and national and local priority issues. Such decisions would be a result of inclusive processes involving youth, educators, indigenous peoples, vulnerable populations most affected by climate change, and other stakeholders. Greening curriculum planning and implementation are addressed in Section 4.

ESD teaching and learning processes should be transformative, that is, they should empower people to make informed decisions and take action to modify the structures and processes of an increasingly complex world (UNESCO, 2022). This section does not include specific recommendations for pedagogy, but methodologies are addressed in Section 2.

3.1. Domains, key concepts and topics

The Guidance contains six key concepts linked with the sustainable development domains: environment, society and economy.

Environment: This domain refers to holistic notions of the environment, drawing on physical and biological sciences and showing the impact of human activities on natural processes, reflected from the entry point of climate change. The inter-relatedness of environmental challenges in a complex mix of science-based, social and economic issues is the basis upon which the Guidance seeks to empower learners to think critically and make informed actions toward environmental integrity and justice (UNESCO, 2020).

Society: This domain refers to society envisioned as human arrangements where every individual has an active role to play, based on the fundamental values of equity, equality, social justice, human rights, freedoms, tolerance, and diversity (UNESCO, 2021). Through the lens of climate change, a process of societal transformation, equipping learners with skills, knowledge, values and attitudes towards advocating for a just and sustainable society for present and future generations (UNESCO, 2020), is discussed.

Economy: This domain refers to a complex and multidimensional system of relationships including the production, consumption, distribution, and exchange of goods, with inclusive and sustainable means of continued development and employment. A shared and circular view of the green economy envisions alternatives to unsustainable production and consumer-heavy societies driven by the notion of unlimited growth, by encouraging learners to explore sufficiency, fairness, and solidarity in the economy (UNESCO, 2020).

Figure 3: A holistic approach to greening education



These domains are distinct and yet interrelated. For example, climate change mitigation and adaptation will involve science and technology ('Environment' domain), the role of businesses working towards a circular economy ('Economy' domain), and actions to address eco-anxiety and protect those most vulnerable ('Society' domain). Therefore, we encourage making links across the key conceptual categories and associated topics.

Six associated key concepts have been developed:

- Climate Science
- Ecosystems and Biodiversity
- Climate Justice
- Resilience-Building
- Post-Carbon Economies
- Sustainable Lifestyles

In turn, for each key concept, a set of topics has been identified, with each topic associated with specific key ideas and learning outcomes organized according to age groups (5-8 years, 9-12 years, 13-15 years, 16-18 years, and 18+ years). For example, for the key concept of Sustainable Lifestyles, the associated topics are: Engagement with Nature; Renewable Energy Use; Responsible Consumption; Sustainable Living Spaces; Sustainable Mobility; Sustainable Diets; Sustainable Waste Practices.

While the Guidance is wide in its conceptual scope, it could never be comprehensive in terms of all possible topics that might be addressed. There will be specific topics of special importance to learner groups in the local context, and the reader is encouraged to seek these out and include them in their greening curriculum effort, using localization strategies presented in Section 4.

3.2. An overview of expected learning outcomes across different education levels

The Guidance contains a wide range of learning objectives across different ages, beginning with young learners. This progression reflects increasing complexity and challenges in relation to the topics, and learners' increased agency and room for action as they mature. It is organized according to learner age rather than specific education sector or subject (in the case of formal education) and the learning outcomes have been designed to apply to both the formal and non-formal education sectors, including TVET. Learning outcomes outlined in the Guidance will be the first element for curriculum developers to generate ideas for an effective new curriculum as well as to improve an existing curriculum. Curriculum developers will want to select or adapt learning outcomes that are most relevant and to consider sequencing accordingly.

Early childhood development

Offer nature-connection experiences and opportunities to develop responsibility.

The cognitive and social-emotional skills acquired during early childhood, including problem-solving, critical thinking, and empathy, have enduring impacts on later outcomes throughout schooling and adulthood (OECD, 2020). Very young children primarily engage in sensorimotor learning, exploring the world through their senses and movements. Integrating nature-based experiences, such as outdoor play and hands-on activities with natural elements, lays the foundation for an early understanding of the environment. Teaching complex subjects like climate change to very young children is achievable through play and a positive, solutions-focused approach. This approach enables children to learn about these issues without experiencing anxiety or fear. At this age, the emphasis should be on fostering a love for nature, promoting individual responsibility, and encouraging sustainable behaviours. These early experiences set the stage for active engagement in climate-related actions later in life. While the Guidance does not address learning for early childhood (younger than 5 years old), it may be possible to draw inspiration from the Guidance provided for 5- to 8-year-olds and develop experiences (notably through art and play) for younger children. It is essential to build values, habits and attitudes that support the conservation of the environment and the sharing of resources from an early age. Early child education addressing composting and vegetable gardening, for example, will help children learn how to be environmentally responsible.

Primary school

Explore the interlinkages between environmental, social and economic dimensions of climate change.

The curriculum developer is encouraged to integrate foundational concepts encompassing the three pillars of sustainability – environmental, social, and economic – into the curriculum. Within the environmental pillar, learners could be introduced to essential scientific principles regarding the water and carbon cycles, fossil fuels, GHGs, pollution, and renewable energy. Learners should understand the causal linkages between fossil fuels and GHGs that can cause climate change. Learners should demonstrate an understanding that average global temperatures are increasing, and extreme weather events are more frequently attributed to climate change. The scientific facts should be integrated with social approaches, such as climate justice and resilience-building.

It is critical for learners to consider how the circumstances that they live in can create negative experiences of climate change for others. They could critically consider how past human actions have had positive or negative impacts on the environment and communities up until today. Taking this approach, they should appreciate that some of our actions today can worsen the situation unless we work to change them. However, it should be clear that creating a fairer future in the face of climate change will require society to address long-standing social inequalities and extra support will be required so these groups can also benefit from climate solutions.

Learners should be encouraged to critically think about the economic system and how it exacerbates the climate crisis. Building on the idea of finite versus infinite resources, learners could be encouraged to compare the minimal carbon dioxide (CO_2) emissions produced from renewable energy sources (such as solar, wind, etc.) with emissions from non-renewable sources (such as coal, oil, etc.) and critique why non-renewable sources are still the dominant sources of energy in the current economic system. The learners may also be involved in activities which enable them to analyse how climate change-related extreme weather events can affect people's lives and discuss disaster risk reduction measures, and explore how sustainable living spaces help reduce environmental impacts, save money, improve quality of life, and reduce threats to humans, animals, and biological diversity.

A key consideration is to ensure that rather than an over-reliance on cognitive knowledge, learners are exposed to a range of pedagogical approaches that enable social-emotional and behavioural domains. Learners should empathize with people, communities, and countries which are less able to cope with and/or to adapt to the impacts of climate change because of unfair events in history that have either made them more exposed to climate hazards or have diminished their ability to adapt or to cope with its impacts. They should also acknowledge that emotions can be complex around climate change, and they can learn coping strategies to address climate change anxieties. Similarly, a key focus at all levels should be action. This could be expressed through behaviour change by adopting more sustainable practices, influencing others in or out of school and participating in community projects that seek to combat climate change and that promote collective and climate-friendly practices.

Lower secondary

Environmental, social and economic dimensions of climate change with a focus on justice.

This Guidance is built upon principles of a spiralling curriculum; therefore, studies at lower secondary level will deepen and build upon foundational concepts already learned at lower levels. A holistic approach should integrate environmental, social, and economic aspects across all learning areas in the curriculum at this level.

From the environmental angle, learners analyse the rapid rise in atmospheric temperatures since industrialization, explore global efforts to limit this increase, and examine emerging technologies for mitigating climate change. The concept of the greenhouse gas effect is further developed, allowing learners to explain the causal link to human activities. Moreover, the curriculum should connect these environmental approaches to social aspects like climate justice and resilience-building, as well as economic considerations. Learners should critically reflect on how climate change disproportionately affects various groups, leading to unequal experiences of its impacts and adverse conditions in vulnerable contexts and settings around the world. They should engage in problem- or project-based activities that encourage questioning of oppressive systems perpetuating climate injustices, while also critiquing long-standing environmental, social, and economic injustices driven by self-interest.

The curriculum should empower students to envision and propose pathways towards a greener and fairer future, emphasizing equality, social inclusion, environmental and climate justice, and respect for human rights. Additionally, the curriculum should prompt students to consider alternative economic models, such as the post-carbon, circular economy, contrasting with the traditional 'linear growth' economy predicated on infinite natural resources. Students should understand the causal relationship between energy consumption and increased carbon emissions, while also exploring negative externalities in economic activities and potential measures to mitigate their effects. Additionally, they could advocate for climate actions that address the needs of those disproportionately affected by climate impacts or propose solutions and approaches in their school or community that are inclusive of diverse perspectives and develop and implement adaptation projects.

Upper secondary

Environmental, social and economic dimensions of climate change with a focus on taking personal action.

The curriculum at this level should prioritize higher order thinking skills from Bloom's taxonomy and incorporate innovative pedagogies to elucidate complex concepts effectively. Emphasis should be placed on key climate change concepts such as 'net zero' and 'CO_2 equivalency', utilizing reliable data sources such as the IPCC to ensure a comprehensive understanding of the basic science underlying the climate crisis. By the conclusion of this stage, learners should be able to articulate a clear definition of climate change, its causes, mechanisms, and potential mitigation strategies, supported by robust evidence.

The curriculum should integrate discussions on renewable energy technologies and sustainable practices like improved building design and insulation, highlighting their role in reducing fossil fuel dependency and achieving net-zero emissions. Additionally, learners should explore the adverse impacts of ocean acidification and rising temperatures on marine ecosystems, as well as the dual role of technological advancements in enhancing food production while posing threats to biodiversity. It is crucial to underscore the escalating ramifications of climate change on biodiversity and ecosystems in the future.

Learners should understand that the climate crisis is rooted in historical economic and political systems, perpetuating global social and economic disparities. Climate injustice amplifies existing inequalities across various levels. Learners should explore how certain groups lack resources to engage in lower-polluting activities, emphasizing the need for a just transition towards equity, equality, and sustainability. Achieving a greener and fairer future requires all stakeholders to accept a differentiated responsibility based on social justice and human rights. The curriculum should highlight the role of social movements and civic engagement in advocating for climate justice and pressuring governments to prioritize climate action.

The curriculum should highlight the increasing frequency and severity of climate change-related weather events and disasters, underscoring their significant economic impact. Learners should differentiate between economic growth and sustainable development, understanding that the latter encompasses sustainable changes for overall well-being. They should reject the notion of infinite growth, recognizing the detrimental effects of high resource exploitation on both people and the planet. Thus, it should be emphasized that the current economic growth model and consumption patterns are drivers of the climate crisis. Additionally, the curriculum could emphasize the lifecycle approach in a circular economy, which considers the environmental impact of all stages of a product's life. Furthermore, adaptation and mitigation mechanisms serve as tools to mitigate the adverse economic consequences of climate change. Learners could explore the linkages between economic growth, the prevailing economic model, and their contributions to the climate crisis from various perspectives.

In the social and emotional domain, the curriculum should address climate anxiety as a chance to develop emotional awareness and coping strategies. Learners should differentiate between emotions like grief, anger, fear and guilt stemming from climate concerns and empathize with themselves and others experiencing such feelings. They should cultivate hope and recognize the potential for collective and individual action to address climate challenges. The curriculum should focus on the actions of the learner, encouraging the translation of cognitive knowledge into behavioural outcomes. This may include new behaviour adopted by the individual, using their talents (e.g. communication, artistic expression etc.) to highlight critical issues, participation in youth advocacy events, and community projects among others.

The above 18 age group

Lifelong learning for climate change and fostering societal changes.

A range of learning situations may apply, including non-formal lifelong learning, TVET and tertiary education. Learners at this stage, regardless of specialization, should achieve certain key learning outcomes related to climate change. They should understand the urgency of the crisis and take both individual and collective action to combat it. Additionally, they should be able to access and interpret accurate scientific data on climate change, comprehend key concepts such as 'carbon capture' and 'carbon footprint', and articulate the causes, prevention strategies, and mitigation measures of climate change. Learners should also grasp the connections between human activities and climate change, as well as methods to mitigate, adapt to, and build resilience against its impacts.

Learners should develop a deeper understanding of how climate change exacerbates existing inequalities and injustices and recognize the role of policies, social institutions and economic systems in perpetuating or mitigating these injustices. They should critique economic systems and political structures that contribute to the climate crisis, considering alternative economic models and reflecting on technological and financial innovations for a post-carbon transition. Learners may possess or acquire green competencies or skills and should be encouraged to innovate in areas such as renewable energy or environmental economics. Specialized areas may require additional competencies, but curricula should maintain a holistic approach. Lastly, learners are expected to demonstrate leadership in addressing climate change through adopting sustainable practices, influencing others, advocating for climate action and participating in relevant projects.

Technical and Vocational Education and Training

Green skills and sustainability in the workplace.

TVET is critical in addressing knowledge, skills, and challenges for achieving the SDGs. It can take place in both the formal and non-formal education sectors and be part of lifelong learning. In different parts of the world, TVET learning systems are undergoing transformations to support green economic development through the provision of green-skilled workers needed by new green businesses in the private and public sectors (UNESCO, 2014). Moreover, international sustainable development policy is now aligning with the global TVET policy in responding to the green skills and green economy agenda. In June 2023, the Resolution and Conclusions adopted in the 111th Session of the International Labour Conference (ILC) endorsed the International Labour Organization (ILO) Guidelines for a just transition towards environmentally sustainable economies and societies for all – as the central reference for policy-making and a basis for action. The Guidance systematically integrates key concepts and learning outcomes relevant to TVET. This includes not only developing green job skills but also broader education across the domains of the environment, society, and economy. Students of all ages learn about the impacts of climate change on their chosen fields, with tailored instruction for different age groups. The Guidance addresses outcomes applicable to both TVET and non-TVET settings.

It may be the case that the key ideas and learning outcomes that have been identified for specific age groups will not be a close fit for the educational level of learners in the local environment. For example, learning experiences outlined in the Guidance might assume a level of literacy or previous exposure to conceptual 'building blocks' not covered earlier in the local curriculum. When working with older students, therefore, it may be necessary to work with learning outcomes designed for younger learners that involve the introduction of foundational knowledge. Moreover, as with all educational programming, the curriculum should be inclusive

and consider the diversity of learners' backgrounds and ability levels. The curriculum developer is strongly encouraged to use the Guidance in whatever way deemed best for their learners, taking account of the context, climate-related priorities, the learning environment, and resources available in schools and other settings, as well as ensuring contextualization and sufficient focus on national and local priority issues.

3.3. Learning domains

This Guidance is oriented towards transformative learning and the empowerment of learners and their educators. UNESCO has identified three learning domains relevant for transformative learning: cognitive, social and emotional, and behavioural. The cognitive domain comprises knowledge and higher thinking skills necessary to better understand the thematic sustainable development areas and the challenges in achieving them. The social and emotional domain includes social skills that enable learners to collaborate, negotiate, and communicate to promote the achievement of the SDGs as well as self-reflection skills, values, attitudes and motivations that enable learners to develop themselves. The behavioural domain describes action competencies (UNESCO, 2017, p. 11). For effective teaching and learning of ESD, all three learning dimensions need to be developed in conjunction with one another, to contribute to broader ESD competencies (UNESCO, 2019). More detailed definitions of these learning domains are presented below in Box 4.

Box 4. Definitions of learning domains in Education for Sustainable Development

Cognitive: To acquire knowledge and understanding, and to practice critical thinking about global, regional, national, and local issues; the interconnectedness and interdependence of different countries and populations; as well as the social, economic, and environmental aspects of sustainable development.

Social and emotional: To have a sense of belonging to a common humanity and of concern for the natural environment; sharing values and responsibilities beyond borders; having empathy, solidarity and respect for differences and diversity; as well as feeling, reflecting, and assuming a sense of intergenerational responsibility for the present and future.

Behavioural: To act effectively, creatively, and responsibly at local, national and global levels to promote a more peaceful, inclusive, green and sustainable world. This domain nurtures the ability of learners to act in responsible, compassionate, respectful and non-violent ways, building constructive and sustainable relationships. It also refers to action competencies, such as participating constructively in community (local or global) projects that promote sustainable development in one's immediate environment and beyond. Finally, the behavioural dimension helps learners apply their learnings according to local community norms or broader societal standards.

Source: Adapted from UNESCO, 2015, p.15. Available under CC BY-SA 3.0 IGO

3.4. Integrated, cross-disciplinary approach

A core tenet of the Guidance is that education takes place in a holistic, cross-disciplinary manner, embracing the humanities, social sciences and natural sciences and involving institution-wide engagement with themes and climate actions. There is no single formula for creating such an integrated and locally meaningful approach. Hence, the matrices contained in this section can serve as a source of inspiration and ideas that will ultimately come alive in the process of curriculum design and implementation.

Scientific measurements and models use climate data to predict alternative futures. The scientific method also underpins our understanding of the impact of climate change on ecosystems and biodiversity. Clear understanding of the fundamental science and evidence can help learners to combat misinformation, to be empowered to actively engage in green social and economic transformation, and to adopt sustainable lifestyles.

It is important for learners to be aware of the efforts being made worldwide by scientists and engineers to find ways to mitigate global warming and adapt to climate change. This provides an avenue of hope. However, learners need to become aware of the broader challenges and opportunities. They should indeed be able to integrate what they learn about climate projections with solutions from physical sciences and the biological sciences. (See Key Concept 1 Climate Science and Key Concept 2 Ecosystems and Biodiversity.) Equally important, learners should build a multidisciplinary and holistic overview, which links the scientific, the societal and the economic. Climate change modelling from the IPCC shows the need for urgent action to constrain the speed and level of global warming. Science and technology are being harnessed to find new approaches to sustainability. Renewable energy, for example, offers the promise of substituting for fossil fuels to meet the energy requirements of modern lifestyles. Sustainable agriculture can help restore ecosystems and protect biodiversity. Strengthening preparedness and resilience to climate change, both to reduce disaster risk and eco-anxiety, can be addressed through taking positive actions on climate issues relevant to the learners. (See Key Concept 4 Resilience-Building.) Societal actions ensure collective decision-making on policies to mitigate, adapt and be resilient to climate change. Climate Justice (see Key Concept 3 Climate Justice) can protect the vulnerable who often suffer the most from climate harms. Businesses can work towards post-carbon green economies (see Key Concept 5 Post-Carbon Economies), saving the Earth's resources and reducing waste and associated greenhouse gas emissions. Of direct relevance to learners are the required changes in lifestyle if energy-intensive and resource-depleting consumer products and habits are to give way to sustainable ways of living. (See Key Concept 6 Sustainable Lifestyles.) Throughout the matrices in Section 3 there are cross-references to other Key Concepts and Topics.

Key concept 1

Climate science

Key topics

Topic 1.1. Weather, climate and climate change 53

Topic 1.2. Greenhouse gases 55

Topic 1.3. The carbon cycle 57

Topic 1.4. The water cycle 60

Topic 1.5. Avoiding pollution and conserving resources 62

Topic 1.6. Renewable energy 65

Definition

The science of climate and sustainability can be taught through stand-alone curriculum units and interdisciplinary projects, and through integration in the teaching of particular sciences, geography, and other subjects. Statements of general learning outcomes for each discipline should have an additional learning objective such as 'applying disciplinary knowledge and skills to support personal, societal and planetary well-being and sustainable development.'

Explicit study units/lessons on specific climate science topics, as well as climate impacts on ecosystems and biodiversity, are essential so that students are able to discuss these inter-related science-based issues with fluency, confidence, and a sense of agency. This explicit learning can be reinforced across the curriculum in formal education when relevant disciplinary science concepts are studied, e.g. gases in chemistry, electromagnetic radiation in physics, photosynthesis in biology, or forest cover in geography. Selection and treatment of climate science topics should be based on national circumstances and reflect the country's priorities. While the warming effect of GHGs is global, many issues are more location-specific, e.g. concerns such as melting of glaciers, ocean changes, loss of forest cover/desertification, sea level rise and approaches to disaster risk reduction (DRR).

The science of global warming and climate modelling is very complex but can be introduced in age-appropriate fashion. Thus, cognitive learning of climate science begins with discussion that 'weather' is part of daily life experience, and that 'climate' describes weather patterns observed over longer time frames. Social and emotional and behavioural learning outcomes must likewise be age-appropriate. It can be explained to younger children that extreme events such as fires, heatwaves, heavy rain, floods, snow blizzards and ice storms may sometimes happen, but that there are things that students can do with their families and in the community to address these challenges.

'Climate science' as presented in this section includes rates of global and regional warming, their causes, and consequences. Younger students can learn that solar heat is partially trapped by a blanket of GHGs, and that excess CO_2 from human activities is causing temperature rise with consequences such as glaciers melting and extreme weather events. Older students can progressively review the evidence for global warming, the Intergovernmental Panel on Climate Change (IPCC) projections, and how the carbon and water cycles underpin temperature rise and its consequences including enhancement of extreme weather events such as storms and drought. Conserving energy and other Earth resources, use of sustainable energy and sustainable agriculture, as well as 'Refuse-Re-use-Repair-Recycle,' are examples of climate change mitigation and adaptation that can be reflected multiple times in the science curriculum. Pollution must be addressed in science studies as it impacts health and quality of life and often contributes to global warming.

The climate science learning outcomes set out here are illustrative and should be adapted to meet national and local priorities based on the context. The suggestions are phrased to allow for different capacities within a learning environment (e.g. differences in internet connectivity and types of scientific equipment available, as well as in class size and resources). The suggestions are structured by age group but learning outcomes from adjacent or other age groups may be more useful in a particular situation. In all situations, learners should explore the connection between their studies of climate science concepts and their responsibilities in terms of lifestyle and contribution to societal action to mitigate/adapt to climate change.

Key ideas and learning outcomes per topic per age group

Topic 1.1. Weather, climate and climate change

'Weather' describes our daily experience of precipitation, wind, atmospheric temperature, etc. while 'climate' describes patterns over longer periods of time, such as average seasonal profiles and exceptional events. Average temperatures of the lower atmosphere are rising, and this phenomenon is called global warming or global heating. Future temperatures can be predicted using complex models that integrate natural and manmade climate factors and potential feedback effects. International agreements and institutional arrangements enable governments to consult on targets for climate change mitigation, e.g. the United Nations Framework Convention on Climate Change (UNFCCC), the Paris Agreement, the work of the Intergovernmental Panel on Climate Change (IPCC) and the annual Conference of the Parties (COP) to the UNFCCC.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: 'Weather' describes daily experience, while 'climate' describes weather patterns over many years.**		
	Learners should be able to: ▶ describe some features of the weather in their country or community. ▶ generalize regular weather patterns as seasons and 'climates.'	Learners should be able to: ▶ participate in group discussions about seasonal preferences, actively listening to their classmates' perspectives on different seasons. ▶ explain their own preferences in a way that is respectful of others' viewpoints, fostering understanding and building positive relationships. ▶ demonstrate curiosity about the world around them, asking questions about plants, animals, and weather. ▶ connect their emotional responses to the seasons by asking questions that reveal their wonder, excitement, or even anxieties about different weather patterns or changes in nature.	Learners should be able to: ▶ demonstrate the ability to assess weather risks, select appropriate clothing and gear, identify safe locations (like shelter), and implement preventative measures (e.g. avoiding flood zones, securing outdoor furniture) to navigate various challenging weather conditions.
9-12 years	**KEY IDEA: Average global temperatures are increasing and extreme weather events more frequent.**		
	Learners should be able to: ▶ demonstrate an understanding that temperature has changed in the past over long periods of time, and that changes have become more rapid since industrialization. ▶ investigate the range of temperatures in their country. ▶ explain the term 'global warming' (used interchangeably with the term 'global heating'). ▶ describe how seasonal temperatures may vary from year to year, but that the trend is upwards. ▶ describe some of the effects of global warming, globally and in their region, such as heatwaves, drought, wildfires, melting glaciers and ice caps, sea level rise, increased ocean temperature and acidity, death of coral reefs, and increased severity and frequency of storms, hurricanes and monsoons and flooding.	Learners should be able to: ▶ express their own feelings about taking action, like feeling hopeful, empowered, or motivated to make a difference. ▶ participate in activities that connect positive emotions with taking action on climate change.	Learners should be able to: ▶ collaborate in family/local actions to prevent/mitigate/adapt to the enhanced risk of events such as flooding, heatwaves, wildfires, drought such as planting drought-resistant trees.

13-15 years

KEY IDEA: Temperatures of the lower atmosphere have risen faster since industrialization and especially in this century. Many countries are seeking to limit this increase to 1.5C (or under 2C). International agreements and institutions promote this goal, and many scientists are researching new technologies that can reduce global warming.

Learners should be able to:

- give some examples of how scientists collect weather data, including the temperature of the lower atmosphere.
- demonstrate an understanding of the role of international action to address global warming.
- describe recent IPCC temperature projections and assess the targets for limiting average global temperature rise to 1.5C (or less than 2C).

Learners should be able to:

- appreciate the importance of monitoring weather patterns and climate trends through engaging in debates, discussions, and collaborative activities.

Learners should be able to:

- adopt more sustainable lifestyle choices such as including energy-saving practices in schools (e.g. turning off lights, using natural light)

16-18 years

KEY IDEA: Climate projections show that global warming in this century may exceed 1.5C or 2C, depending on human actions and available technologies. Increases in the frequency and strength of extreme weather events are predicted, together with sea level rise and impacts on ecosystems and biodiversity.

Learners should be able to:

- identify key findings of the most recent IPCC reports of greatest relevance to their own region/country.
- assess the likelihood of high, low or central temperature predictions.
- analyse types of extreme events that occur globally, regionally and in their locality, and assess how they might be affected by global warming.
- evaluate the potential of innovative technologies and of societal and economic practices that may lessen the pace of global warming, such as transitioning to a circular economy and addressing lifestyle choices. (See Key Concepts 5 Post-Carbon Economies and 6 Sustainable Lifestyles.)

Learners should be able to:

- show empathy with those at risk of internal displacement by climate change (e.g. drought, desertification, sea level rise) through creative works such as artwork, poems, or stories that capture the experiences of those facing displacement.

Learners should be able to:

- work with fellow students and youth groups, to counter misinformation on climate change in online spaces, and advocate for preventive measures. (See Topic 4.6 Tackling Climate Mis/Disinformation.)
- initiate or support efforts to mitigate/adapt to the effects of global warming, in their school and community. (See Key Concept 4 Resilience-Building).

18+

KEY IDEA: Scientific knowledge on climate change is increasing. New data may affect models and projections and perhaps suggest even greater urgency of action to mitigate planetary warming and its impact on learners' own and other communities and on the natural world, with especial attention to climate justice (see Key Concept 4 Climate Justice).

Learners should be able to:

- evaluate the role of the IPCC, assessing the significance of its current reports and predictions and consider their uncertainties, including possible feedback effects.
- select one or more key findings of the IPCC reports and consider some creative ways to address them through technological change, green manufacturing and transport, sustainable agriculture and transitioning to a circular economy.
- analyse international agreements and national policies for carbon reduction, in view of the need to sequester carbon, adopt regenerative practices, and go beyond net zero to post-carbon practices and lifestyles (see Key Concept 5 Post-Carbon Economies).

Learners should be able to:

- feel concern over the impact of projected climate change on their own and future generations in different regions and for different social groups, especially those who are socially/economically marginalized and in vulnerable locations.
- empathize with nature and place value on the need to take care of the natural environment at local and global scale, including through the adoption of green practices and the use of green skills through activities such as virtual exchanges with students from other schools, regions or countries facing different environmental challenges.

Learners should be able to:

- engage in advocacy, debate, and negotiations locally, nationally and globally for climate change mitigation and adaptation measures.
- develop video clips, podcasts, vlogs, etc. and share via social media and other channels, as appropriate.
- adopt (and with youth peers, family, educational institutions, and employers) promote best practices such as energy efficiency and conservation, sustainable agriculture, forests and fisheries.
- choose green products, travel, construction, etc. (See Key Concept 6 Sustainable Lifestyles.)
- conduct action research with local communities, municipalities and businesses on the impact of climate change and on prevention/adaptation measures.

Topic 1.2. Greenhouse gases

The Earth's temperature is affected by naturally occurring GHGs which serve as a blanket, lessening the loss of heat from the Earth's surface. Loss of heat (as infra-red radiation) from the Earth's surface is restricted by small amounts of GHGs such as CO_2 in the lower atmosphere. Without this 'greenhouse effect', the Earth's average air temperature would be -18C instead of about 15C. The rise in the levels of CO_2 and of other GHGs (computed as CO_2 equivalents), since industrialization, corresponds to the rise in overall global temperature. CO_2 stays in the atmosphere for thousands of years. Water vapour (H2O) is also a GHG but forms clouds and falls as rain. Methane (CH4) from natural sources and from cattle farming, waste dumps, leakage from oil wells, etc. is a stronger GHG than CO_2 but stays in the atmosphere for a shorter time. GHGs also include nitrous oxides (N2O), ozone and other chemicals. Chemicals such as fluorocarbons used in refrigerators are GHGs but are better known for damaging the ozone layer in the stratosphere. The stratospheric ozone layer is a friend of life on Earth, absorbing much of the ultraviolet radiation from the sun which would otherwise be harmful. Destruction of the ozone layer at the Earth's poles (creating a seasonal 'ozone hole') is discussed in Topic 1.6 Renewable Energy below.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Sunshine heats the Earth's surface. GHGs such as CO_2 in the air help to stop this heat being radiated into space.**		
	Learners should be able to: ▶ give evidence of the heat from solar radiation (e.g. effect on hands, stones). ▶ explain that some gases in the air (e.g. CO_2 that we breathe out) act like a greenhouse or blanket and keep the air warm. ▶ describe air temperatures during different seasons and times of day, and those that they like/find uncomfortable. ▶ suggest the effects of too much warming if human activities increase the amount of GHGs like CO_2.	Learners should be able to: ▶ participate in activities that spark wonder about the sun's warmth. ▶ show concern that global warming due to people's greenhouse gas emissions may cause problems to people and animals, e.g. heatwaves, melting of ice where polar bears live.	Learners should be able to: ▶ raise the awareness of family members regarding greenhouse gas emissions due to people's activities, which are causing global warming and associated problems. ▶ tell stories about the sun and its warmth. ▶ play outdoor games like 'Follow the Sun', where children follow the direction of the sun's rays.
9-12 years	**KEY IDEA: GHGs from natural sources keep the Earth warm enough for life. However, extra CO_2 from use of fossil fuels and other sources has an unwanted global warming effect.**		
	Learners should be able to: ▶ describe the main gases in the air we breathe and explain that CO_2 (e.g. from exhalation), and some other gases in the atmosphere, keep the air warm (at about 15C instead of -18C) by stopping heat loss into space. ▶ design simple demonstrations of the greenhouse effect. ▶ explain the concept of fossil fuels (formed underground over millions of years) and that burning them in cars and other vehicles, for heating, etc. generates extra CO_2, increasing the 'greenhouse effect.' ▶ explain that CO_2 is created by burning wood and that forest conservation and expansion is needed to help re-absorb this as well as CO_2 from other human activities.	Learners should be able to: ▶ show concern over the potential harm to people and animals from human-induced greenhouse gas emissions, including feeling empathy with those affected by increased flooding, sea level rise, drought, etc. ▶ appreciate the value of forests by empathizing with the motivation of indigenous people or young forest wardens to protect forests in their region/country.	Learners should be able to: ▶ raise family, school and community awareness about GHGs and the ways in which locally used fuels, etc. create CO_2, adding to global warming. ▶ take actions to reduce use of fossil fuels (e.g. by walking instead of using motorized transport). ▶ participate in community gardening or tree planting projects to learn about the relationship between sunlight, plants, and GHGs.

13-15 years

KEY IDEA: GHGs include CO_2, methane, and nitrous oxide, which absorb heat being radiated from the earth's surface, thereby creating a 'greenhouse effect.' Human activities have caused increases in these gases, as well as creating other gases not found naturally, leading to global warming. Action is needed to reduce emissions of GHGs and to increase CO_2 capture by forests and other means, to lessen the pace of global warming.

Learners should be able to:

- demonstrate an understanding of Charles Keeling's findings on rising atmospheric CO_2 levels and of CO_2 measurements worldwide.
- give other examples of where methane occurs naturally and how it is linked to various human activities, from cattle-raising to waste dumps.
- compare major sources of different human-induced GHGs, in terms of how difficult it might be to reduce emissions, globally and/or in their own country.

Learners should be able to:

- appreciate the importance of trees, forests, and mangroves in removing CO_2 from the air, while also understanding their various benefits to humans and their role as habitats.
- reflect on their own commitment to environmental values and on how they and their families can be motivated to reduce greenhouse gas emissions.

Learners should be able to:

- raise awareness of GHGs, their sources, and effects, through interactions with family, whole school activities and in organizations to which they belong.
- take personal actions or advocate to preserve or extend tree cover/forest/mangroves, and/or to reduce use of fossil fuels, e.g. in personal or commercial transportation.
- volunteer for local environmental organizations involved in activities such as tree planting, habitat restoration, or waste reduction efforts.

16-18 years

KEY IDEA: The IPCC and many governments aim for 'net zero' human-induced CO_2 emissions by mid-century (other terms include zero-carbon, low-carbon, carbon-neutral or green economies). Other GHGs are included using the concept of 'CO_2 equivalency.'

Learners should be able to:

- explain the basics of the 'greenhouse effect,' including how incoming sunlight heats the Earth's surface and then GHGs such as CO_2 in the lower atmosphere trap some of the outgoing infrared (heat) radiation leaving the Earth's surface.
- give examples of different GHGs and their sources (natural, human), and explain that they have varied absorptive effects and duration of stay in the atmosphere.
- explain the concept of CO_2 equivalency for GHGs such as methane and nitrous oxide and its use in IPCC projections.
- define the concept of 'net zero' for GHG emissions due to human activity, and critically analyse some of the suggested ways of reaching this goal.
- use the concept of Global Warming Potential to compare the effects of GHGs.

Learners should be able to:

- cultivate empathy and environmental responsibility by collaborating on projects exploring the environmental impact, empowering them to cut their carbon footprint and build solutions together (see also Key Concept 6 Sustainable Lifestyles).
- use communication, negotiation and collaboration skills needed to support climate-related advocacy and action.

Learners should be able to:

- raise awareness of the 'greenhouse effect' of CO_2 and some other gases, with family, at school, through youth (or other) organizations or online.
- advocate for climate-related action in their educational institution, and with local organizations or businesses.
- critically evaluate information online by checking sources, identifying bias, and verifying facts with credible websites before sharing them.
- organize youth summits or conferences focused on climate change and sustainability, providing platforms for young people to exchange ideas, share best practices and collaborate on solutions.

18+

KEY IDEA: IPCC Working Group reports show factors influencing future climate and weather events, notably projected levels of GHG. Given that all current projections show unwanted levels of global warming, and that feedback mechanisms and other processes may cause underestimation, remedial action is urgently needed.

Learners should be able to:

- explain the 'greenhouse effect' and the impact of naturally occurring and human-made GHGs on life conditions, including enhanced risk of extreme weather events.
- explain the concepts of the CO_2 equivalency and Global Warming Potential of different GHGs.
- analyse the inter-related roles of the international treaties and associated institutions addressing climate change (notably the UNFCCC, Paris Agreement, COP meetings, IPCC), and of Nationally Determined Contributions to meeting agreed goals.
- identify and critically evaluate some remedial actions that can reduce GHG emissions and levels, in their personal lives, workplaces and country.

Learners should be able to:

- show concern about the ethical dimensions of GHG emissions, focusing on the responsibility to protect the environment, vulnerable populations, and future generations.
- use communication, negotiation, and collaboration skills across diverse social groups, needed to support climate-related advocacy and action.

Learners should be able to:

- make better choices regarding climate change in their personal and professional lives, illustrated by choices that reduce GHG emissions.
- engage in advocacy, debate, and negotiations locally, nationally, and globally for reduction of GHG emissions.
- engage with family, friends, local and national organizations, and businesses on specific ways to reduce net GHG emissions and to increase disaster preparedness.
- conduct action research on emissions levels and reduction with local communities, education institutions, municipalities and businesses.

Topic 1.3. The carbon cycle

Life is carbon-based. The carbon cycle is the process where carbon compounds are interchanged among the biosphere, the atmosphere, the lithosphere (rocks), the soil, and the hydrosphere. For example, CO_2 is taken up by plants, forests, and phytoplankton through photosynthesis, enabling their growth. However, industrialization and associated CO_2 emissions have disturbed the carbon cycle, notably through the use of fossil fuels as a non-renewable energy source for transport, industry, etc. A related concept is the 'carbon footprint,' which quantifies the CO_2 emissions caused directly or indirectly by our activities, such as use of fossil fuels. Our carbon footprint can be reduced through changes of lifestyle and the 'circular' economy, as well as by supporting compensatory activities such as forest conservation and development of new technologies.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Life is carbon-based. During daylight hours, plants and plankton use CO_2 from the air to help them grow.**		
	Learners should be able to: ▶ explain that during daylight hours, plants, including trees and plankton, use CO_2 from the air to help them grow. ▶ suggest how plant life is important in the lives of animals and humans. ▶ discuss how fossil fuels were formed from plant life in previous eras and comprise different forms and compounds of carbon, that cause global warming when burned.	Learners should be able to: ▶ appreciate the value of trees and plants and show how they benefit their lives by engaging in hands-on activities, exploring the science behind their importance, and developing a sense of empathy and responsibility towards the natural world.	Learners should be able to: ▶ grow some indigenous plants and tree seedlings. ▶ advocate for simple actions to protect nature, such as picking up litter.
9-12 years	**KEY IDEA: Plant life removes carbon from the atmosphere through photosynthesis enabling plant life (including trees and phytoplankton) to grow, and to support the food chain for animal life. Respiration by plants and animals, and decomposer organisms, return CO_2 to the air. Sea organisms' skeletons, composed mainly of calcium carbonate, sink to the ocean floor, and are stored for thousands of years as sediment or sedimentary rock.**		
	Learners should be able to: ▶ describe how carbon is found in different carbon stores (atmosphere, biosphere, soil, lithosphere, and hydrosphere, especially oceans) and moves between them. ▶ compare the amounts of time that carbon remains in these different 'carbon sinks' (or stores, reservoirs). ▶ explain that plants use CO_2 for photosynthesis and to grow; and how plant life supports the animal food chain. ▶ investigate the methods of reforestation used in the Green Wall project in Africa to prevent desertification or other Green Wall projects, and what related approaches are successful in their own area. ▶ give examples of fossil fuels, where they are found and extracted, and explain that the time scale of their formation means that they are effectively a finite resource. ▶ describe how fossil fuel use leads to an increased level of CO_2 and global warming. ▶ suggest how the CO_2 level may be increased by deforestation and burning of wood/ charcoal/crop residues.	Learners should be able to: ▶ appreciate the motivation of people and organizations who have protected forests or engaged in reforestation/ restoration of mangroves/stopping desertification (referring to the carbon cycle). ▶ show concern over practices in their area which lead to increased CO_2 levels. ▶ show concern about preserving/ restoring forests and preventing desertification, and appreciate the benefits to people and animals, relating this to the carbon cycle.	Learners should be able to: ▶ investigate and, where appropriate, support organizations in their country which protect forests/support planting of indigenous trees/mangroves, thereby increasing the storage of CO_2 as biomass. ▶ raise awareness of the harmful effects of using fossil fuels and support the use of alternative energy sources, engaging with family and in schools and other organizations with which they are associated.

KEY IDEA: Life is carbon-based. In the natural carbon cycle, carbon flows between living organisms, the air, the oceans, soil and rocks, remaining in these reservoirs for different lengths of time. In particular, the burning of fossil fuels releases long-stored carbon as CO_2. Harvesting of trees releases their carbon as CO_2 through combustion or when wood products decay, and thus forest maintenance is needed to avoid net emission of CO_2.

13-15 years

Learners should be able to:

- describe the natural carbon cycle.
- compare the amounts of carbon dissolved in the ocean, stored in ocean floor rocks and sediments, fossil fuels, soil, and peat, and present in the atmosphere and living organisms.
- describe key fossil fuels, their uses, impact on CO_2 levels and associated pollution.
- describe the role of the oceans in storing carbon and its movement within the thermohaline circulation.
- consider the effects on sea life of increased acidity due to dissolved CO_2.
- research the effects of warming oceans on a particular kind of sea animal or plant, such as coral reefs.

Learners should be able to:

- appreciate the contributions of some global, national, local heroes of environmental action and aspire to follow in their footsteps.
- value the natural environment and express the desire to preserve it for future generations, potentially citing role models such as Wangari Maathai, the Chipko activists and others.
- express appreciation of volunteers and workers who undertake forest maintenance, promote regeneration and act to prevent desertification.
- appreciate the beauty of coral reefs and the biodiversity they support, and value efforts to protect or restore them.

Learners should be able to:

- raise awareness of the carbon cycle, including the role of oceans through developing and sharing informative materials as a whole school activity and with family and community-based organizations.
- Organize or participate in events or initiatives that promote sustainable living, such as eco-friendly workshops, zero-waste challenges, or community clean-up efforts.

KEY IDEA: The carbon cycle is the process whereby carbon compounds are interchanged among the biosphere, the atmosphere, the lithosphere (rocks), the soil and the hydrosphere.

16-18 years

Learners should be able to:

- describe carbon flux between various stores in the atmosphere, lithosphere, soil, hydrosphere, and biosphere, considering the time scales involved, and analyse a specific problem(s) related to changes in the carbon cycle.
- explain the finite nature of fossil fuels and their impact on the environment.
- explore indigenous/traditional methods of nature conservation and lifestyle, and their effects on the carbon cycle.
- investigate the potential of using methane from waste (e.g. using digesters) and practices that can reduce methane emissions in their region.
- make a simple computation of their own carbon footprint.
- analyse the emissions associated with selected products or industries, globally and in their region, which give rise to a high carbon footprint.

Learners should be able to:

- cultivate an attitude of care towards the carbon-based ecosystems on this planet, expressing their concerns in terms of respect for life.
- express concern and ideas about 'fair' sharing of finite resources and a quality environment globally and across different generations. (See Key Concept 3 Climate Justice.)
- feel empathy for populations affected by extreme weather events associated with global warming. (See Key Concept 4 Resilience Building.)
- feel concern over the imbalance in the carbon cycle and motivated to adopt and encourage others to adopt new behaviours to reduce the emissions of GHGs such as CO_2 and methane.

Learners should be able to:

- reduce their carbon-based energy consumption and conserve energy and resources to protect the environment and meet the needs of future generations, and respond to those affected by extreme weather events, acting with peers in school, youth or other organizations, as appropriate.
- encourage family and friends to reduce their respective carbon footprints.

	KEY IDEA: The carbon cycle can enable absorption of some human-related CO_2 emissions, and new technologies are under development for 'carbon capture,' which may help reduce people's 'carbon footprint.' Reducing emissions is still a priority.		
18+	Learners should be able to: ▶ explain that using biomass as a fuel requires vegetation replacement or carbon capture to reduce CO_2 levels. ▶ describe natural processes that householders and architectural designers can use to naturally heat and cool buildings, reducing use of fossil fuels. ▶ explore indigenous/traditional approaches to nature conservation and lifestyle, in terms of their impact on the carbon cycle. ▶ discuss how businesses, farmers and influencers can address climate-related ecosystem/ biodiversity concerns. (See Key Concepts 2 Ecosystems and Biodiversity, 5 Post-Carbon Economies and 6, Sustainable Lifestyles.) ▶ investigate how students can investigate heat and energy leakages from their homes, schools, and community buildings and reduce their energy usage. ▶ illustrate the processes of environmental/climate impact assessments for proposed initiatives,	Learners should be able to: ▶ show appreciation of indigenous and traditional practices that support forest and soil preservation. ▶ express their motivation to minimize CO_2 emissions, sequester carbon, adopt regenerative agricultural and fishery practices, and adopt low-carbon technologies/lifestyles. (See Key Concepts 2, 5, 6.) ▶ express concern for climate justice and how to equitably share our common heritage with future generations, and for the impact of extreme weather events on vulnerable populations. (See Key Concepts 3 Resilience-Building and 4 Climate Justice.)	Learners should be able to: ▶ advocate for carbon neutrality in local and global contexts e.g. through lobbying elected representatives and policy makers to enact legislation and policies that promote carbon neutrality e.g. spearhead initiatives for urban or rural reforestation and carbon offsetting. ▶ introduce energy-saving/clean energy approaches in their field of work. ▶ engage in advocacy, debate, and negotiations locally, nationally and globally to reduce carbon footprints and find ways to increase carbon capture naturally or through new technologies.

Topic 1.4. The water cycle

The global demand for fresh water is increasing. Atmospheric water vapour condenses and forms clouds, from which water precipitates as rain, snow and hail, infiltrating the land surface or forming run-offs that enter lakes, rivers and the sea. Water vapour is returned to the atmosphere by evaporation and through transpiration from plant life. Global warming causes more evaporation of surface water; warm air can hold more water, thereby having a feedback effect on global warming (since water vapour is a GHG). Global warming affects ocean (thermohaline) circulation and leads to ocean acidification, thermal expansion, ice melt and sea level rise. The ocean plays a major role in regulating climate through heat absorption and carbon storage. Global warming leads to more extreme events in the water cycle such as hurricanes, rainstorms and associated flooding as well as prolonged periods of drought. Under some climate conditions, many conventional agricultural practices and deforestation can lead to the drying out of the natural environment and the loss of ecosystem integrity, disrupting large- and small-scale natural water cycles and lowering water tables, and increasing salinity, which can be caused also by sea level rise and storm surges. The lives and livelihoods of millions of people are thus at risk, necessitating remedial and preventive action, such as measures for flood protection and active support for water conservation in personal life, agriculture and industry, together with avoidance of water pollution.

	Cognitive	Social and emotional	Behavioural
	KEY IDEA: Water is important for humans, animals and plants. Our life depends on water. It falls from clouds as rain, snow, ice or hail and then enters groundwater/rivers/seas, returning to the air to form clouds		
5-8 years	Learners will be able to: ▶ explain that water makes up over half our body, and we need to consume it daily. ▶ illustrate how water forms steam when boiled, and then enters the air as invisible vapour. ▶ analyse how water evaporates at different rates depending on temperature. ▶ describe the water cycle in simple terms, analysing why water vapour in the air forms clouds and why rain/snow/hail fall.	Learners should be able to: ▶ affirm their sense of agency, problem-solving skills and care through the creation of a water-related story, showing social and emotional dimensions.	Learners should be able to: ▶ identify when cultivated plants need watering and assist when appropriate. ▶ conserve water through changing their routines such as turning off taps after use, collecting rainwater, using leftover water from drinking to water plants etc
	KEY IDEA: Fresh water is key to human life, and its availability is affected by global warming in ways that vary between geographic regions, e.g. in deserts vs. downstream of shrinking glaciers.		
9-12 years	Learners should be able to: ▶ identify geographic regions where the supply of water for households, as well as for agriculture and industry, is plentiful or problematic. ▶ cite evidence that rising temperatures are melting polar ice and glaciers, affecting habitats and causing sea level rise, together with increased salinity of drinking water in some coastal regions. ▶ collect/analyse data showing how specific small island states and coastal areas will be affected by sea level rise, especially during storms. ▶ compare the impacts of climate change on freshwater resources for two different communities e.g. a family dependent on Himalayan glacial melt for fresh water and a family living on a small island state dependent on groundwater.	Learners should be able to: ▶ demonstrate compassion towards people, animals and plants affected by decreased availability of fresh water due to climate change and extreme weather events. ▶ show empathy for people and animals affected by melting ice and glaciers, or sea level rise, with examples, and discuss the implications for their own attitudes towards taking action on climate change.	Learners should be able to: ▶ take care of the water around them, as appropriate, e.g. protecting and caring for a local water tank/rain collection device; avoiding waste of clean or used water; take steps to keep water supplies clean and dispose of wastewater appropriately.

13-15 years

KEY IDEA: The water cycle is affected by global warming, e.g. evaporation from oceans is increased. Weather patterns are affected by changing temperatures leading to more flooding and drought. The El Niño cycle in the Pacific Ocean affects weather patterns globally.

Learners should be able to:

- explain the natural water cycle of evaporation, condensation, sublimation, precipitation, transpiration, run-off and infiltration, and changes due to global warming, such as increased storms, flooding and drought.
- measure rainfall and safely observe levels of rivers, wells, etc. in their home area, maintaining records.
- explore and map their local water catchment area and its boundaries and interactions with other areas.
- give a simple description of the oceanic (thermohaline) circulation, its effect on regional climates and its vulnerability to climate change.
- cite evidence of how the El Niño cycle in the Pacific affects weather globally and in their region.

Learners should be able to:

- show concern for people affected by the impacts of global warming on the water cycle, recognizing the potential for increased storms, flooding, and drought, and understand the emotional toll on affected individuals.
- develop emotional resilience for climate change's extreme weather by journaling emotions, role-playing community responses, and practicing adaptation strategies.

Learners should be able to:

- engage with local communities and organizations to raise awareness about the impact of global warming on the water cycle and collaborate on initiatives that promote water conservation, sustainable practices, and resilience to weather-related challenges, with special focus on the needs of vulnerable populations.
- demonstrate the ability to adopt and promote behaviours that contribute to mitigating global warming, such as reducing their 'carbon footprint' and advocating for sustainable practices, aiming to minimize adverse effects on the water cycle.

16-18 years

KEY IDEA: Fresh water is a scarce resource, dependent on the water cycle. Domestic water supplies often require treatment to remove infectious organisms and pollution from agriculture/industry/waste disposal/salination. Techniques exist for producing fresh water by desalination but require energy, often from fossil fuels.

Learners should be able to:

- describe the water cycle; show that water vapour is a short-lived GHG removed from the atmosphere by precipitation.
- describe how global warming and El Niño cycles affect water supplies, including through drought and flooding, and sea level rise/coastal storms.
- give examples of sources of fresh water, and human dependence on its availability and purity.
- Analyse threats to freshwater supplies and suggest possible remedies.
- assess the relevance of potential water purification methods such as chlorination, sedimentation, filtration, evaporation, desalination, and of water storage methods.
- cite examples of water pollution, and critically analyse the impact on affected ecosystems and communities, the responsibilities of relevant people and organizations to remove the pollution and the need to legislate or enforce legislation on water quality. (See Key Concepts 2 Ecosystems and Biodiversity and 3 Climate Justice.)
- give examples of life cycle assessment of selected products, including the energy and resources used to make and dispose of them, linking this to their carbon and water footprints as appropriate. Compare this with indigenous/traditional lifestyles.

Learners should be able to:

- show concern over access to fresh water and adequate sanitation in their own locality/country and discuss how to encourage people to address these issues fairly and with empathy for others. (See Key Concept 3 Climate Justice.)
- make a personal commitment to support the equitable supply of water, food, shelter, and medicine to vulnerable and displaced people when the opportunity arises. (See Key Concept 4 Resilience-Building.)

Learners should be able to:

- advocate for behaviours that contribute to water conservation, including responsible usage and waste reduction, aiming to address the issue of freshwater scarcity, with especial attention to the needs of vulnerable populations. (See Key Concept 3 Climate Justice.)
- initiate and lead water conservation campaigns in their schools or with youth or other organizations in their neighbourhoods.
- adopt energy-efficient practices and, where relevant, support the use of renewable energy sources in desalination processes, to minimize the environmental impact of freshwater production.
- adapt workplace processes (if applicable) and personal/family lifestyle in support of water conservation and purity.

18+	**KEY IDEA: Human-induced global warming and other activities have affected the water cycle. Competition over water supplies and prolonged drought can fuel conflict and migration from affected areas. Water-saving techniques include preventing over-use by households, agriculture and industry, and avoiding pollution.**		
	Learners should be able to: ▶ identify the main processes involved in the water cycle and changes in rainfall patterns, storms and drought attributable to global warming as well as the El Niño cycles. ▶ give examples of the impact of drought on agricultural livelihoods and the effects of flooding/sea level rise/ salination on affected communities. ▶ assess the impact of human activities on water supplies, and compare options such as desalination, enhanced storage, and water pricing policies. ▶ demonstrate an understanding of the concept of a 'water footprint' and distinguish between consumer items that have higher or lower embodied water. ▶ explore the ethical dimensions and social justice implications of the need to equitably share access to scarce or limited water resources (see Key Concept 3 Climate Justice), and its relevance to preventing conflict locally and internationally.	Learners should be able to: ▶ express concern over the impact on community members and fellow citizens of water scarcity, flooding, or polluted water supplies. ▶ use communication, negotiation, and collaboration skills across diverse social groups, needed to support climate-related advocacy and action.	Learners should be able to: ▶ mobilize goodwill/take action to remedy or mitigate risks of water-related issues that affect their community/country/region, having regard to needs of the most vulnerable groups and social justice. (See Key Concept 4 Climate Justice.) ▶ engage in activities that preserve water quality and minimize the impact of pollutants. ▶ demonstrate youth leadership in promoting sustainable water management practices. ▶ engage in advocacy, debate and negotiations locally, nationally and globally to address issues of water supply, droughts and flooding.

Topic 1.5. Avoiding pollution and conserving resources

Pollution affects not only human health but the Earth's climate and ecosystems. Human pollution of the lower atmosphere includes sulphur and nitrogen oxides, carbon monoxide, particulate matter and more. Pollution of the stratosphere with fluorine compounds such as chlorofluorocarbons (CFCs) can damage the ozone layer. Agrichemicals, animal waste, sewage, mining, and industrial waste (among others) damage water supplies and ecosystems. (See Key Concept 2 Ecosystems and Biodiversity Topic 2.4 Human Relation to Nature: Domestication and Agriculture.) Earth's resources are limited. Extracting metals from ores uses energy and creates waste, as well as reducing their availability to future generations. Concepts such as Refuse (avoid unnecessary purchases), Re-use, Repair and Recycle (RRRR) can reduce pollution as well as saving finite resources and reducing energy use and associated GHG emissions. (See Key Concept 6 Sustainable Lifestyles and Key Concept 5 Post-Carbon Economies Topic 5.2. Post-Carbon Economy and Everyday Life.)

	Cognitive	Social and emotional	Behavioural
	KEY IDEA: Human activity affects air quality and water quality. Littering affects quality of life, whereas RRRR reduces energy and resource use and pollution.		
5-8 years	Learners should be able to: ▶ describe and give examples of some forms of littering and of air/water/land pollution in their area. ▶ explain that the Earth has limited resources for making new things and describe the benefits of recycling. ▶ suggest types of recycling that they see in their community and draw a map of recycling sites and waste dumps (where applicable).	Learners should be able to: ▶ appreciate clean and healthy environments, highlighting the emotional benefits of a tidy space and the joy it brings to individuals and communities. ▶ show awareness of the connection between actions and environmental well-being. ▶ express positive feelings associated with working together to care for nature.	Learners should be able to: ▶ engage in age-appropriate re-use or repurposing activities. ▶ participate in activities that actively discourage littering. ▶ share resource conservation tips with family members or friends.

9-12 years

KEY IDEA: Pollution of air, water and soil threatens sustainability and can affect the climate. Conserving Earth's resources can also reduce energy use, e.g. through RRRR.

Learners should be able to:

- assess the impact of littering on the environment and quality of life for humans and other species, including pollution of oceans by plastics (which take energy to create, and which slowly disintegrate releasing CO_2) and by oil leaks from shipping and pipelines.
- explain how mining may destroy vegetation and create large amounts of waste/pollution (linking this to resource conservation through RRRR).
- give examples of extraction processes which produce CO_2 directly (e.g. in production of aluminium, iron and cement) and/or due to energy requirements, and how such resources can be conserved by RRRR.

Learners should be able to:

- share their feelings about the environment, expressing joy about clean parks or concern about litter.
- express appreciation of champions of the environment, and of those who protect forests and wildlife in designated nature reserves.
- show appreciation of indigenous concerns to protect nature from pollution and harm.

Learners should be able to:

- take action to preserve nature/ their natural environment in their community with the help of parents or teachers such as through nature walks and small clean-up activities, taking health and safety precautions.
- implement the principles of RRRR in daily activities. Recycle according to the rules of their community/ municipality.
- adapt their lifestyles and purchases to avoid single use plastics and promote sustainable consumer choices.

13-15 years

KEY IDEA: Chemicals, like fluorine compounds from refrigeration, harm the ozone layer, increasing UV radiation. The nitrogen cycle, while aiding crop growth via bacterial fixation, poses risks from fertilizer runoff, causing water pollution and ecological damage.

Learners should be able to:

- describe the ozone layer in the stratosphere and that it absorbs ultraviolet radiation from the sun, thereby protecting life on Earth.
- distinguish damage to the ozone layer in the stratosphere (caused, e.g. by fluorine compounds used in certain products) from the effects of GHGs (including both ozone and the fluorine compounds when in the lower atmosphere) which cause global warming by restricting the radiation of heat (infrared radiation) from the Earth's surface into space.
- explain the nitrogen cycle, including fixation of nitrogen by bacteria, and describe the adverse effects of fertiliser run-off into rivers, giving local examples where possible.
- explain the adverse consequences of nitrate conversion to nitrous oxide (a greenhouse gas) by bacteria, with increased particulate matter formation in the air and potential damage to the ozone layer in the stratosphere.
- consider ways of reducing nitrogen-related pollution (e.g. where relevant, the suggestion of placing urea fertilizer deeper in soils to reduce run-off).

Learners should be able to:

- show appreciation of international collaboration to restrict the use of gases that harm the ozone layer, as a way of protecting people and species from harm.
- appreciate the interconnectedness between human activities and environmental well-being.
- develop a sense of responsibility towards reduction of pollution.
- express empathy for the impact of nitrogen pollution on aquatic ecosystems.

Learners should be able to:

- raise awareness of family and friends on the harmful effects of GHGs on global warming of the lower atmosphere and of certain chemicals that reach the stratosphere and thin the ozone layer.
- support their school, local youth groups and/or other organizations in assessing harmful effects of nitrates and nitrous oxide in their area/region, and in follow-up actions, in raising awareness of the potential harms associated with fertilizer use.
- participate in community-based environmental projects, such as implementing sustainable farming practices or participating in local watershed protection initiatives.

16-18 years

KEY IDEA: Pollution and waste can harm human health, damage ecosystems and increase global warming. Conserving resources through RRRR can reduce pollution directly and through lesser rates of waste-producing resource extraction.

Learners should be able to:

- describe the health impacts of industrial and vehicular emissions, and distinguish between pollutants causing greenhouse effects and those harming the ozone layer.
- recognize the contribution of plastics to greenhouse gas emissions and microplastic contamination throughout their lifecycle.
- apply problem-solving skills to devise strategies for resource conservation and pollution reduction, considering the needs of vulnerable populations and ecosystems in their region.
- evaluate the necessity of legislation and pricing systems enforcing extended producer responsibility and product recycling, discussing the feasibility and modalities of implementing the 'producer pay' principle.

Learners should be able to:

- cultivate self-awareness and social consciousness regarding their role in preventing pollution, fostering a safe environment for humans and wildlife, and conserving ecosystems.

Learners should be able to:

- collaborate with school management and local youth groups/other organizations to raise awareness of, measure and address pollution-related challenges.

18+

KEY IDEA: We can take action for pollution reduction and resource conservation at local, national and global levels. Responsibility for creating pollution rests on individuals, farms, and firms/organizations. We can practice RRRR and use non-polluting technologies to conserve ecosystems and resources, protect health, and lessen global warming.

Learners should be able to:

- identify major types and sources of pollution in the region. Discuss whether this impacts more severely on vulnerable groups, and the action needed for social justice.
- compare levels and types of resource use and pollution in indigenous/traditional and modern lifestyles.
- compare how much energy is required to use virgin materials instead of recycled and the impact of each on the natural environment.
- explain the resource requirements associated with various types of construction practices and building materials and compare their benefits and challenges in terms of resource conservation and climate change impact.
- assess the potential of RRRR to improve the quality of life in the community and region, and conserve ecosystems.
- evaluate the potential of standards and labelling to improve the rates of RRRR.
- explain approaches to certification of renewable inputs such as 'renewable portfolio standards' and how legislation and pricing systems that extend producer responsibility can enhance the rate of RRRR.

Learners should be able to:

- feel a sense of obligation to promote sustainable practices at local, national and global levels, and conserve resources for future generations.
- express concern over high levels of pollution that damage health and quality of life especially for vulnerable groups, e.g. in housing areas with low levels of amenities and services.
- value indigenous and other traditions that conserve resources and protect ecosystems and biodiversity.
- use communication, negotiation, and collaboration skills across diverse social groups, needed to support climate-related advocacy and action.

Learners should be able to:

- engage with fellow students and community organizations to study and take measurements of pollution in their area.
- collaborate with local authorities and CSOs to develop pollution control policies and promote sustainable practices.
- support or apply climate-friendly and less resource-intensive practices in crop management and irrigation (agriculture); sustainable use of timber and forest rehabilitation (forestry); wastewater treatment and rainwater management (water management); waste-to-energy techniques and entrepreneurship using waste products and materials.

Topic 1.6. Renewable energy

Progress towards the use of renewable energy can provide a sense of hope at a time when global warming appears to be making life harder for many people and damaging ecosystems and biodiversity. Modern lifestyles depend, to a large extent, on energy from combustion of fossil fuels, resulting in GHG emissions. Renewable energy sources include solar, wind, water, and geothermal technologies, as well as biomass. Combustion of biomass (e.g. wood, crop residues) is sustainable only if new biomass is created that will compensate for the CO_2 emissions. Nuclear power does not directly emit GHGs but is not classified as renewable since there are limited supplies of nuclear fuel; nuclear power stations create radioactive waste that lasts for tens or hundreds of thousands of years and must be safeguarded throughout that time. (See also Key Concept 5 Post-Carbon Economies Topic 5.4 Energy Consumption and Carbon Emissions and Key Concept Sustainable Lifestyles Topic 6.2 Renewable Energy Use and Topic 6.7. Sustainable Waste Practices.)

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Use of fossil fuels creates GHGs that can cause climate change. Fossil fuels are a finite resource that cannot be renewed. Renewable energy can be obtained from sunlight and the movements of wind and water, without producing GHGs.**		
	Learners should be able to: ▶ give examples of different types of energy, e.g. the energy in our body to do things, energy supplied by burning fossil fuels in car engines or for cooking and heating. ▶ give examples of fossil fuels and explain that they were formed long ago and are not renewable, and that their use causes global warming. ▶ compare weather conditions that favour use of other energy sources such as solar energy or wind energy to create electricity. ▶ share stories about sources of energy, helping communicate their understanding of why it is important to care for our planet.	Learners should be able to: ▶ feel proud and happy when they help take care of the Earth, like turning off lights or using less water. ▶ feel safe knowing that when they take care of the Earth, it helps keep their homes and communities safe and beautiful.	Learners should be able to: ▶ participate in simple Earth-friendly activities such as planting seeds, turning off lights when not needed, or creating posters that show why it is important to save energy.
9-12 years	**KEY IDEA: Renewable energy can often replace the combustion of fossil fuels, and thus reduce greenhouse gas emissions.**		
	Learners should be able to: ▶ describe in simple terms selected renewable energy resources such as solar radiation, wind, water. ▶ compare the potential of different renewable energy technologies to reduce global warming (e.g. solar photovoltaics, solar thermal, hydropower). ▶ analyse conditions under which use of wood/charcoal/other biomass as fuel is sustainable (requires replacement of the trees or other plant materials used).	Learners should be able to: ▶ value and argue persuasively for the use of renewable energy, explaining how it can reduce the problems that global warming is causing and may cause in future to humans and ecosystems. ▶ develop a sense of responsibility for the environment, demonstrating understanding that their choices and actions can positively impact the planet.	Learners should be able to: ▶ discuss the potential of renewable energy sources with fellow students (as part of a whole school approach), family and friends, together with possibilities for insulation of buildings, use of shade, etc. and the need to replace biomass after its use as a fuel. ▶ engage in imaginative play, art or writing that might involve a world or setting powered by the sun and wind.

13-15 years

KEY IDEA: Renewable energy resources include solar, wind, hydro, geothermal, tidal, wave and biomass. Electricity obtained from nuclear power stations does not generate CO_2, though radioactive waste needs appropriate disposal. Nuclear energy is not categorised as renewable since nuclear fuel is used up.

Learners should be able to:

- identify in simple terms the scientific basis of selected types of renewable energy (e.g. gravity for hydropower).
- discuss the advantages and disadvantages of renewable energy sources (e.g. solar power and wind power are intermittent since they depend on the time of day and weather conditions, respectively), and be able to match them to uses (e.g. solar for electricity and some heating purposes)
- critically analyse types of energy use in their home area in terms of renewability.
- collect and analyse evidence on the extent to which particular types of biomass use in the area are sustainable.

Learners should be able to:

- make a commitment to supporting the development and use of renewable energy.
- value remaining forests and trees and commit to restoring nature and to reducing the use of wood as fuel where this harms ecosystems and biodiversity.

Learners should be able to:

- engage in hands-on problem-solving challenges related to renewable energy, using critical thinking and creative solutions.
- raise awareness of renewable energy options within the school, youth groups and other organizations, and online, including sharing video clips.

16-18 years

KEY IDEA: Renewable energy technologies, together with approaches such as better building design and insulation, can reduce the use of fossil fuels and help achieve 'net zero'.

Learners should be able to:

- explain the science behind renewable energy technologies crucial for achieving 'net zero' emissions.
- provide examples of indigenous and traditional practices incorporating renewable energy.
- analyse the 'net zero' concept, emphasizing the transition from fossil fuels to renewable energy sources.
- evaluate the pros and cons of different types of renewable energy, as well as nuclear power.

Learners should be able to:

- appreciate ways in which renewable energy already supports their lives.
- appreciate indigenous/traditional sustainable energy use.

Learners should be able to:

- explore with family members the potential of renewable energies as well as better insulation/shading to lessen CO_2 emissions for heating and cooling.
- advocate with fellow students for increased use of renewable energy in their school and by businesses/organizations in their area.

18+

KEY IDEA: Increased energy efficiency and use of renewable energy are central to achieving 'net zero'.

Learners should be able to:

- differentiate between renewable and non-renewable energy sources, also considering their relationship to indigenous lifestyles.
- analyse the suitability of renewable energy technologies and of nuclear power as sustainable energy sources. Describe the falling comparative costs of renewable power.
- utilise resources like the World Bank's Global Wind Atlas, Global Solar Atlas, and IRENA's Global Atlas for Renewable Energy and its Database, to access region-specific energy data.
- describe the fundamental science behind renewable energy sources and related employment opportunities in their region.

Learners should be able to:

- show self-awareness in discussing with peers how to move towards personal 'net zero' emissions/a lower carbon footprint.
- show appreciation of forests for their beauty, as a habitat and carbon sink, and of preservation of old wood native forests.

Learners should be able to:

- adapt to changing climate conditions and understanding, e.g. through uptake of renewable energy, building sustainable and energy-conserving infrastructure for homes and workplaces and developing related green skills.

Key concept 2

Ecosystems and biodiversity

Key topics

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Definition

Natural environments are defined as the (bio)diversity of animals and plants, their relationships with each other (at different levels: individuals, communities, and species) and the interaction of animals and plants with natural elements such as minerals in the soil, water, and sun. Combined, these define the local ecosystem.

Humans are a humble part of nature and are dependent on it for survival. Biodiversity and ecosystems provide food, shelter, health, clothing, recreational, artistic and spiritual needs. Human impact on nature has not always been positive, however. Domestication of plants and animals has altered the course of natural evolution in species to benefit human needs, in food production, medicines, building and so on. Both natural and human-shaped environments have limited resources, and only sustainable management and a reduction of human consumerism activities can decrease the pressure on nature and maintain a healthy balance.

However, around the globe, individuals, communities, CSOs, and countries are combatting the disconnection with nature, and pledging for nature conservation. Scientists work to understand better ecosystems and biodiversity and to propose conservation solutions. Education has a key role to play in empowering learners of any age to connect with nature, through understanding better the science of land and ocean biodiversity and ecosystems, eco-anthropology, by practicing sustainable agronomy; and experimenting with ways of connecting to nature through outdoor education plans.

Key ideas and learning outcomes per topic per age group

Topic 2.1. Natural environments: ecosystems and biodiversity (land and ocean)

Biodiversity is a scientific definition of the variability among living organisms from all sources, including, inter alia, terrestrial, marine and other aquatic ecosystems and ecological complexes. It is important for the learners to understand the concepts as well as experience the richness of animals, plants, or fungus species and how they interact with each other and with the elements such as climate or soil, forming an ecosystem (a complex of living organisms and the abiotic environment with which they interact in a specified location). Knowledge of ecosystems and biodiversity, especially local ones, is a key element for encouraging its conservation.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Ecosystems are animals and plants in interaction with each other, as well as with land and weather.**		
	Learners should be able to: ▶ describe how biodiversity entails different species, both as groups and individual members ▶ identify and contrast how animals/plants are different, including behaviours and habitats. ▶ explain that humankind is also a species and is part of nature.	Learners should be able to: ▶ enjoy spending time in natural environments. ▶ feel appreciation that humans share the planet with other species and are not superior to them.	Learners should be able to: ▶ take care of a natural environment by visiting it, helping out the interactions between species and reducing human impacts. ▶ seek out and enjoy experiences in the wild with family members and friends.
9-12 years	**KEY IDEA: Biodiversity is the variety of plants and animal life in the world/a particular habitat. It is also a broader notion to define nature in non-scientific discussions.**		
	Learners should be able to: ▶ recognize the diverse presence of biodiversity across ecosystems, including urban areas and marine environments. ▶ identify key factors contributing to the sustenance of life on Earth. ▶ recognize the significance of seasonal variations, such as rainfall, temperature changes, and sunlight, in shaping local biodiversity dynamics throughout the year.	Learners should be able to: ▶ feel a connection with local nature by engaging with the sights, sounds, and textures of their local natural environment. ▶ show appreciation for the aesthetics of nature and the dynamics of the ecosystems with the elements (soil, weather…).	Learners should be able to: ▶ encourage the preservation and enhancement of local ecosystems (e.g. through gardening, reforestation, fostering closer connections with nature). ▶ participate in outdoor activities in natural environments (when appropriate) rather than indoor or non-natural environments. ▶ demonstrate a sustained commitment to responsible environmental behaviour in their daily lives through various activities such as collaborating with local environmental organizations or school clubs to identify areas in need of restoration and actively contribute to restoring biodiversity in their community. ▶ spend time in nature and develop their own definition of biodiversity and nature.

13-15 years	**KEY IDEA: Ecosystems are based on interactions between species, and between species with their non-living environment.**		
	Learners should be able to: ▶ describe how a variety of species in a given ecosystem helps it to recover its function when under stress. ▶ describe how humans (and other animals) are ecosystems in themselves, with gut bacteria and viruses for instance. ▶ identify and compare tools to identify and recognize microscopic diversity (e.g. microscopes, filters for marine plankton).	Learners should be able to: ▶ appreciate the psychological benefits of taking care of plants. ▶ appreciate how variability (in friends, food, entertainment) enriches their life, and is an analogy for the importance of diversity in ecosystems.	Learners should be able to: ▶ encourage beneficial species interactions, such as pollination by planting flowers or composting process.
16-18 years	**KEY IDEA: Ecosystems are based on fluxes of matter and energy between elements (weather, sun, soil) and biodiversity at various scales.**		
	Learners should be able to: ▶ describe the large fluxes of matters in place in a specific ecosystem. ▶ explain larger scales and molecule cycles such as carbon, phosphorus, or nitrate between the biosphere, atmosphere and lithosphere. ▶ describe small scale fluxes and energy changes in conditions such as photosynthesis and cellular respiration. ▶ understand middle scale energy fluxes in an organism. ▶ demonstrate complex thinking towards biodiversity.	Learners should be able to: ▶ appreciate the aesthetics of the complexity and the harmony of an ecosystem.	Learners should be able to: ▶ organize and analyse the results of ecosystem surveys, with scientists, park rangers, or CSOs, and share the results with their community.
18+	**KEY IDEA: Ecosystems are dynamic and complex natural systems that include biodiversity, abiotic elements and human activities.**		
	Learners should be able to: ▶ explain the complexity of biodiversity and ecosystems, including in their local environment. ▶ describe that humans are part of any ecosystem. ▶ analyse and discuss how humans shape and impact their natural environments in ways that are stronger than other species.	Learners should be able to: ▶ reflect on their own position and feelings as individuals and as members of the human community in their direct natural environment. ▶ feel connected to biodiversity through meditation, outdoor activities, and nature observation as citizen scientists. ▶ be inspired by biodiversity in their jobs and career choices.	Learners should be able to: ▶ demonstrate an increased awareness and appreciation for the dynamic and complex nature of ecosystems, including biodiversity and human interactions, through contact with nature and the natural environment in their various learning, professional and personal lives.

Topic 2.2. The evolution of biodiversity over time and in the future

Biodiversity is dynamic. Environmental changes induce changes in species migration, extinction or even speciation (formation of a new species). Darwinism is the first theorization of the evolution of species via natural selection. Scientific methodologies, from fossil analyses to genomics, have been able to characterise the processes of evolution through Earth's history. Geological forces have been shaping the evolution of biodiversity since the early ages. Different biodiversity crises, called mass extinctions, have been recorded and identified in past geological times. Our current geological era can be coined as Anthropocene (even if the term is still under debate) as humans are now an important driver of the dynamic of biodiversity. We are entering the sixth mass extinction due to human activities.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Some animals used to live on our planet and are now no longer here (such as dinosaurs).**		
	Learners should be able to: ▶ explain that species are different now than in earlier geological time (such as dinosaurs and birds). ▶ elaborate those geological forces and how human activities are responsible for mass extinction. ▶ conduct individual or group research on extinct animals, such as dinosaurs, to gather information on their characteristics, habitats, and the reasons for their extinction. ▶ imagine and create coherent past or imaginary ecosystems with extinct species.	Learners should be able to: ▶ participate in discussions about the lives of prehistoric creatures based on fossil evidence demonstrating curiosity about the past through inquiry and questioning.	Learners should be able to: ▶ advocate for the memory of the recently extinct species near where they live by building memorials and fostering a culture of conservation that ensures similar losses don't occur in the future. ▶ use their creativity to construct models or sculptures of dinosaurs and their habitats using materials such as clay, rocks, or paint.
9-12 years	**KEY IDEA: Biodiversity is dynamically linked with migration or adaptation.**		
	Learners should be able to: ▶ describe how the evolution of species works. ▶ explain how evolution is driven by natural selection, drawing on examples from the local environment (if applicable). ▶ explain that due to natural or human-induced events, some populations had to migrate to a new territory. ▶ describe and compare how, in some cases, individuals or whole populations have adapted (not evolved) to specific conditions.	Learners should be able to: ▶ appreciate that life evolves through geological time and that animals and plants evolve. ▶ use the arts (poetry, drawings, dance, etc.) to express the aesthetics of nature and the dynamics of the ecosystems with the elements (e.g. soil, weather).	Learners should be able to: ▶ construct evolution trees and share them with their family or community. ▶ observe and describe the changes of a local natural place through the year, according to the seasons (using observation, scientific drawings and data collection).

13-15 years	**KEY IDEA: Evolution of the species is based on environmental pressure that affects the survival of certain individuals. Some will reproduce and spread the favourable characteristics to their offspring while others will be less successful.**		
	Learners should be able to: ▶ explain and contrast the evolution of groups of species through time. ▶ identify past mass extinctions. ▶ define and critique the concept of Anthropocene. ▶ experiment and observe the reproduction of plants or animals to understand the influence of the environment on reproductive traits and the concept of natural selection. ▶ identify human-induced irreversible changes in their local natural environment that led to the extinction of species, and use this information to advocate for changed human behaviour in the present.	Learners should be able to: ▶ feel a connection with historical scientific discoveries and the life of scientists such as Darwin. ▶ appreciate that Earth's biodiversity and ecosystems have resulted from evolution.	Learners should be able to: ▶ organize and participate in awareness campaigns within their schools or communities to educate peers about environmental pressures and their effects on biodiversity.
16-18 years	**KEY IDEA: Individuals that are best adapted to a specific ecosystem have more chance to reproduce and pass on genes, epigenomes, or behaviours to their offspring. This leads to the appearance of new species and the extinction of others.**		
	Learners should be able to: ▶ describe the evolutionary process as a lengthy journey, requiring multiple generations for the dissemination of new traits within populations and the emergence of a distinct species. ▶ research and describe how living things in the present age are adapting to changing conditions. ▶ identify data sources on biodiversity loss, such as the IPBES (Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services), IUCN (International Union for Conservation of Nature). ▶ present specific examples of taxa or biodiversity functions that are endangered (bees, frogs…).	Learners should be able to: ▶ appreciate how living things are the result of thousands/millions of years of adaptation and survival. ▶ experience a sense of connectedness with and empathy towards the broader tree of life, recognizing the interconnectedness of all living things within an ecosystem. ▶ demonstrate ethical considerations regarding the role humans play in the natural world.	Learners should be able to: ▶ initiate educational campaigns or workshops within the community to share knowledge about the impact of better adapted individuals on the tree of life, emphasizing the significance of biodiversity and ecological balance. ▶ share with the local community concerns about local and global species extinctions and the linkages with climate change.
18+	**KEY IDEA: Biodiversity patterns around the globe have been linked with global geological changes in the past.**		
	Learners should be able to: ▶ describe the tectonic plate and illustrate how it can cause changes in species populations. ▶ explain how atmospheric composition has evolved through Earth history in line with biodiversity. ▶ describe the principle of the molecular clock. ▶ define and contrast the different types of genetic mutations.	Learners should be able to: ▶ create a timeline of significant geological events in their local area demonstrating respect for the power and influence of the geosphere, atmosphere, and oceans on shaping the natural environment. ▶ participate in simulations or role-playing activities that model natural selection to discover how small changes over time can lead to big adaptations.	Learners should be able to: ▶ investigate, interpret and present to others the historical links between biodiversity patterns worldwide and global geological changes through the analysis of relevant scientific literature, maps, and data. ▶ engage in citizen science projects focused on documenting biodiversity patterns and global geological changes. ▶ use hashtags related to biodiversity conservation and evolution to reach a wider audience and spark discussions on social media platforms.

Topic 2.3. Ecosystems, biodiversity and ecosystem services

Biodiversity provides various benefits (or ecosystem services) that are crucial to sustain ecosystems, help regulate climate, and meet various human needs. Without healthy ecosystems and biodiversity, human populations are at risk. Only sustainable management and use of these ecosystems' benefits/services can ensure the perennation (survival from generation to generation) of human populations. All types of human societies need nature to provide them with goods and services. However, modern ways of living (involving urbanization and industrialism) have sometimes used too many natural resources, depleting ecosystems and damaging biodiversity. Indigenous and more traditional ways of living impact the natural environment less.

	Cognitive	Social and emotional	Behavioural
	KEY IDEA: We need nature for every kind of activity and natural resources are not infinite.		
5-8 years	Learners should be able to: ▶ identify how daily life activities are linked with plants, animals and/or the natural environment (resources for food, clothes, houses, etc.). ▶ appraise how some human technology is inspired by natural elements (called biomimetics, such as helicopters and some maple fruits for instance). ▶ explain that natural resources can regenerate but are not infinite.	Learners should be able to: ▶ create a gratitude list for the ways nature supports our daily lives (clean air, water, food), demonstrating appreciation for the natural world. ▶ brainstorm inventions or solutions inspired by natural elements in small groups, demonstrating creativity and open-mindedness to learning from nature.	Learners should be able to: ▶ build items from natural resources for their own use or use by others in their family or school. ▶ create new items inspired by nature and share with others. ▶ promote respect for ecosystems and natural resources through recycling, reuse, or composting. ▶ reduce their consumption patterns (see also Key Concept 6 Sustainable Lifestyles)
9-12 years	**KEY IDEA: Ecosystems provide us with material and immaterial services.**		
	Learners should be able to: ▶ describe and differentiate how specific plants, such as trees/forests, sea algae and planktons, specifically are important for the climate. ▶ analyse the different kind of benefits provided by ecosystems to human populations. ▶ explain how our natural resources are not infinite, and that mining goods, fossil fuel, plants and animals have finite quantities on our planet.	Learners should be able to: ▶ demonstrate awareness of the various ways we benefit from healthy ecosystems such as through activities like creating a concept map to categorize the different material and immaterial services that ecosystems provide us. ▶ organize a class debate or role-playing activity to advocate for the importance of ecosystem services, demonstrating empathy for the impact human actions have on the environment.	Learners should be able to: ▶ take care of plants for example, through growing them from seedlings. ▶ monitor their own/family/community extraction of natural resources over a period of time and develop a plan to reduce it.
13-15 years	**KEY IDEA: Ecosystems and biodiversity provide ecosystem services to sustain itself and regulate climate.**		
	Learners should be able to: ▶ Compare the roles of species diversity in ecosystem self-regulation, including the functions of decomposers and umbrella species. ▶ Articulate the connections between climate patterns and biodiversity. (See Key Concept 1 Climate Science.) ▶ Demonstrate an understanding of photosynthesis as a pivotal process in sequestering CO_2 from the atmosphere and incorporating it into the biosphere.	Learners should be able to: ▶ show empathy towards the different species of a local ecosystem, even if they are not iconic. ▶ reflect on what is essential and what is superfluous in their daily life in a modern society. ▶ appreciate and relate to indigenous respect and care for the environment. ▶ imagine how they could live their life with less impact on local and global ecosystems.	Learners should be able to: ▶ identify and develop activities that can be carried out with others to protect a specific local ecosystem. ▶ enhance a local decomposing ecosystem through composting. ▶ invest time and energy in mitigation/adaptation projects for a better climate that involve biodiversity. ▶ reduce their consumption of natural resources and encourage others to do so.

16-18 years	**KEY IDEA: Fluxes of energy from ecosystems are important for human activities and urbanization has negative impacts on biodiversity.**		
	Learners should be able to: ▶ Describe and compare the different ways that we can produce electricity as renewable and non-renewable. (See Key Concept 6.2) ▶ explain how fossil fuel comes from ancient biodiversity that is fossilised. ▶ outline the processes of energy transfer from plants to humans through biodiversity (plant energy stored in wood or fossil fuel and then used in various human activities). ▶ illustrate how thermos-industrial societies are based on the usage of such fossil fuel. ▶ explain how modern ways of building cities, houses and so on impact climate and biodiversity.	Learners should be able to: ▶ imagine new ways of living more sustainably with less consumption. ▶ imagine cities that enable more contact with nature. ▶ share ideas in small groups and collaborate to develop creative solutions that promote a more sustainable lifestyle.	Learners should be able to: ▶ reduce their use of electricity by saving energy, reducing use of electrical appliances. ▶ increase the presence of nature in cities by actively promoting tree protection, gardens, and parks.
18+	**KEY IDEA: There are various ways of using natural resources for human needs and various levels of regulations on the use of natural resources.**		
	Learners should be able to: ▶ explain and compare various industrial and socio-economic models of human society that differently impact ecosystems and natural resources. ▶ explain the various and complex political and socio-economic roots and consequences of the human use of nature. ▶ compare local and national laws and regulations on the use of natural resources. ▶ describe how lobbying by certain groups for increased access to natural resources can affect laws and regulations that allow for increased use of these resources.	Learners should be able to: ▶ envision other ways of seeing nature and natural resources, such as indigenous peoples' ways. ▶ recognize their own role and responsibility to influence the content of local and national laws and regulations on the use of natural resources.	Learners should be able to: ▶ explore alternative methods of utilizing natural resources in their local environment, drawing from indigenous or traditional knowledge. ▶ advocate for laws and regulations that support sustainable ways of using natural resources.

Topic 2.4. Human relation to nature: domestication and agriculture

Most of the land on Earth has domesticated biodiversity on it and humans have shaped entire landscapes for their benefit. Since the industrial revolution, agricultural practices have been industrialized in a lot of countries, with the use of mechanisation and chemicals to increase yields. Humans benefit in terms of health and food security. However, at the same time, human agricultural activity heavily affects biodiversity with the increase of pollution in the soil, the effects of pesticides on insects, plants or even humans, and even on the climate with the emission of GHGs. Agriculture is highly linked with human populations' diets so considering plant-based protein diets is an important lever to mitigate climate change. Sustainable farming, such as permaculture, organic, agroforestry and small-scale farming, tends to be more resilient towards climate change and have fewer negative impacts on climate and biodiversity.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: The food we eat comes from plants and animals.**		
	Learners should be able to: ▶ analyse the dietary habits of selected species, including their consumption of both plants and animals ▶ describe the basic nutritional needs of humans according to their stage of life (e.g. baby, child, youth, adult, elder). ▶ research and compare different diets and food cultures from around the world.	Learners should be able to: ▶ reflect on the importance of plants and animals in food use in a creative style (such as a song, dance or poem) expressing appreciation for their role in sustaining life.	Learners should be able to: ▶ adopt sustainable eating habits by making informed choices about the sources and production methods of food.
9-12 years	**KEY IDEA: Farming transforms biodiversity.**		
	Learners should be able to: ▶ define the term agrosystem (an ecosystem where agriculture is dominant) and explain how it has been shaped by humans. ▶ describe how farmers work directly with principles of biodiversity and weather. ▶ analyze and explain how biodiversity and healthy ecosystems are important for farming.	Learners should be able to: ▶ develop a sense of responsibility towards agricultural practices. ▶ show empathy towards the interconnectedness of human activities with natural ecosystems.	Learners should be able to: ▶ promote food production and animal farming that respects biodiversity.
13-15 years	**KEY IDEA: Biodiversity and climate are essential for food production.**		
	Learners should be able to: ▶ analyse the direct impact of climate conditions, including seasonal variations and extreme weather events, on food production processes. ▶ explain the significance of biodiversity in food production, particularly the essential role of pollinators such as bees in the cultivation of fruits and vegetables. ▶ evaluate the environmental consequences of industrial farming practices, including the emission of GHGs through pesticide and fertilizer use, overexploitation of soil, vast monocultures and their implications for biodiversity and climate.	Learners should be able to: ▶ Foster a sense of responsibility for the relationship between biodiversity, climate and food production.	Learners should be able to: ▶ take proactive steps towards environmentally-conscious food choices and lifestyle decisions. ▶ undertake activities in their local community to increase pollinator diversity. ▶ support or work with others in carrying out a local project of sustainable farming.

	▶ compare various farming methods, including organic farming, small-scale farming, agroforestry and permaculture, in terms of their effects on biodiversity and climate resilience, highlighting the importance of local knowledge and sustainable practices. ▶ identify that food security is at risk around the globe due to biodiversity crisis and climate change impacts.		
16-18 years	**KEY IDEA: Technologies can improve food productions but can have negative impacts on biodiversity.**		
	Learners should be able to: ▶ compare major farming processes such as genetically modified organisms, artificial selection, and cloning. ▶ describe the dependency of industrial farming from fossil fuel on tractors and mechanization, and the implication for CO_2 emissions. ▶ research on how technologies can be used in optimizing agriculture and reducing the need for water and fertilizers. ▶ debate on the trade-off between using mechanization, industrialization, and the human workforce for farming.	Learners should be able to: ▶ develop a sense of ethical responsibility and concern for the natural world especially around artificially modifying elements of biodiversity.	Learners should be able to: ▶ advocate for the responsible use of technology in food production through social media campaigns and participating community outreach activities. ▶ initiate family discussions about the importance of responsible technology use in food production
18+	**KEY IDEA: Changes in agriculture can result from consumers choices, collective actions and regulations.**		
	Learners should be able to: ▶ discuss national and local policies regulating farming techniques and the use of pesticides. ▶ identify the strong lobbying systems in place to secure an agro-industrial system that has negative impacts on farmers and on biodiversity. ▶ debate the various positions of different stakeholders involved in farming policies and industry, as well as environmentalists. ▶ explain the influences of individual, familial, and collective choices in diets. ▶ make links between diets and the related farming techniques. ▶ identify how food production and consumption is influenced by globalization and the liberal market.	Learners should be able to: ▶ develop a sense of agency and responsibility in shaping agricultural practices and policies. ▶ reflect on their role as active participants in the food system.	Learners should be able to: ▶ launch or participate in citizen campaigns to promote sustainable farming policies at various levels. ▶ write blog posts, videos, or infographics to engage peers and the broader community in discussions about the importance of sustainable food systems and the potential for positive change through consumer choices, collective action, and regulatory measures. ▶ participate in farm workdays, community-supported agriculture programmes, or farmers' markets to support local producers who prioritize environmental sustainability and ethical farming practices. ▶ participate in public hearings, town hall meetings, or stakeholder consultations related to agricultural policies and regulations.

Topic 2.5. Human-induced biodiversity loss and its consequences

Human activities have direct negative impacts on biodiversity. First of all, around the globe, populations tend to be more and more urban, resulting in local extinctions and habitat loss. Poaching and intensive fishing have strong negative consequences on local fauna and ocean ecosystems. Globalization, tourism and the increase of imports and exports have resulted in the displacement of species and introduced invasive species. Through climate change, human activities induce habitat loss and population migrations on land or in oceans. Ocean acidification through increases of CO_2 in the water directly affects marine ecosystems. All kinds of land, water and air pollution are negatively impacting biodiversity, as well as noise and light pollution. Biodiversity disturbances related to modern human lifestyles have negative consequences such as increases in disease transmissions from animals to humans.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Human activities in cities or rural areas have direct impacts on biodiversity.**		
	Learners should be able to: ▶ explain how buildings, towns or cities have less biodiversity than natural areas. ▶ describe how biodiversity, climate and seasons affect people living in cities. ▶ compare the different environmental impacts of different modes of transportation.	Learners should be able to: ▶ reflect on where they live and the biodiversity they regularly witness. ▶ share how they feel connected with people who live far away from them. ▶ reflect on the modes of transportation that they use.	Learners should be able to: ▶ adopt environmentally friendly transportation methods, such as walking, cycling, or public transit. (See Key Concept 6 Sustainable Lifestyles.)
9-12 years	**KEY IDEA: Pollution, invasive species, climate change, and human overexploitation collectively threaten biodiversity, contributing to ecological disruption and altering habitat conditions.**		
	Learners should be able to: ▶ identify various types of pollution (air, soil, water, light, noise) and analyse their effects on local animals and plants. ▶ describe how pollution results from specific human activities. ▶ explain the impact of community pollution levels on local biodiversity. ▶ explain how human activities such as overuse, extraction, or hunting can harm wild biodiversity. ▶ analyse the reasons why societies that are not closely connected to nature physically and culturally have less engagement in nature conservation.	Learners should be able to: ▶ express concern for how pollution can negatively affect a specific animal or plant. ▶ express to others their feelings about the impact of pollution on nature. ▶ value efforts to reduce the impact of invasive species in their local environment. ▶ imagine a future where humans do not overexploit animal or plant species.	Learners should be able to: ▶ take steps to reduce pollution sources in their community through activities such as neighbourhood clean-up events with friends and family to pick up litter in local parks, streets, and waterways. ▶ promote local activities to reduce the risks of invasive species through activities such as habitat restoration to help remove invasive plants and restore native habitats. ▶ participate in mitigation efforts to address the effects of climate change on biodiversity e.g through participating in environmental clubs or youth organizations focused on climate action and biodiversity conservation.
13-15 years	**KEY IDEA: Globalization, climate change, and trade intensify pandemics, alter biodiversity, and harm ecosystems through invasive species, while poaching and intensive fishing devastate local fauna and marine life.**		
	Learners should be able to: ▶ explain the detrimental impact of poaching on endangered species. ▶ explore knock-on effects of the loss of cornerstone species in ecosystems, i.e. how one species struggles to survive without another. ▶ describe the adverse effects of intensive and industrial fishing on marine ecosystems. ▶ identify and advocate for sustainable fishing practices. ▶ demonstrate the global spread of invasive species and how they disrupt ecosystems.	Learners should be able to: ▶ demonstrate increased awareness and care for animals that are endangered due to poaching. ▶ feel inspired to take action to address poaching and overfishing. ▶ tell local stories from First Nation/elders about the original ecosystems they lived in with native plants/animals.	Learners should be able to: ▶ participate in efforts for the reduction of poaching being undertaken by local/ national/ international organizations. ▶ advocate for small-scale fishing. ▶ consume fish and other marine animals coming from sustainable fishing. ▶ participate in local actions to reduce invasive species pressure. ▶ take steps to implement adaptation projects that protect local ecosystems from the negative effects of climate change.

16-18 years

KEY IDEA: The acidification of the ocean and increased water temperature negatively affect corals and marine ecosystems.

Learners should be able to: ▶ describe how acidification happens because of an increase of CO_2 in the ocean, negatively affecting calcification and growth of plankton and crustaceans. ▶ explain that corals are endangered due to increase of local water temperature.	Learners should be able to: ▶ tell stories and share images about coral reefs and their precious ecosystems. ▶ appreciate how indigenous worldviews on the spiritual connection to nature contributes to protection of biodiversity (such as the Māori concept of Taniwha which has a major influence on the protection of waterways in New Zealand.)	Learners should be able to: ▶ use social media platforms, blogs, or personal networks to raise awareness about the importance of caring for local water and marine ecosystems. ▶ volunteer for coral reef monitoring programmes or participate in reef restoration efforts, such as coral gardening or artificial reef construction projects, to help mitigate the impacts of ocean acidification and warming on coral reefs (as applicable). ▶ engage with policy-makers and elected officials at local, national, and international levels to promote marine conservation efforts and advocate for the protection of coral reefs and vulnerable marine species.

KEY IDEA: Climate change induces variations in inter-species interactions.

Learners should be able to: ▶ describe how climate change influences the phenology of plants by inducing earlier blooming year after year. ▶ explain that changes in blooming affect pollination interactions. ▶ research how climate change affects the increase of parasites on some local species.	Learners should be able to: ▶ recognize how harbingers of the seasons are being affected by climate change and present their feelings about this.	Learners should be able to: ▶ collaborate with others in helping local ecosystems to cope with changes in the seasons. ▶ engage with other schools, nature centres, and community groups to raise awareness about the importance of understanding and conserving species interactions

KEY IDEA: Climate change will have stronger consequences for biodiversity in the future.

Learners should be able to: ▶ present on modelling from IPCC reports that shows how the pressure of climate change on biodiversity will be higher in the future.	Learners should be able to: ▶ imagine a future where the worse impacts on ecosystems and biodiversity have been avoided due to human action. ▶ demonstrate commitment to the containment of degree increases, as every degree matters.	Learners should be able to: ▶ participate in advocacy campaign or letter-writing campaigns to urge policy-makers to take action on climate change and protect vulnerable species and ecosystems.

18+	**KEY IDEA: Monitoring climate change impact on biodiversity, mitigation policies and global and local coordination around poaching and invasive species are important.**		
	Learners should be able to: ▶ demonstrate techniques to monitor climate impact locally and globally on biodiversity (see also Key Concept 1 Climate Science). ▶ describe and appraise the levers for reducing the pressure of climate change on biodiversity by mitigating human activities and helping biodiversity to adapt. ▶ clarify why we need international cooperation to reduce poaching. ▶ explain the importance of political engagement to reduce the increase of invasive species.	Learners should be able to: ▶ increase and demonstrate their curiosity and passion for climate change science and ecology monitoring. ▶ feel personally concerned and recruit others in mitigation activities. ▶ be motivated to increase contact with people from other nations and cultures in dialoguing about cooperative efforts to reduce poaching and invasive species.	Learners should be able to: ▶ engage in programmes of biodiversity monitoring such as joining citizen science initiatives or join local monitoring programmes organized by conservation groups or government agencies. ▶ contribute to small scale and large-scale policies to increase adaptation and mitigation projects such as collaborating with local governments, NGOs, and stakeholders to develop and implement adaptation and mitigation projects, such as habitat restoration, green infrastructure development, or sustainable land use planning. ▶ cooperate with people from other countries on reducing poaching and invasive species through joining conservation organizations or participating in conferences and workshops focused on combating poaching and invasive species.

Topic 2.6. Reconnecting to nature and protecting it

As a part of nature, humans need to show respect for and seek out a stronger connection with nature. Understanding how our own existence within nature can contribute to positive human mental health. Conversely, the destruction of the local natural ecosystem can have a negative impact on our physical and mental health and increase eco-anxiety. Preserving a liveable Earth is essential for humankind and this is undoubtedly linked with preserving biodiversity and ecosystems. Conservation biology involves the analysis of the status of biodiversity and the best ways of protecting ecosystems (through the reintroduction of species, for instance). Conservation programmes are an essential component of collective and political action around protected areas, such as national parks and marine reserves, allowing the protection of species and ecosystems.

	Cognitive	**Social and emotional**	**Behavioural**
5-8 years	**KEY IDEA: Human protection of nature is essential for the functioning of ecosystems.**		
	Learners should be able to: ▶ identify and categorize the different kinds of animals and plants in their community and country. ▶ describe indigenous views of animals and plans and the oneness of the world. ▶ explain how natural environments, such as forests, are good for human mental and physical well-being. ▶ investigate, evaluate and present promising practices to respect and protect local ecosystems. ▶ identify important 'world nature days' such as 'bee days', 'ocean days', 'biodiversity day', etc.	Learners should be able to: ▶ share their feelings about why all animals or plants are important. ▶ identify and value personal connections with indigenous views of animals and plants. ▶ express their appreciation and respect for other species. ▶ discover the beauty in natural phenomena and the understanding of humans as a part of nature through tales or storytelling. ▶ show an ongoing curiosity and interest to know more about nature and biodiversity.	Learners should be able to: ▶ have increased direct contact with nature, such as through walks in nature (as applicable). ▶ take actions to clean up trash in the local environment. ▶ take part in local events celebrating specific animals or aspects of nature.

9-12 years

KEY IDEA: There are strong and specific cultural connections between humans and the surrounding nature and animals.

Learners should be able to: ▶ describe how in some cultures there are sacred land, sacred trees and animals. ▶ research and present how a local culture venerates some aspect of nature, and how this has been maintained over time.	Learners should be able to: ▶ appreciate how animals are seen as spiritually linked to humans in the local culture, or another culture of choice.	Learners should be able to: ▶ engage in inter-generational, cross-cultural dialogue with senior members of the community, local populations and indigenous people about rites on preservation and celebration of sacred natural sites, trees, and animals. ▶ have increased direct contact with nature, such as through walks in nature (as applicable).

KEY IDEA: Animals and plants communicate with each other.

Learners should be able to: ▶ analyse the purpose of language and communication in animal species. ▶ compare the different styles of communication for animals, for example, birds and whales have huge repertoires of songs to communicate with each other. ▶ explain how human-induced sound pollution is directly affecting animal communication.	Learners should be able to: ▶ incorporate in various forms the songs and communication patterns of a favourite animal in artistic productions. ▶ imitate animals calls and communication and feel connected to nature.	Learners should be able to: ▶ work with others to help maintain diversity in local ecosystems through sharing information and resources about the importance of biodiversity with classmates, friends, and family members. ▶ protect ecosystems against disturbances related to human-induced noise pollution through practising habits that minimize personal noise pollution, such as lowering the volume of electronic devices, using headphones or earplugs in noisy environments.

KEY IDEA: In order the assess the states of biodiversity on our planet, scientists collect data.

Learners should be able to: ▶ research plants and animals according to their status of extinction, using the list developed by the IUCN (International Union of Conservation of Nature).	Learners should be able to: ▶ create their own stories around endangered species in their local habitat. ▶ be motivated to interview local community members about their knowledge around local endangered species.	Learners should be able to: ▶ participate in guided nature walks, field trips, or outdoor excursions to learn how to observe and document different plant and animal species.

KEY IDEA: Endangered species can be reintroduced in their natural habitat from captive populations.

Learners should be able to: ▶ describe how conservation CSOs and programmes reintroduce animals into their natural ecosystems, thus protecting the species from extinction. ▶ understand that preparatory habitat work is sometimes required before reintroducing a species (e.g. woodland restoration).	Learners should be able to: ▶ feel solidarity with different stakeholders involved in animal reintroduction.	Learners should be able to: ▶ engage in reintroduction programmes in their local environments, while avoiding non-native species.

13-15 years

KEY IDEA: Animals show great variation of intelligence, defined as skills to fulfil basic needs.		
Learners should be able to: ▶ explain and contrast how animals exhibit intelligence to fulfil their needs through behaviours such as using tools. ▶ describe how some insect species (bees, wasps, ants) and mammals (marmots, mole rats) are 'social' and show collaboration, for example, through divisions of labour within the group by helping each other.	Learners should be able to: ▶ appreciate the ingenuity and cooperation that can be found in certain animals and insects and reflect any similar qualities in the human species.	Learners should be able to: ▶ take steps to care for the well-being of social insects in the local community, such as bee colonies.
KEY IDEA: There has been increased distancing from nature in modern societies.		
Learners should be able to: ▶ describe how urbanization, mechanization and a human preference for convenience and comfort have increased the distance between humans and nature.	Learners should be able to: ▶ explain and reflect upon how they, or others, may sometimes view nature as dangerous.	Learners should be able to: ▶ spend time in contact with nature, as their local environment allows.
KEY IDEA: Farmed animals can be traumatised and kept under poor conditions.		
Learners should be able to: ▶ describe how industrial farming can often result in poor life conditions for animals such as pigs, cows, and chickens. ▶ compare industrial farming and free-range/small-scale agropastoralism.	Learners should be able to: ▶ develop compassion towards farmed animals.	Learners should be able to: ▶ demonstrate responsible dietary choices. ▶ advocate for improved conditions for farmed animals.
KEY IDEA: There are protected natural places meant to reduce the pressure of human activities on wildlife.		
Learners should be able to: ▶ organize different categories of natural reserves in their country (or a country of choice) in terms of the amount of contact allowed between wildlife and human populations. ▶ explain how connections between protected areas, such as wildlife corridors, are important. ▶ analyse and visually present the structuration of protected areas with buffer zones and ecological transition zones.	Learners should be able to: ▶ support the principle of protected natural places.	Learners should be able to: ▶ advocate for protection of natural places at the local/national/global levels.
KEY IDEA: The way we see and perceive biodiversity around us is key to engaging in pro-environmental behaviour.		
Learners should be able to: ▶ analyse the reasons why societies that are not closely connected to nature physically and culturally have less engagement in nature conservation. ▶ explain why influencers and other inspiring figures in modern societies may not always promote degrowth and increase of contact with natural environments.	Learners should be able to: ▶ identify and feel inspired by advocates for connecting with nature and demonstrate pro-environmental behaviour.	Learners should be able to: ▶ take action for the promotion of contact with nature and degrowth by organizing nature walks in local parks, participating in school gardening projects, and learning about sustainable living practices at home.

	KEY IDEA: Some local and indigenous practices engage communities in the protection of their local environments.		
	Learners should be able to: ▶ identify local and indigenous practices for sustainable use of natural resources.	Learners should be able to: ▶ feel connected to local indigenous populations and reflect on similarities with their own practices and views.	Learners should be able to: ▶ adopt some virtuous practices derived from local and indigenous knowledge.
16-18 years	**KEY IDEA: Action can be taken through international policies, at the local level by CSOs and politicians, or through other groups to protect nature.**		
	Learners should be able to: ▶ compare results of the COP for biodiversity over time. ▶ describe how UNESCO's Natural Heritage initiative works to help protect natural resources. ▶ explore and present how CSOs, politicians and others can influence decisions to protect nature, at the local and national levels. ▶ describe how activists who defend their land, including indigenous people, are endangered in many countries because of the financial interests of big companies or governments. ▶ discuss criminalization of climate-specific protests in many countries.	Learners should be able to: ▶ visit (virtually or in person) a UNESCO Natural Heritage site and be inspired. ▶ appreciate the sacrifices that eco-activists have made to help protect nature.	Learners should be able to: ▶ reduce negative human impact on animal communication by reducing noises, chemicals or lights at night. ▶ take part in protests and marches and other non-violent ways to promote action to protect nature. ▶ promote the safety of environmental activists, for example, through using social media to advertise their peaceful efforts. ▶ have increased direct contact with nature, such as through walks in nature (as applicable).
18+	**KEY IDEA: Strategies for influencing political decisions are important in the protection of biodiversity.**		
	Learners should be able to: ▶ explain how conservation biology can guide the implementation of nature conservation programmes. ▶ provide arguments for why nature conservation programmes require monitoring efforts to analyse the results of protection on biodiversity. ▶ analyse and appraise a range of political tactics that have been used to influence decisions that protect nature.	Learners should be able to: ▶ appreciate the importance of science and conservation biology for protecting nature. ▶ reflect on their role in promoting biodiversity and how they can use their skills to influence political action.	Learners should be able to: ▶ work collaboratively – both locally and internationally – to reduce poaching and invasive species. ▶ support the development and implementation of nature conservation programmes. ▶ engage collaboratively with others in creating and implementing strategies to influence decision-makers on the protection of biodiversity.

Key concept 3

Climate justice

Key topics

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Definition

Climate Justice is about addressing the underlying social, political, and economic drivers of the climate crisis and working to transform harmful power relations, structures of oppression, and systems of discrimination that are at the root of the disproportionate burden of climate risks, vulnerability and impacts borne by the marginalized. These include very young children, youth, girls and women, indigenous peoples, persons with disabilities, displaced people, the elderly, informal workers, and people of Small Island Developing States (SIDS) and Least Developed Countries (LDCs) who have contributed the least to the climate crisis. Achieving climate justice requires fair allocation of the burdens of the impacts of climate change at local, national, and global levels and seeks to amend historical and ongoing inequities across intersecting environmental, social, and economic dimensions. Climate justice in education entails building the knowledge and skills to address these inequities related to climate change – including its causes, impacts, and solutions.

Key ideas and learning outcomes per topic per age group

Topic 3.1. Contemporary manifestations

The burdens of climate change impacts are not equally shared by everyone. Some people and some communities experience these impacts worse than others, even if they did little to contribute to climate change. Often, these people and communities hold relatively less power compared to dominant groups/interests and experience multiple forms of exclusion, discrimination, or oppression.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Certain climate events and human activities impact different groups differently, leading to unequal treatment in coping with climate change.**		
	Learners should be able to: ▶ visualize how issues like pollution, drought, and extreme storms are felt everywhere around the world (or across one's country), but that some parts of the world (or one's country) experience these issues more than others; similarly good things like clean air, clean water, nice weather and very few extreme storms can and should be enjoyed by everyone, everywhere. ▶ explain how the experience and impact of environmental problems can be different for some people, even those located in the same community. ▶ differentiate between high polluting/high emitting human activities and those that are low polluting/low emitting human activities. ▶ identify and contrast patterns and trends in the characteristics of high emitting/high polluting groups of people, communities, countries, or geographic areas (e.g. urban vs. rural, SIDS and LDCs, etc.) compared to low emitting/low polluting entities. ▶ explain the types of activities that a high emitting/high polluting group of people, community, or country might engage in. ▶ explain how the decisions being made about who gets help and how much are not always based on how much certain people need help, and that this is unfair.	Learners should be able to: ▶ empathize with the different groups of people, communities, and/or countries that are more likely to experience the worst effects of heatwaves, extreme storms, flooding, or other locally relevant climate events. ▶ interpret with care and compassion the different experiences of climate change that people from similar and different backgrounds may have. ▶ value decisions that are fair and positively contribute to others' ability to cope with climate change.	Learners should be able to: ▶ advocate for the people who experience the worst impacts of climate change and who will likely need more help to recover afterwards. ▶ take responsibility for the environmental impact of their own actions. ▶ communicate to family and friends when their actions may be harmful or helpful to others/the environment and articulate alternative actions that have less harmful impact on others/the environment. ▶ defend those whose actions are less harmful to the planet. ▶ cooperate with others to promote positive actions that have adaptive value and build climate resilience.
9-12 years	**KEY IDEA: Some people, communities, and countries have contributed little to climate change, yet experience its worst impacts.**		
	Learners should be able to: ▶ explain how wealthy populations, industrialized countries, and polluting companies are more responsible for climate change and environmental degradation because they are more likely to be engaged in activities that are environmentally unfriendly and emit greenhouse gases.	Learners should be able to: ▶ value climate actions that promote accountability, fairness, and taking ownership over one's responsibilities.	Learners should be able to: ▶ take action to reduce environmental harm and to increase sustainability in ways that are commensurate to their responsibility.

	▶ identify ways in which climate change disproportionately impacts girls/women, children with disabilities, refugees/migrants/displaced people, indigenous communities, informal workers, SIDS, LDCs, drawing on national and global examples. ▶ evaluate how these groups are less responsible for climate change and/or environmental degradation, and why they need more support to deal with the impacts of climate change. (See Key Concept 4 Resilience-Building Topic 4.2 Navigating Climate Impacts: Strategies for Safety and Resilience.) ▶ identify and provide examples for a range of characteristics that might put some people, communities, and countries in harm's way, and conversely those characteristics that help communities to adapt to climate change.	▶ express concern for how it is unfair for some groups to bear more risk and exposure to climate hazards, especially if it is not a result of their own choices or decisions.	▶ step up and call out instances where actors are misrepresenting or spreading misinformation about the nature or extent of their activities that are harming the planet and/or communities with less power. (See Key Concept 4 Resilience-Building Topic 4.6 Tackling Climate Mis/Disinformation.) ▶ raise awareness among friends and family of the injustice behind the unequal burden of climate impact that marginalized communities experience. ▶ prioritize and take steps to implement a list of actions that could reduce exposure to climate hazards and reduce the potential impact of climate risks, especially for those most marginalized. (See Key Concept 4 Resilience-Building Topic 4.2 Navigating Climate Impacts: Strategies for Safety and Resilience).
13-15 years	**KEY IDEA: The impacts of climate change can feel/be worse for people, communities, and countries with fewer means of preparing for, planning for, adapting to, responding to, or recovering from these impacts.**		
	Learners should be able to: ▶ describe how some groups have relatively more power, choices, agency in the context of climate adaptation, and that this is unfair because this difference is largely determined by circumstances and structures and not because they deserve these privileges more than those with less power, choices, and agency. ▶ evaluate how certain groups – locally, nationally and globally – have relatively less power, choices, agency, and resources to cope or to adapt, and explain how this is unjust because this difference is determined by poverty and inequalities and not because they don't deserve more. ▶ describe how continued setbacks, disruptions, destruction, and crises can further exacerbate/increase communities' climate vulnerability. ▶ list and categorize the different costs that the impacts of climate change can have (e.g. financial, emotional, psychological, social, cultural, environmental, etc.). ▶ investigate how people, communities, and countries that experience a higher burden of cost need more support and assistance to recover from these costs.	Learners should be able to: ▶ reflect critically on the circumstances and structures around them that unfairly privilege some groups over others in the context of climate adaptation. ▶ demonstrate care and compassion toward those who have experienced loss as a result of climate impacts, and explain how it is unfair that these losses are experienced more by these people, communities, and countries. ▶ channel feelings of injustice toward identifying climate solutions, especially through cooperative approaches. ▶ critically reflect on how the same kind of 'cost ' from climate change impacts can affect some people more than others (e.g. girls and women, and in particular the most vulnerable ones, displaced people, indigenous people, et.), communities (e.g. communities facing conflict, IDP camps), and countries (e.g. SIDS, LDCs).	Learners should be able to: ▶ explain to others how some groups may unfairly benefit from or suffer from the impacts of climate change or from climate solutions as a result of unequal power and discriminatory structures. ▶ motivate others to resist behaviours and climate actions that strengthen these power inequalities and discriminatory structures. ▶ advocate with others for actions at local, national, and global levels that would help those without means to better prepare and plan for, adapt and respond to, and recover from the impacts of climate change. ▶ make decisions to act in response to the impacts of climate change based on the 'calculation' of all the potential costs from the perspective of oneself, one's family, one's own community, and communities unlike one's own.

16-18 years

KEY IDEA: Some groups of people, communities, companies, and countries might engage in high polluting/high emitting activities because they do not have the resources or opportunities to choose to engage in lower polluting/lower emitting activities.

Learners should be able to:

- evaluate and explain how poverty, and unequal relations of power, privilege and choice, can influence opportunities to engage in activities or access resources that are more socially and environmentally sustainable.
- assess how climate injustice is a symptom of local and global social and economic relationships structured along unequal relations of power.
- defend how prioritizing self-interest over collective well-being can be harmful for people and the planet.
- critically evaluate sources of information and supporting evidence about the 'greening' actions of those who have historically contributed to pollution, emissions, and/or environmental harm. (See Key Concept 3 Resilience Building Topic 3.6 Tackling Climate Mis/Disinformation.)
- explain how higher costs are a burden borne disproportionately by communities most vulnerable to the impacts of climate change, and that this is unfair.
- describe how some loss and damage can be irreplaceable, irreversible, or felt across generations, using examples.
- design one strategy to reduce the impact of climate change on a marginalized population in their locality or country.

Learners should be able to:

- reflect critically on the detrimental impacts of poverty and inequality on both people and the planet.
- demonstrate a sensitivity to the weight or burden that some might bear as a result of actions or decisions made by others, influencing the impacts of climate change.
- show an ability to regulate their own emotions, sense of guilt, or sense of injustice and to channel these toward productive climate actions and care for others and for the planet.

Learners should be able to:

- identify and advocate with others for actions that could remove barriers and obstacles, especially among marginalized populations, to access/engage in low polluting/low emitting behaviours, actions, resources, choices, and opportunities.
- marshal evidence in ethical ways and organize others to use this evidence to speak up against actors acting in their self-interest while harming others and the planet.
- identify and advocate with others for actions that would help to reduce the burden of the impacts of climate change on marginalized populations.

18+

KEY IDEA: Climate change compounds the effects of existing inequalities and injustices.

Learners should be able to:

- describe with the use of local/national examples the ways in which climate change exacerbates inequalities, vulnerabilities, and injustices in multiple, simultaneous, and intersecting ways.
- argue that without intervention that centres on climate justice, the status quo is harming and will continue to harm marginalized groups and diminish their potential to face the impacts of climate change on an equal footing.

Learners should be able to:

- critically reflect on how injustice begets injustice, and vulnerabilities create more vulnerabilities, and how these connect to the experience of climate change.

Learners should be able to:

- collaborate with diverse stakeholders to generate and implement local climate solutions that address the systemic underlying vulnerabilities of marginalized populations and promote climate justice.

KEY IDEA: Policies, social institutions, and economic systems have played a role in entrenching and/or exacerbating climate injustice, but can also play an instrumental role in reversing this and promoting climate justice.

Learners should be able to:

- evaluate how policies, institutions, and systems at local, national, and international levels can discriminate and/or exclude marginalized groups, sustain harmful practices against them, and exacerbate their climate vulnerabilities.

Learners should be able to:

- appreciate the role of policies, institutions, and systems in remediating past injustices and in promoting a more just, fairer, equal, and sustainable society.

Learners should be able to:

- organize support for and engage in civic activities that promote pro-environmental policies that address climate injustice.

KEY IDEA: Some people, communities, and countries have less access to the knowledge, skills, technologies, and jobs necessary to strengthen their climate resilience, adaptive capacities, and green competencies needed to address climate change through livelihoods.

Learners should be able to: ▶ point out the injustice in the unequal distribution of climate assets and climate risks, through the use of examples. ▶ identify underlying causes of injustice in the unequal distribution of climate assets and climate risks. ▶ develop potential solutions for overcoming obstacles to knowledge, skills, technologies, and jobs necessary to address climate risks.	Learners should be able to: ▶ channel climate-related emotions toward building skills and social networks to engage in economic activities that can help to address the unequal distribution of climate assets, especially in marginalized communities. ▶ reflect critically about how their training and skills can be leveraged to address climate change and climate injustice.	Learners should be able to: ▶ direct their knowledge, skills, technologies, and economic activities toward supporting marginalized populations to better mitigate against and/or adapt to the climate crisis.

Topic 3.2. Social determinants

Climate injustice is an extension of underlying social structures and systems of inequality, including racism, gender/patriarchy, caste, class, knowledge hierarchies, rural exclusion, etc. At the heart of these structures and systems are unequal power relations. Each of these dynamics can create vulnerability to the impacts of climate change. The effects of one can further compound or be compounded by the effects of another dimension/dynamic.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Who we are and the circumstances we live in can create more negative experiences of climate change than for others with different characteristics and circumstances.**		
	Learners should be able to: ▶ explain how identities (race, gender, disability, where one lives, immigration status, socioeconomic status, etc.) can shape how one experiences weather events like heatwaves, sea level rise, floods, droughts, and extreme storms. ▶ illustrate how we are likely to share experiences of climate change with others who share similar aspects of our identities and to have different experiences of climate change from others with whom we don't share aspects of our identities. ▶ discuss how other people may treat us differently based on the different elements that make up who we are, which may not be fair or right, and can put us in harm's way when it comes to climate change.	Learners should be able to: ▶ appreciate how everyone and every living thing on this planet deserves to be happy and live a healthy life in a healthy and safe environment. ▶ express how the ways different people experience climate change can feel unfair, especially for those whose circumstances make it harder for them to stay safe or be happy and healthy in the face of climate change.	Learners should be able to: ▶ stand up for and defend those who are experiencing the negative effects of climate change and are not being treated fairly because of who they are. ▶ explain to family and friends how people who are treated unfairly are also likely to have more unfair experiences of climate change.
	KEY IDEA: Who we are and the circumstances that we live in can shape the degree to which we contribute to climate change and/or environmental harm.		
	Learners should be able to: ▶ explain how some aspects of who we are might shape our circumstances, and how some of these circumstances might lead us to engage in activities that contribute more to environmental harm or activities that make climate change worse.	Learners should be able to: ▶ value actions and behaviours that do not harm others or the environment. ▶ demonstrate compassion for all people even if they engage in activities or behaviours that might harm the environment. ▶ appreciate what makes us who we are, while being curious or critical about why we do some of the things we do to others and the environment, especially if we do not mean to cause harm.	Learners should be able to: ▶ articulate to family and friends how someone might engage in actions that harm the planet even if they did not mean to. ▶ cooperate with others in brainstorming alternative actions and behaviours that could replace those environmentally harmful behaviours while improving the circumstances of those people.

9-12 years

KEY IDEA: A key element of climate injustice is that those groups who are more likely to experience the negative effects of climate change are also more likely to experience other forms of inequality, discrimination, exclusion and oppression.

Learners should be able to:

- identify and differentiate between patterns of inequality and unfair treatment of people based on different characteristics, like race, gender, caste, class/socioeconomic status, disabilities, immigration status, etc. that can put them at greater risk of exposure to climate hazards.
- describe through use of an example how the treatment of people who share certain characteristics can shape their circumstances at a scale bigger than our individual selves, and how some of these circumstances can put these groups at more risk of experiencing negative impacts of climate change than others.

Learners should be able to:

- critically reflect on how girls and women, and in particular the most vulnerable ones, and groups like racial minorities, girls and women, children with disabilities, refugees, migrants, and displaced peoples, indigenous communities, people of SIDs, and LDCs, are treated unfairly, more vulnerable to experience some of the worst impacts of climate change, and may hold less power than dominant groups, even though they have valuable experiences, perspectives, knowledge, skills to contribute to society, and equal human rights to happiness, health, and safety.

Learners should be able to:

- explain to others with evidence and examples of how groups with shared characteristics, experiences, and circumstances are more likely to be exposed to poor air quality, poor water quality, poor food quality, poor land, hazardous living or working conditions, etc. and that this is not a coincidence or by choice, but a result of larger patterns and trends.

KEY IDEA: The abuse of power by certain groups of people, communities, companies, and/or countries drives the unequal impacts of climate change felt by marginalized groups.

Learners should be able to:

- explain that power in the context of climate justice is the ability to make decisions, to take actions, or to influence others in ways that affect who has access to information, resources, and opportunities that could shape people's experience of climate change for bad or for good.
- examine and articulate how unequal power between groups is unfair, especially if it is used to benefit the interests of those with more power rather than the collective well-being or the health of the planet.

Learners should be able to:

- value the participation and involvement of communities most impacted by climate change in climate decision-making processes and planning.
- value actions that are a result of the just and ethical exercise of power to help others meet their basic needs, that respect their human rights, and that safeguard their well-being and dignity in the face of climate change.
- criticize the abuse of power for self-interest or self-benefit, and view with scepticism those who wield power and make climate-related decisions without transparency or sense of accountability.

Learners should be able to:

- demand that those who are the most responsible for activities that contribute to climate change, and who continue to engage in these activities knowingly, must be held accountable for their actions and brought to justice for contributing to this harm, including the spread of misinformation.

KEY IDEA: Power and self-interest are at the heart of climate injustice, preventing the fair treatment of others, especially those in most need or most likely to experience the negative impacts of climate change, including vulnerable groups of girls/women, children with disabilities, refugees/migrants/displaced people, indigenous communities, informal workers, people of SIDS, LDCs, etc.

Learners should be able to:

- analyse ways in which self-interest can drive climate decision-making and actions that harm marginalized populations, drawing on local and national examples.
- marshal evidence to argue that it is in our power to make this right.

Learners should be able to:

- develop an intolerance for the abuse of power and self-interested actions that impede the ability of marginalized populations to access the resources they need to better cope with and to be prepared for climate hazards.

Learners should be able to:

- advocate to decision-makers for the fair treatment of those most likely to experience the worst impacts of climate change at the local/ national/ global levels.
- brainstorm with others and identify evidence for the types of actions that would benefit those most likely to experience the worst impacts of climate change.

13-15 years

KEY IDEA: When people, communities, and/or countries hold power and influence over others, they are likely to make decisions, create policies, institutions, and practices that benefit themselves and their self-interests, oftentimes at the detriment or harm of those with less power, resources, and opportunities.

Learners should be able to: ▶ explain how climate decision-making that does not consider the interests and needs of marginalized groups can create structures, at the macro level, that systematically benefit those with more power. ▶ analyse and compare who benefits more or less from actions that cause climate change as well as from efforts at climate mitigation and climate adaptation.	Learners should be able to: ▶ regulate and express feelings of climate injustice in ways that can be channelled toward civic engagement.	Learners should be able to: ▶ advocate for alternative climate actions and solutions that centre the interests and needs of marginalized groups.

KEY IDEA: The heightened experience of negative impacts of climate change by marginalized groups are not coincidences but patterns and trends that reflect structures of bias, discrimination, exclusion, and oppression in society.

Learners should be able to: ▶ evaluate and explain how at a macro scale, such chronic exclusion creates structures that systematically discriminate against those who have contributed the least to climate change but experience the worst impacts. ▶ evaluate and explain how these structures of discrimination and exclusion contribute to the heightened vulnerability of these groups to climate change, and the heightened risk of experiencing negative impacts.	Learners should be able to: ▶ express concern over the injustice of structural discrimination and structural vulnerability, while maintaining hope and optimism in structures that promote climate justice.	Learners should be able to: ▶ show a commitment to addressing prejudice, bias, fear, and feelings of superiority in climate action efforts by actively promoting equitable and fair solutions that prioritize the needs of those most affected by climate change. ▶ hold themselves and others accountable to climate actions that promote equality, fairness, and justice.

16-18 years

KEY IDEA: Climate injustice is an extension of multiple existing inequalities at play all at once.

Learners should be able to: ▶ describe how individuals and communities may face multiple forms of oppression and discrimination that intersect and compound their vulnerability to climate change. ▶ list the intersecting characteristics of groups of people in the country who are most to least vulnerable to the impacts of climate change and explain why and how this is an example of intersectionality. ▶ differentiate between groups of people, communities, countries, companies, etc. who knowingly persist in actions that harm others and the planet, and those who engage in activities that harm the planet but have no power, choice, or opportunity to pursue alternative actions.	Learners should be able to: ▶ demonstrate empathy, compassion, and tolerance for those without power, choice, or opportunity to engage in alternative sustainable behaviours, while demonstrating intolerance for those who knowingly choose to engage in unsustainable behaviours or misinformation about their actions.	Learners should be able to: ▶ motivate others to demand those who knowingly perpetrate climate injustice be held accountable for their actions. ▶ encourage climate decision-makers and those who can vote to pursue positive actions that transform structural inequalities and systemic discrimination.

KEY IDEA: How we treat each other is a reflection of how we treat the environment, and vice versa.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ explain through the use of examples how a sense of superiority over and/or a fear of others who are different because of their language, their gender identity, their race, their religion, their culture, their abilities, their origin, their immigration status, etc. can lead to climate actions, decisions, and the use of power in ways that harm or exclude these groups. ▶ evaluate how these outlooks extend to a sense of superiority over the natural world which contributes to actions that dominate, exploit, and hurt the natural world that we depend on for survival and thriving.	▶ appreciate the interconnectedness between social equality and planetary well-being.	▶ educate friends and family, especially those younger than themselves, about the interdependence of our well-being and the well-being of our ecosystems and the planet.

18+

KEY IDEA: While climate change impacts everyone, these impacts – especially loss and damage, displacement, violence, etc. – are compounded for those experiencing multiple intersecting forms of inequality, discrimination, and exclusion.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ illustrate the structural dynamics and social systems that contribute to the unequal impacts of climate change felt by marginalized populations. ▶ trace the structural dynamics and social systems that contribute to marginalized populations' heightened exposure to environmental and climate hazards, using country examples.	▶ demonstrate concern for those experiencing climate injustice, resistance towards actions that perpetuate climate injustice, and compassion towards those who engage in these actions.	▶ translate their concerns about the structural dynamics of climate injustice into mediums and platforms that will inspire others to act collectively and collaboratively to transform them.

KEY IDEA: Social determinants of climate injustice and climate vulnerability are perpetuated and reinforced by local, national, and international policies, systems, and structures designed to benefit those in power.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ analyse and articulate how policies and practices may discriminate against marginalized populations and exacerbate climate injustices against them. ▶ analyse and identify solutions at local, national, and international scales to address these systemic injustices through policy mechanisms.	▶ maintain optimism in the power of collective action to catalyse systems change in pursuit of climate justice.	▶ engage in civic activities that promote policy changes centred on the achievement of climate justice.

KEY IDEA: Corporations and companies have contributed to and perpetuated climate injustice by focusing metrics of success on profit and growth that promote extractive processes, especially among marginalized groups, placing them at greater climate vulnerability and climate risk.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ identify local/national/global business and workplace practices, policies, and strategies that can disproportionately impact marginalized groups and/or exacerbate structural dynamics that put them at greater risk of exposure to climate hazards.	▶ appreciate alternative business models with bottom lines that promote gender equality, social inclusion, indigenous knowledge, intergenerational equality and environmental sustainability. (See Key Concept 5 Post-Carbon Economies Topic 5.2 Circular Economy and Everyday Life.)	▶ adopt and encourage others to adopt behaviours and practices that promote regenerative growth and prioritize people, planet, and then profit. (See Key Concept 5 Post-Carbon Economies Topic 5.2 Circular Economy and Everyday Life and Topic 5.5 Our Roles in a Post-Carbon Economy.)

Topic 3.3. Historic economic and political processes

The unequal burden and differential impact of climate change felt today by some groups have been shaped over centuries by local and global economic and political processes, including colonialism/imperialism, industrialization/capitalism (limitless economic growth, extraction, exploitation, profit), development/globalization, and conflict. The impact of these historical dynamics on shaping the climate vulnerability and climate inequality today are further entrenched and aggravated by their modern-day manifestations of consumption, production, trade, and power.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Human actions in the past have long-lasting positive or negative impacts up until the present day.**		
	Learners should be able to: ▶ draw lessons from history about how people began to lose sight of the consequences of taking from the environment without making sure there were enough resources for future generations or a way for the natural world to make more of those resources for the next generation of people. ▶ identify past harmful relationships between people in their country as a result of one group trying to conquer another in order to have access to their natural resources, or as a result of one group trying to master another group in order to control them.	Learners should be able to: ▶ demonstrate concern about past actions that hurt the planet and/or took away people's human rights and freedoms. ▶ value past actions that have helped to sustain the planet's natural resources and promoted human rights and freedoms. ▶ appreciate the mutual and respectful relationship between local indigenous peoples and the natural world, and how these practices were informed by a sense of care and concern for the happiness of future generations.	Learners should be able to: ▶ engage in efforts to mitigate negative impacts and promote positive legacies that contribute to sustainable and equitable outcomes for current and future generations.
	KEY IDEA: Some people today have benefited from human actions in the past, while others have suffered.		
	Learners should be able to: ▶ differentiate between and give examples of the experiences of people in the past who took from others and people in the past from whom things were taken. ▶ explain how, if, over time, one group of people continues to have things taken from them by another group, the people today from that group are likely to be treated unfairly too.	Learners should be able to: ▶ regulate emotions about past actions, expressing both feelings of unfairness for harm done to others and gratitude for past actions benefiting all. ▶ manage emotions about ongoing impacts of past climate and environment actions, fostering empathy for those affected today. ▶ use feelings of unfairness as motivation to enact positive change today, particularly for those historically treated unfairly.	Learners should be able to: ▶ show awareness of historical injustices and their ongoing effects on daily interactions.
	KEY IDEA: Some of our actions today can worsen this unfairness unless we work to change our actions and make things right.		
	Learners should be able to: ▶ determine which climate actions and activities today are similar to or different from the harmful and beneficial climate or environmental actions and activities of people in the past. ▶ identify ways that we can change these actions to make things fair and right for each other today and for future generations of people, plants, animals, and the natural world.	Learners should be able to: ▶ value climate actions that attempt to make things right for those who have experienced unfairness in the past or today.	Learners should be able to: ▶ communicate with family and friends about the importance of caring for others and making decisions and taking actions that do not harm others, including the natural world.

9-12 years

KEY IDEA: The circumstances that shape how some people today experience the worst impacts of climate change have been shaped by centuries of unfairness and discrimination.

Learners should be able to:
- explain how colonization negatively impacted human relationships and set in motion the exploitation of people and the natural world for profit, at scale.
- explain with examples how industrialization led to the rapid deterioration and destruction of the environment, and that this was dependent on the abuse of large groups of people for their unpaid or poorly paid labour by a small increasingly powerful and wealthy group of individuals and corporations/companies.
- evaluate how these processes of colonization and large-scale industrialization were made possible by those in/with power prioritizing the interests of the dominant group over the interests of other groups.

Learners should be able to:
- understand that, while they are not responsible for the choices and actions of their ancestors, they carry responsibility for influencing the actions of our institutions to make things right for present and future generations.

Learners should be able to:
- advocate with others for decision-makers to think about and centre the well-being of present and future generations, especially those most impacted by climate change, in their decisions.

KEY IDEA: Some people, communities, and countries today are better able to cope with and/or to adapt to the impacts of climate change because they have benefited from the decisions and actions of dominant groups from previous generations.

Learners should be able to:
- evaluate how those people, communities, and/or countries with greater access today to cleaner air and water, safer infrastructure, etc. have benefited from historical processes.
- explain how countries that colonized much of the world in the past are wealthier, more powerful, and have access to the technology and resources that can help them cope with or recover more quickly from climate events like heatwaves, flooding, and extreme storms.

Learners should be able to:
- demonstrate tolerance for the people today who have benefited from the actions of previous generations, while criticizing the actions of previous generations that directly or indirectly harm the well-being of people and planet, especially those that persist in the present day.

Learners should be able to:
- identify and resist behaviours, actions, and decisions that could perpetuate the unfair advantage of privileged groups of people to cope or adapt to the impacts of climate change at the expense of marginalized populations, especially indigenous peoples, who may be experiencing the worst impacts of climate change.

KEY IDEA: Some people, communities, and countries today are less able to cope with and/or to adapt to the impacts of climate change because of unfair events in history that have either made them more exposed to climate hazards or have diminished their ability to adapt or to cope with its impacts.

Learners should be able to:
- evaluate how those groups of people, communities (including indigenous peoples), and/or countries that experience the worst impacts of climate change today have been taken advantage of by those with power throughout history.
- explain with the use of evidence how countries that have been colonized are also those with high rates of poverty, making it challenging to plan for, cope with, or to recover from climate events.

Learners should be able to:
- reflect critically on how colonialism, poverty, inequality (including gender inequality), and exclusion can impair people's ability to adapt or to cope with climate change or can put them in harm's way.
- demonstrate concern for and criticize how polluting industries and the corporations/companies behind them are structured so that those who are most exposed to hazardous and harmful working conditions are often the least paid workers, while those with decision-making power and in leadership positions benefit from their labour.
- value leadership and decision-making that aims to rectify past unfairness while building climate resilience.

Learners should be able to:
- identify and advocate for behaviours, actions, and decisions that could promote climate justice for those populations that have been harmed for generations, especially indigenous peoples.

13-15 years

KEY IDEA: Climate injustices today are closely related to long-standing environmental, social, and economic injustices committed by those who used their power for self-interest and self-benefit.

Learners should be able to:

- Describe the environmental injustices perpetrated by those in power, the economic, social, and political systems that have profited from these injustices.
- Suggest the resources needed to adapt to and cope with climate change that these injustices created across groups.
- evaluate and explain how the rise of the modern economy benefited from a limitless growth mindset that drove economic actors to seek profit at all costs, allowing for decisions to be made and actions taken that placed the short- and long-term well-being of people, especially the most marginalized peoples, and planet, secondary to personal profit. (See Key Concept 5 Post-Carbon Economies Topic 5.1 Economic Growth and Development.)
- analyse systematically the economic and political systems that have resulted in practices that have brought us to this point in terms of climate change.

Learners should be able to:

- value practices and systems that pursue environmental and climate justice by promoting the redistribution of power from those who abuse it to those previously disenfranchised.

Learners should be able to:

- point out and condemn harmful systems and ways of thinking, being and doing that diminish the capacity of marginalized populations to adapt, cope with or reduce their exposure to climate hazards. (See Key Concept 3 Resilience-Building Topic 3.1 Social Impacts of Climate Change.)
- cooperate with others to identify actions that help to redistribute power in pursuit of climate justice.

KEY IDEA: Some of our economic systems and political processes today enable or allow harmful practices by some actors to continue because of the benefits they provide to those in power, even though they exacerbate climate change and/or the climate vulnerability of marginalized groups.

Learners should be able to:

- identify modern-day actors or populations at the national/global levels whose actions may have benefited progress of human society in the past, but at a high cost for some groups of people and the planet, and whose continued practices continue to harm people and the planet today.
- analyse the roadblocks or barriers, including economic and political, that may be impeding the transition away from activities that may benefit the powerful but harm the planet and marginalized groups.

Learners should be able to:

- direct frustration, anger, and disappointment at the actions of the powerful toward coalition-building and collective climate action that changes unsustainable enabling systems.

Learners should be able to:

- motivate others to speak out against unfair, unjust, and unethical 'green' practices by those in power.
- collect, synthesize, and effectively communicate evidence of systemic injustices related to the climate or the environment.
- advocate for solutions that remove barriers to pursuing climate justice.

16-18 years

KEY IDEA: Climate injustice today is an extension of economic and political thinking and practices that have structured local and global social and economic inequalities across modern human history.

Learners should be able to: ▶ evaluate and explain with examples how local and global, historic and contemporary economic and political processes shape relations of power between groups of people, communities, and countries, which can have real material and immaterial consequences on people's experience of climate change and their capacity to adapt to its impacts. ▶ evaluate and explain with examples how principles of profit and growth enabled extractive and exploitative processes by those in power against marginalized groups around the world, driving industrialization and the rise of capitalism over 200 years, benefiting those in power while destroying the planet and oppressing those without power. (See Key Concept 5 Post-Carbon Economies Topic 5.1 Economic Growth and Development.)	Learners should be able to: ▶ demonstrate sensitivity to unequal relations of power in interpersonal relationships, social institutions, economic transactions, decision-making spaces, etc. in relation to climate action.	Learners should be able to: ▶ navigate unequal relations of power in ways that promote the restoration of equality simultaneously with the restoration of the planet.

KEY IDEA: Systemic injustices have repercussions that can be felt for generations, unless interventions are pursued that transition away from harmful practices and transform the unequal relations of power that sustain them.

Learners should be able to: ▶ evaluate and explain how capitalism driven by the assumptions of profit over planet, or even profit over people, have driven resource extraction, human exploitation (including those of indigenous people), and the climate crisis. ▶ compare and make arguments for alternative principles, frameworks, and models of economics and politics that could address climate injustices today and prevent further injustices as the climate crisis continues to unfold. (See also Key Concept 5 Post-Carbon Economies Topic 5.1 Economic Growth and Development.)	Learners should be able to: ▶ value, respect, and uphold indigenous ways of knowing, equality, human rights and social inclusion in the consideration of alternative principles, frameworks, and models of economics and politics that promote a greener and fairer future. ▶ critically reflect on the underlying values behind resource extraction, human exploitation and climate injustice.	Learners should be able to: ▶ take actions that centre the well-being of future generations and those in parts of the world most affected by the impacts of climate change in day-to-day decision-making. ▶ engage in cooperative behaviours and collective practices that uphold transparency, accountability, and inclusion while pursuing climate action.

18+

KEY IDEA: Some of those who have benefited from history continue to harm marginalized groups today, making them more exposed to climate hazards or more vulnerable to their impacts.

Learners should be able to: ▶ describe the relationship between industrialization, modern-day dominance of the fossil fuel industry, and the social dynamics of climate injustice, drawing on national and global examples. ▶ analyze and present on a timeline the rise of capitalism and corporations, the exploitation of human labour in the global south, the rise of overconsumption in the global north, and the economic dynamics of climate injustice. (See also Key Concept 5 Post-Carbon Economies Topic 5.1 Economic Growth and Development.) ▶ explain connections between colonialism, modern-day geopolitics and the political dynamics of climate injustice.	Learners should be able to: ▶ demonstrate awareness of unequal relations of power in national/global economic transactions that affect climate justice.	Learners should be able to: ▶ resist practices that place marginalized groups in greater positions of vulnerability in the face of climate change by promoting their fairer treatment. ▶ leverage evidence and tell stories to help those younger and older about the connections between past and present climate injustices and the urgent need to pursue behaviours and actions that will ensure these injustices stop with this generation.

KEY IDEA: Modern-day economic systems, political structures, and policy frameworks will continue to entrench and aggravate historic climate injustices unless there is a transformation of their underlying assumptions, values, and objectives towards the achievement of climate justice.

Learners should be able to: ▶ explain with the use of evidence how affluence and overconsumption among the top 10% is harmful for the world's majority and to the natural world. ▶ identify alternative forms of production and consumption that can meet the needs of present generations without sacrificing the ability of future generations to do the same. (See also Key Concept 5 Post-Carbon Economies Topic 5.2 Circular Economy and Everyday Life and Key Concept 6 Sustainable Lifestyles Topic 6.3 Responsible Consumption).	Learners should be able to: ▶ critically reflect on the limitations of neoliberalism and free market capitalism to serve humanity in climate crisis because it sustains the dominance of the political and economic status quo while muting the sense of urgency required to address climate injustice. ▶ place value in exploring proposals for alternative economic models that centre on care and well-being rather than on profit and growth.	Learners should be able to: ▶ advocate for, participate in, and support efforts to transform our economic and political systems, and their underlying systems of values and objectives, in relation to the health and well-being of people and planet.

KEY IDEA: Economic systems built on the backs of colonialism and industrialization have promoted a set of values and assumptions that perpetuate decision-making and governance structures that benefit the powerful while committing injustices against the most marginalized population.

Learners should be able to: ▶ explain the relationship between economic injustice, racial and gender injustice, and climate injustice.	Learners should be able to: ▶ channel emotions associated with injustice towards collective actions that can address systems change in pursuit of climate justice.	Learners should be able to: ▶ identify and communicate against business and workplace values, assumptions and practices that could perpetuate climate injustice, while promoting alternative values, assumptions, and practices that could promote climate justice.

Topic 3.4. Transformed futures

Climate change is a global issue that requires action by everyone. Everyone has a role to play but these will be different based on who we are, where we live, and how we experience and/or contribute to the climate crisis. While our experiences of the impacts of climate change are in many ways a by-product of structural and historical dynamics, our actions, and the climate solutions we pursue, should not and need not perpetuate these dynamics. Climate justice rests on the achievement of a future where the well-being of people and planet is realized through the pursuit and establishment of new social, economic, and political structures and systems, as practiced through community renewal, transformative placemaking,[3] a just transition, post-carbon, circular economies, respect for indigenous people's rights, children's rights, human rights, and valuing multiple knowledge systems. We have a role to play to ensure such a transformed future can become reality.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: We all have a role to play in addressing the unfair impacts of climate change and to ensure that everyone can be happy, healthy and safe even amidst climate change.**		
	Learners should be able to: ▶ describe the roles and the types of actions we can take depending on factors like how old we are, where we live, how we experience climate change, or how we contribute to climate change. ▶ identify a role that they can play in addressing the unfair impacts of climate change.	Learners should be able to: ▶ demonstrate a sense of confidence and self-efficacy in motivating or inspiring family and friends to help those who experience the worst impacts of climate change to be better supported and treated more fairly.	Learners should be able to: ▶ educate family and friends about how those people, communities and countries that have done more to cause climate change will now need to do more to stop climate change, even though we all have a role in stopping climate change. ▶ help others to understand that those people, communities, and countries that experience the worst effects of climate change may need help from those people, communities, and countries that have more money and resources.
	KEY IDEA: If we care for others and our environment, they will care for us.		
	Learners should be able to: ▶ understand that if we only think of ourselves, our actions could harm others and the planet. ▶ provide examples of how nature 'takes care of humans' (for example, through providing food, a sense of well-being).	Learners should be able to: ▶ appreciate indigenous practices and relationships with the land as a model to emulate and better understand. ▶ reflect on the interconnectedness of the well-being of the planet and our well-being as humans.	Learners should be able to: ▶ raise awareness among friends and family of the importance of caring for others and the planet and treating others (including the more-than-human world) fairly and equally, even those who may be different from us. ▶ persuade friends and family of the importance of caring for the plants and animals in our natural world and to take care of the environment, as our well-being and survival is dependent on their well-being.

3 See https://link.springer.com/article/10.1057/s41276-020-00254-8

	KEY IDEA: Our climate actions today can make a positive difference for generations to come.		
	Learners should be able to: ▶ explain how our choices and actions, and those of our families and communities, and of our leaders and community heroes, can make a difference for those impacted by climate change. (See also Key Concept 4 Resilience-Building Topic 4.2 Navigating Climate Impacts: Strategies for Safety and Resilience and Topic 4.4 Strength in Interconnectedness, and Topic 4.5 Urgency and Community Action.)	Learners should be able to: ▶ appreciate how our choices and actions today will impact future generations who will inhabit the planet.	Learners should be able to: ▶ explain to family and friends how our climate- and/or environment-related choices and actions today in our community can either help to keep unfair circumstances in place, which continues to hurt those groups of people that were hurt a long time ago, or make things more equal and fairer for all.
9-12 years	**KEY IDEA: We all have a role to play in creating a greener, fairer, and more equal future in the face of climate change, and this role will look different depending on who we are and how we experience the climate crisis.**		
	Learners should be able to: ▶ identify the actions and behaviours that we as individuals can take to contribute to a fairer and greener present and future, while recognizing the limitations of our individual contributions and the need for collective action as well. ▶ identify an action that they can take in their local community to contribute to a fairer, greener present-day and future.	Learners should be able to: ▶ demonstrate a conviction for accountability for actors, populations, and/or social and economic systems, who continue to act in their own self-interest, to abuse their power in individual or collective decision-making, and to harm marginalized people and the planet.	Learners should be able to: ▶ convince others how actors (and/or populations) who are most responsible for climate change must take rapid actions to counter the effects of their past actions towards the planet. ▶ advocate with others for the provision of resources and assistance by those who have them to those groups of people, communities, and countries who experience the worst impacts of climate change and have the least resources to respond. (See Key Concept 5 Post-Carbon Economies Topic 5.3 Climate Change and Our Economics and Topic 5.5 Our Roles in a Post-Carbon Economy.)
	KEY IDEA: Creating a fairer future in the face of climate change will require society to address long-standing social inequalities.		
	Learners should be able to: ▶ distinguish when decision-making may be excluding, harming, or perpetuating climate injustice against marginalized groups based on who they are, where they live or are from, or what they do. ▶ identify lessons from past efforts in history to advance social equality and social justice that can be applied to contemporary efforts to achieve climate justice.	Learners should be able to: ▶ value a diversity of perspectives and marginalized voices in the identification of climate-related challenges, in the development of climate solutions, and in climate-related decision-making.	Learners should be able to: ▶ help others distinguish between climate actions that promote the self-interests of the powerful and the collective interests of all, between individual well-being and collective well-being. ▶ show others the value and wisdom of indigenous knowledge and voices and local experience in defining justice-centred solutions to climate change.

KEY IDEA: In order for climate solutions to not create new inequalities and new injustices among people, communities, and countries who are already likely to experience negative impacts of climate change, extra support will be required so these groups can also benefit from climate solutions.

Learners should be able to: ▶ distinguish those actions that are required of society to adapt to a world impacted by climate change from those actions that will be harder for some people, communities, and countries because of long-standing inequalities they have experienced, and who must be supported in transitioning to a transformed future. ▶ propose and defend a climate solution that can be implemented in the community or country that addresses both climate change and the historic inequalities experienced by some groups.	Learners should be able to: ▶ anticipate and feel comfortable with the complexity and uncertainties that come with considering short-term climate solutions and long-term climate transformations.	Learners should be able to: ▶ promote individual and collective actions and policies that may help to support marginalized people, communities and countries in the transition to a more sustainable and equitable future.

13-15 years

KEY IDEA: To ensure a future centred on climate justice, action is needed to ensure everyone can access and participate in alternative sustainable lifestyles and livelihoods.

Learners should be able to: ▶ argue with evidence that to promote climate justice, actions must be taken to transition away from fossil fuels and from economic practices that promote the extraction of natural resources for profit and growth. (See Key Concept 5 Post-Carbon Economies Topic 5.2 Circular Economy and Everyday Life and Topic 5.4 Energy Consumption and Carbon Emissions.)	Learners should be able to: ▶ reflect on the actions that can help provide marginalized populations with the means, resources, opportunities and choices to transition away from vulnerable lifestyles and/or high-emission livelihoods.	Learners should be able to: ▶ synthesize the evidence and articulate the arguments that demonstrate how the cost of transitioning to more environmentally-friendly, sustainable lifestyles and livelihoods may be different for marginalized people, communities and countries, and that these groups will need additional support in the interim to transition away from practices that perpetuate harm.

KEY IDEA: A greener and fairer future requires the achievement of equality, social inclusion, environmental and climate justice and respect for human rights.

Learners should be able to: ▶ defend the importance of centring the well-being and rights of future generations in climate solutions pursued today. ▶ express the value and importance of centring indigenous voices and knowledge, multiple ways of knowing, and diversity in the identification of solutions pursued, for a transformed future amidst the climate crisis. ▶ explain how past injustices committed against marginalized populations, including environmental injustices, must be made right, and those that committed these injustices must be held accountable.	Learners should be able to: ▶ discern the mindsets, values, and behaviours that promote gender equality, racial equality, human rights, economic inclusion, etc. in a green future, and those that do not.	Learners should be able to: ▶ tell stories from history where collective action helped to advance equality, inclusion, justice, and/or human rights to identify and inspire present opportunities to advance climate justice in the future.

	KEY IDEA: Some actions can be helpful in addressing climate change, but we also need actions that tackle the problems that are causing some people to experience the impacts of climate change worse than others.		
	Learners should be able to: ▶ distinguish between actions that address the symptoms of climate change and those that address the root causes of climate injustice, through the use of local examples. ▶ identify and analyse how climate solutions being promoted today may worsen inequalities and vulnerabilities among marginalized populations, and how these solutions can be strengthened in their attention to climate justice.	Learners should be able to: ▶ differentiate between the space and place for (and limitations of) individual action, and the space and place for pursuing collective action to achieve systems change that promotes climate justice, and feel motivated to take action. ▶ demonstrate the capacity to cope with uncertainty, to manage complexity, and to think systemically in the context of climate action.	Learners should be able to: ▶ work with others to plan and execute individual or collection actions that advance climate justice.
16-18 years	**KEY IDEA: A just transition is required to achieve a future that is built on equity, equality, and sustainability.**		
	Learners should be able to: ▶ explain the concept of a just transition, the vision of the future that it is centred upon, and the holistic approach to, well-being and human dignity that it promotes. ▶ defend the position that addressing climate change requires a comprehensive and equitable approach that considers the needs and vulnerabilities of all communities. ▶ propose one strategy for a just transition that can be applied at the local/national level.	Learners should be able to: ▶ build solidarity, trust, coalitions, and relationships grounded on mutual respect, autonomy, equal rights, equal participation, and shared climate decision-making.	Learners should be able to: ▶ identify and advocate with others for actions that rectify past wrongs and address past environmental or climate injustices committed, especially those that have been a result of unequal social and economic systems.
	KEY IDEA: Achieving a greener and fairer future entails all key players accepting a common but differentiated responsibility to act in accordance with social justice and human rights.		
	Learners should be able to: ▶ explain how, while everyone has a role to play, those entities that have contributed the most to climate change must take greater responsibility to mitigate against further climate change and to help support the adaptation of others. ▶ describe how those entities that have experienced the worst loss and damage from climate change and who are the most vulnerable to exposure to climate hazards will require additional assistance to prepare for, respond and adapt to climate change.	Learners should be able to: ▶ demonstrate a sense of agency and confidence in engaging in climate solutions within one's control and realm of influence.	Learners should be able to: ▶ convince others to act and make decisions in alignment with their responsibility and in pursuance of climate justice.

KEY IDEA: Social movements and civic engagement are powerful mechanisms to advance social justice, especially when it comes to demonstrating to governments and decision-makers the urgency around, and the demand for, advancing climate action that centres on climate justice.

Learners should be able to: ▶ analyse the power of protests, activism, and resistance in history, especially by marginalized populations, and their role in building solidarity and advancing social justice and how these can be applied to advancing climate justice today and into the future. ▶ identify and research the efforts of a civil society organization (local/national/global) working to promote climate justice.	Learners should be able to: ▶ appreciate the role of civic participation in catalysing the systems change needed to enable and support actions at scale that promote climate justice.	Learners should be able to: ▶ participate in the efforts of a civil society organization engaged in the social movement and/or policy advocacy for climate justice.

18+

KEY IDEA: New policies, investments, and social institutions will be needed to support transformative actions and sustain social movements toward a future built on climate justice.

Learners should be able to: ▶ argue for the need to invest in new social institutions and public services that enable everyone's social foundations to be met, especially in the face of local climate hazards. ▶ argue for the need for new economic systems and systems of governance and decision-making that ensures human activities are sustainable and do no harm to marginalized populations. (See Key Concept 5 Post-Carbon Economies Topic 5.2 Circular Economy and Everyday Life and Topic 5.5 Our Roles in a Post-Carbon Economies.)	Learners should be able to: ▶ value opportunities for civic participation and engagement in helping to shape climate policies, investments and social institutions. ▶ reflect on and feel comfortable navigating the complexity of the local, national and international climate policy architecture and governance mechanisms.	Learners should be able to: ▶ persuade others of the role and need for global policy mechanisms and institutions that channel financial and technical assistance to low- and middle-income countries and marginalized populations to cope with loss and damage, to adapt to the impacts of climate change, and to strengthen their capacity to reduce exposure to climate risks and harm. ▶ advocate to others, including decision-makers and future employers, to pursue policies and practices that could help to transform their current institutions and organizational practices into green institutions and green practices.

KEY IDEA: The achievement of gender equality, racial equality, social inclusion, and the promotion of human rights – both in lived reality as well as in policy and in our institutions and governance structures – are prerequisites to restoring the planet and to achieving climate justice.

Learners should be able to: ▶ articulate how the achievement of gender equality, economic empowerment, social and environmental justice, food sovereignty, human rights, and the eradication of other forms of violence, discrimination and exclusion, are foundational to achieving climate justice. ▶ evaluate whether proposals for a transformed future meet the criteria of a vision of climate justice, and if not, discern what is missing and what solutions could strengthen that missing dimension.	Learners should be able to: ▶ appreciate how struggles for human flourishing are inter-related with struggles for planetary well-being. ▶ feel and express a sense of urgency in strengthening the public's constructive attention to equality and inclusion in climate action. ▶ value climate solutions and opportunities that advance social equality and environmental sustainability, and the inclusion of affected populations and indigenous peoples.	Learners should be able to: ▶ incorporate principles of gender equality, racial equality, social inclusion, and human rights into daily interactions and decision-making processes. ▶ engage in activities and initiatives that prioritize climate justice and address systemic inequalities.

Key concept 4

Resilience-building

Key topics

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Definition

Resilience-building in education is about building the capacities of learners to anticipate, absorb, accommodate and/or recover from the effects of climate change, climate shocks, climate stressors, or a hazardous climatic event in a timely and efficient manner. This entails understanding the socioemotional, psychosocial, social, economic, and political dynamics of climate change, in particular the associated risks and potential impacts. It also entails being able to identify actions, solutions, or pathways to navigate these risks and potential impacts in ways that are constructive, adaptive, and equitable. Resilience-building in CCE should also enable learners to identify opportunities to work towards individual and collective climate actions that build psychological resilience, social cohesion and inclusion. This form of education aims to create an informed and engaged citizenry capable of making decisions that contribute to climate change mitigation and adaptation efforts, and that foster healthy and resilient communities for the well-being of all.

Key ideas and learning outcomes per topic per age group

Topic 4.1. Social impacts of climate change

The social impacts of climate change are far reaching, touching various aspects of our daily lives, and reshaping many aspects of society. Our health is impacted in numerous ways, from heatwaves to waterborne diseases after floods. The economy and job sectors, particularly those dependent on predictable weather, like agriculture, are also affected. A farmer, for instance, can face significant financial hardships if persistent heat or drought affects crop growth. This economic strain has impacts across society and sectors. The upheaval of relocating due to floods or wildfires, the despair of losing homes, or the anxiety stemming from insufficient action against climate change by leaders, all contribute to our mental health. Climate-induced disasters can affect our relationships by displacing friends or fracturing families, reducing the frequency of interactions and straining bonds. The severity of these impacts isn't uniform. Personal aspects like who we are – our gender, race, or immigrant status – can amplify the hardships. Where we live also plays a pivotal role; coastal residents might grapple with encroaching seas, while those in drier regions face water scarcity. Thus, the repercussions of climate change are a complex tapestry, affecting not just the environment but the very fabric of society.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Weather patterns and climate affects us, our families and friends.**		
	Learners should be able to: ▶ describe what weather patterns and climate change are and how they can affect people's lives in different ways, such as how climate impacts can affect our health, jobs and communities.	Learners should be able to: ▶ recognize the emotional effects of climate impacts, such as feeling sad or anxious. ▶ demonstrate empathy towards people who are more impacted than others.	Learners should be able to: ▶ exhibit safe skill sets, such as safe behaviours during different weather conditions e.g. seeking shade and drinking water during a heatwave) ▶ develop water safety skills for themselves, their families and friends during various weather-related situations. ▶ use their creativity to journal weather patterns, play weather dress-up games and cloud-matching activities.
9-12 years	**KEY IDEA: Climate change affects us, our schools and our communities.**		
	Learners should be able to: ▶ describe climate change. ▶ identify that climate change can have varied impacts on our physical and mental health, economy and relationships. ▶ investigate how their school or community has been and will be affected by climate impacts in the future (e.g. 2025, 2030, 2040, 2050, 2100). ▶ investigate individual actions for reducing climate impacts that are supported by reductions in GHG emissions.	Learners should be able to: ▶ respect cultural diversity, and appreciate the importance of equal opportunities, regardless of circumstances.	Learners should be able to: ▶ plan actions that help our schools and communities adapt to climate impacts (water run-off, emergency preparedness, planting trees in schoolyard, green roof installation, energy storage, etc.).

13-15 years

KEY IDEA: Climate change affects everyone, but not everyone equally and diverse experiences of climate impacts are vital for building resilient actions, plans and policies.

Learners should be able to:

- discuss the differential impacts of climate change, recognizing that vulnerable groups are disproportionately affected due to factors such as geography, gender, race, immigration status and socio-economic status.
- explain the contributing factors to the unequal distribution of climate change impacts, including social determinants of health, economic disparities and systemic inequalities.
- propose effective actions and policies that governments and leaders can implement to protect and support those most vulnerable to climate impacts, addressing issues of equity and climate justice.
- analyze the multifaceted consequences of climate change-induced migration and forced displacement, including impacts on physical and mental health, livelihoods, cultural identity and social networks.

Learners should be able to:

- demonstrate empathy for individuals and communities who are disproportionately affected by climate impacts.
- explain the need for equity and justice-focused approaches and interventions that prioritise those who are most vulnerable.
- value diverse experiences and perspectives in enhancing resilience and effectiveness of climate action plans and policies.

Learners should be able to:

- advocate for climate actions that address the needs of those who are disproportionately affected by climate impacts (consider mental and physical health impacts) such as through climate science popularization.
- present solutions and approaches in their school or community that are inclusive of the lived experiences of these diverse perspectives.

16-18 years

KEY IDEA: Climate change is a complex and pressing problem and an opportunity for societal transformation.

Learners should be able to:

- describe the multifaceted nature of climate change as a pressing social problem, encompassing its impacts on food security, health, livelihoods, economy, political systems and societal cohesion.
- analyse the interconnectedness of climate impacts with societal issues such as inequality, health, migration and politics, recognizing how climate solutions can address multiple social challenges and yield co-benefits for health.
- acknowledge the differential impacts of climate change based on individual characteristics such as gender, race, health, age and geographical location, emphasizing the importance of diverse perspectives in developing resilient climate strategies and plans. (See Key Concept 3 Climate Justice Topic 3.2 Social Determinants.)
- propose policy interventions to mitigate underlying causes of climate change, such as reducing societal reliance on fossil fuels, and explore alternative systems of governance or policy interventions that have the transformative potential for addressing climate change and societal challenges. (See Key Concept 3 Climate Justice Topic 3.2 Transformed Futures).

Learners should be able to:

- express solution-oriented thinking and attitudes.
- envision their community as sustainable and resilient.
- develop hopeful attitudes towards the future.
- feel greater confidence in their ability to influence decision-makers developing policies influencing climate change.

Learners should be able to:

- share with family and community members a systems-thinking approach to address the complexity of climate impacts and solutions.
- identify and create solutions or policy interventions that alleviate the human suffering caused by climate impacts.

18+	**KEY IDEA: There are complex climate impacts on society and opportunities for transformed futures.**		
	Learners should be able to: ▶ describe the multi-faceted social implications of climate change, including effects on health, migration patterns, economic disparities and societal infrastructures. ▶ analyse how systemic inequalities amplify the impacts of climate change on marginalized communities, considering factors such as race, gender, socioeconomic status, and geographical location (see Topic 3.2 Social Determinants). ▶ differentiate between global impacts and how specific regions or localities may experience unique challenges due to climate change. ▶ analyse existing and potential solutions to climate change, ensuring they prioritise both sustainability and equity. (See Key Concept 3 Climate Justice Topic 3.2 Transformed Futures).	Learners should be able to: ▶ reflect on their own position in the global network of climate impacts, understanding both their role as potential contributors to the problem and as agents of change. ▶ be motivated to identify and undertake solutions to climate change.	Learners should be able to: ▶ demonstrate understanding of the multi-faceted social implications of climate change through presenting written or visual work or action projects to their community. ▶ create a proposal that outlines strategies, actions and policies that local regions could enact to reduce negative climate impacts.

Topic 4.2. Navigating climate impacts: strategies for safety and resilience

As climate impacts intensify, embedding safety and resilience within the educational journey of children and young people becomes crucial. This topic equips learners with skills to identify and mitigate risks, enhancing their capacity to respond to climate-related emergencies. Learners will explore actionable strategies such as assembling evacuation kits and accessing crucial information during extreme weather events. Emphasizing proactive measures, the curriculum covers the development of comprehensive emergency plans and risk assessment to reduce vulnerabilities. Mitigation efforts are geared towards addressing the core issue: reducing greenhouse gas emissions to slow or stop climate change progression. Adaptation, conversely, focuses on managing the unavoidable consequences of climate change, encouraging innovative thinking for solutions like infrastructure enhancement and ecosystem resilience. This dual approach – mitigating emissions and adapting to changes – comprises a robust framework for safeguarding communities against the evolving challenges of climate impacts.

	Cognitive	**Social and emotional**	**Behavioural**
5-8 years	**KEY IDEA: Climate change causes extreme weather and climate disasters and one can prepare ahead for emergency situations.**		
	Learners should be able to: ▶ identify types of extreme weather such as floods, fires, heatwaves, tornadoes, hurricanes/cyclones. ▶ explain how extreme weather events are linked to the increase of GHG emissions caused by the burning of fossil fuels. ▶ investigate the most common types of extreme weather events and predicted climate impacts in the local area. ▶ identify the basic items that should be packed in an evacuation bag. ▶ investigate what emergency response systems are in place in their school/community and how to find information in an emergency.	Learners should be able to: ▶ appreciate the importance of safety during extreme weather events or climate disasters. ▶ develop a sense of responsibility to care for themselves and others during an emergency. ▶ demonstrate a commitment to teamwork and cooperation during emergencies.	Learners should be able to: ▶ develop a list of actions they would take in different extreme weather events such as cooling down body temperature by staying in the shade when outdoors. ▶ participate in emergency drills for climate disasters. ▶ work as part of a team in creating a response plan to a potential emergency in the community, describing ways that learners can contribute, such as by listening to adults, following rules and working to help.

9-12 years

KEY IDEA: One can reduce harm through risk-reduction behaviour.

Learners should be able to: ▶ identify the most common extreme weather events and predicted climate impacts for their local area or country. ▶ identity potential risks in their home or classroom related to extreme weather or climate disasters (flooding, heat, fire, hurricane/cyclone, tornado). ▶ brainstorm actions that could be taken to reduce harmful risks in home or classroom (e.g. sandbags, cooling strategies, going to the basement or a secure structure). ▶ describe emergency plans for different emergency situations, such as floods, tornadoes, hurricane, fire, and learn about how emergency services respond (e.g. alert systems, police or fire warnings, and the news).	Learners should be able to: ▶ develop confidence to prepare for and respond to extreme weather and climate disasters, building resilience and adaptive capacity. ▶ foster empathy for disaster-affected communities ▶ express understanding of the emotions others might feel during a climate disaster.	Learners should be able to: ▶ share ideas with their family and school members on how to reduce risks at home or in classrooms and present to family members emergency plans for different situations, such as floods, tornadoes, hurricanes, fire drills and learn about how emergency services respond (e.g. alert systems, police or fire warnings and the news). ▶ create a family emergency plan (evacuation route, communication strategies, necessary supplies).

13-15 years

KEY IDEA: Emergency response plans help in preparing for emergencies.

Learners should be able to: ▶ evaluate emergency response plans that are in place for the local region (if available). ▶ discuss the role of emergency services and communication strategies for information during a climate disaster.	Learners should be able to: ▶ exhibit taking responsibility and confidence in responding to extreme weather and climate disasters through participating in a group activity to develop a mock emergency response plan for their classroom or school.	Learners should be able to: ▶ suggest improvements to emergency preparedness and response plans (as applicable) to school and community leaders. ▶ create or share emergency preparedness plans with community (family, friends, online).

KEY IDEA: Mitigation and adaption strategies help in coping with climate change.

Learners should be able to: ▶ define climate change mitigation and adaptation, understand the differences between them, and explain how they are used to address climate disasters. ▶ explain the link between climate change and increased frequency and severity of climate disasters, using evidence from scientific research and case studies. ▶ identify, compare and assess various mitigation and adaptation strategies at individual, community, national and international levels.	Learners should be able to: ▶ develop a commitment to mitigation and adaptation strategies solutions. ▶ be committed to continuing to learn about new developments in mitigation and adaption strategies.	Learners should be able to: ▶ adopt pro-climate behaviours in schools and communities such as reducing single use plastic.

16-18 years	**KEY IDEA: Youth as community leaders can contribute to disaster risk reduction and community resilience.**		
	Learners should be able to: ▶ define climate risks, understand the wide range of impacts caused by climate change, and explain how these impacts vary among different communities and regions. (See Key Concept 3 Climate Justice Topic 3.2 Social Determinants.) ▶ identify, assess, and critically analyse various climate risk mitigation strategies at individual, community, national and international levels. ▶ explain the unique roles, opportunities and challenges for youth in contributing to disaster risk reduction and enhancing community resilience. ▶ assess and describe key qualities of effective leadership and identify strategies for engaging various community stakeholders in disaster risk reduction and resilience-building efforts.	Learners should be able to: ▶ deepen their understanding of the impacts of climate disasters on different community members, communities, regions, and nations and develop a sense of responsibility to protect and support their local community and communities elsewhere. ▶ build confidence in their abilities to contribute to disaster risk reduction and community resilience, developing essential leadership skills such as communication, decision-making and problem-solving.	Learners should be able to: ▶ develop a climate disaster mitigation and adaptation plan for their school or community. ▶ engage various community stakeholders to contribute to development and or implementation (including recommendations for reducing GHG emissions, energy reductions, improving emergency preparedness, and enhancing local ecosystems resilience). ▶ advocate for greater inclusion of youth in local, regional or national decision-making processes related to disaster risk reduction and resilience-building, (e.g. writing letters to local leaders, speaking at community meetings or participating in relevant campaigns).
18+	**KEY IDEA: There are specific activities that we can undertake for emergency responses, risk reduction, mitigation and adaptation.**		
	Learners should be able to: ▶ present the distinctions and inter-relationships between emergency responses, risk reduction, mitigation and adaptation in the context of climate change. ▶ identify key vulnerabilities within their local communities and broader regions that may increase susceptibility to climate impacts. ▶ critically evaluate existing infrastructure, policies, and practices to determine their adequacy in addressing climate risks. ▶ analyse case studies on climate disasters and consider the economic, political, and social costs.	Learners should be able to: ▶ demonstrate a mindset of preparedness and anticipation, understanding that proactive planning can significantly reduce potential harm. ▶ enhance empathy for communities especially vulnerable to climate impacts and understand the importance of collective action in keeping everyone safe.	Learners should be able to: ▶ participate in or even organize community workshops and trainings related to climate impact preparedness, ensuring they and their peers are equipped with emergency preparedness knowledge. ▶ voice their concerns and solutions to local authorities, pushing for strategic planning, infrastructure upgrades, or community programmes that prioritise safety from climate impacts. ▶ integrate risk reduction and mitigation practices into their personal lives, such as by advocating for retrofitting of their living and working spaces, adhering to local safety guidelines or actively supporting sustainable endeavours.

For more detailed information, see:

UNESCO and UNICEF (2014). Towards A Learning Culture of Safety and Resilience: Technical Guidance for Integrating Disaster Risk Reduction in the School Curriculum. https://unesdoc.unesco.org/ark:/48223/pf0000229336/PDF/229336eng.pdf.multi

UNESCO (2014). Stay Safe and Be Prepared: A Parent's Guide to Disaster Risk Reduction: https://unesdoc.unesco.org/ark:/48223/pf0000228964.locale=en

UNESCO (2014). Stay Safe and Be Prepared: A Student's Guide to Disaster Risk Reduction: https://unesdoc.unesco.org/ark:/48223/pf0000228798.locale=en

UNESCO. (2012). Disaster Risk Reduction in School Curricula: Case Studies from Thirty Countries: https://unesdoc.unesco.org/ark:/48223/pf0000217036

Topic 4.3. Climate anxiety and constructive coping

When people (old or young) learn about or experience climate change and impacts, it can cause strong emotions. People can feel sad, angry, worried, betrayed, and many other complex emotions. These feelings are normal and so it is important to develop coping strategies to attend to one's mental health and well-being. Given the levels of climate anxiety being reported from children and youth across the globe, these constructive coping strategies have been repeated across age groups in this topic, with more complexity and scaffolding added accordingly.

1. **Connecting with others: When we're feeling negative emotions like being sad, angry or worried, it can help to talk to our friends, family or teachers about these feelings. They might be feeling the same way and it can make us feel better to know we're not alone.**
2. **Getting involved in our community: Doing something about climate change can also make us feel better. This could be things like planting trees in our community, reducing fossil fuel usage, or helping to organize activities in our school or neighbourhood.**
3. **Mindfulness and self-care: Doing things that help us relax can also help. This can be things like deep breathing, drawing, playing a game or spending time in a favourite place. These activities can help us feel more calm and less worried.**
4. **Spend time in nature: When you spend time outside in nature regularly, it can help you feel less stressed and happier. Nature has a way of calming us down and can help us handle the feelings of worry that come when thinking about climate change. However, access to these spaces varies greatly and, for some, just accessing natural spaces is challenging while for others being in nature can be an emotionally challenging experience.**

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: It is important to express our climate emotions.**		
	Learners should be able to: ▶ identify and label basic emotions (happy, sad, scared, angry) when discussing climate and nature-related topics. ▶ describe simple mindfulness techniques, such as breathing exercises, and how they can help to manage emotions.	Learners should be able to: ▶ understand that it is normal to have climate anxiety or to feel intense emotions about climate uncertainties. ▶ reflect on how they feel after spending time outdoors. ▶ demonstrate curiosity about nature (See Key Concept 2 Ecosystems and Biodiversity). ▶ express basic emotions related to climate and nature-related topics. ▶ practice mindfulness exercises, such as mindful breathing, during class activities.	Learners should be able to: ▶ explore nature-based curiosities through outdoor play and inquiry such as observing wildlife habitats, identifying local plant species, and investigating weather patterns and changes in the environment. ▶ express feelings about nature and climate in age-appropriate ways such as drawings, storytelling, and role-play. (See Key Concept 1 Climate Science and Key Concept 2 Ecosystems and Biodiversity.)
9-12 years	**KEY IDEA: Our emotions can be complex around climate change and we can learn coping strategies to address climate change anxieties.**		
	Learners should be able to: ▶ define and describe a wider range of emotions (e.g. anxiety, hope, frustration, empowerment) related to nature experiences, eco-anxiety, and or climate (in)action in society. ▶ investigate constructive coping strategies (mindfulness, nature-connection, talking with others, getting involved in climate action). ▶ demonstrate understanding of complex climate emotions through creative applications (art, poetry, media, music, etc.). ▶ analyze which coping strategies work best for them and create a personal plan. ▶ practice mindfulness exercises such as body scans, guided visualizations, breathing exercises and nature-connection practices.	Learners should be able to: ▶ understand that it is normal to have climate anxiety or to feel intense emotions about climate uncertainties. ▶ feel empathy and show active listening towards others discussing their feelings/experiences of climate change. ▶ experience positive, personal connections with nature through reflective activities, such as nature journaling or photography. ▶ identify which constructive coping strategies work best for them.	Learners should be able to: ▶ participate in activities focused on understanding and addressing climate change anxieties such as Environment days observed at school. ▶ Initiate family discussions on climate change and its emotional impact and suggest ways to deal with climate anxiety such as creating a family climate action plan, practicing mindfulness exercises together, or spending time in nature to alleviate stress.

13-15 years	**KEY IDEA: It is okay to share our complex climate emotions with others. There are strategies for supporting ourselves and others.**		
	Learners should be able to: ▶ understand that it is normal to have climate anxiety or to feel intense emotions about climate uncertainties. ▶ investigate constructive coping strategies (mindfulness, nature-connection, talking with others, getting involved in climate action). ▶ analyse which constructive coping strategies work best for them and are relevant for the local/regional context.	Learners should be able to: ▶ develop empathy for themselves and other people who are experiencing complex climate emotions. ▶ reflect on how climate emotions can motivate or hinder climate engagement or action. ▶ recognize that climate action can build community and foster connections with others.	Learners should be able to: ▶ develop personal strategies for navigating complex climate emotions, such as climate grief or eco-anxiety, and for supporting others in doing the same. ▶ present strategies (constructive coping) to help people and leaders from across society to move past barriers of climate inaction: distance, doom, dissonance, denial, iDentity.[4]
16-18 years	**KEY IDEA: Climate anxiety presents an opportunity to better understand and manage our emotions.**		
	Learners should be able to: ▶ describe the concept of climate anxiety, its causes, manifestations, and the reasons it has become prevalent among their age group. ▶ distinguish between various emotions related to climate concerns, such as grief, anger, fear, and guilt, and understand the potential sources of these feelings.	Learners should be able to: ▶ foster empathy towards themselves and others experiencing climate anxiety and recognize the value of shared experiences in navigating challenging emotions. ▶ demonstrate a sense of hope and understanding that while the challenges posed by climate change are significant, collective action and individual contributions can make a difference.	Learners should be able to: ▶ demonstrate skills to recognize and manage their emotions related to climate change, such as exploring local solutions to combat heatwaves through online research, ensuring they don't become overwhelming or paralysing. ▶ Express their feelings through creative activities such as journaling emotions or debating about how climate anxiety can arise and ways to manage these emotions effectively. ▶ Participate in community events or initiatives that raise awareness about climate anxiety and promote mental health support.
18+	**KEY IDEA: It is important to work together in addressing climate anxiety.**		
	Learners should be able to: ▶ critically analyse the complex interplay of factors that contribute to climate anxiety, particularly in contemporary society. ▶ recognize the pivotal role that community leaders play in shaping responses to climate challenges, both in addressing practical concerns and in influencing the collective emotional climate. ▶ understand the concept of collective efficacy – believing in the ability of the community to effectively address challenges – and its role in mitigating climate anxiety.	Learners should be able to: ▶ connect their feelings of climate anxiety with opportunities for community engagement, translating personal concerns into collective efforts. ▶ demonstrate qualities like resilience, hope, empathy and assertiveness, essential for leadership in the face of climate challenges. ▶ understand the importance of creating and fostering communities where open dialogue about climate anxiety is encouraged and where members support one another.	Learners should be able to: ▶ take the initiative in creating or joining local community groups focused on climate solutions, leveraging these platforms to address the root causes of climate anxiety. ▶ champion mental health and well-being policies that acknowledge climate anxiety, engaging with local, regional or national authorities to ensure the issue is recognized and addressed. ▶ organize or attend workshops focused on climate anxiety, its implications, and coping mechanisms, ensuring continuous education and discussion on the topic.

4 Stoknes, Per Esper. (2017). How to transform apocalypse fatigue into action on global warming. TED talk: https://www.ted.com/talks/per_espen_stoknes_how_to_transform_apocalypse_fatigue_into_action_on_global_warming?language=en

Topic 4.4. Strength in interconnectedness

As humans we are dependent on the natural world. The interconnectedness of all things extends beyond just the natural world and includes a recognition of the interdependence of diverse cultures and knowledge systems, including those of indigenous people. We build resilience and the possibility for transformation when we understand that our cultures, and constructed 'built' systems (such as agriculture, energy networks, economies, internet connectivity) are interconnected and dependent upon the natural world.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Humans and other living things are dependent on the natural world.**		
	Learners should be able to: ▶ identify examples of how humans and other living organisms depend on the natural world, such as for food, water, air and materials for shelter. ▶ explain how humans and nature are connected (e.g. how human impacts effect natural systems, how natural systems provide life-sustaining building blocks such as food, air, water).	Learners should be able to: ▶ develop a sense of appreciation and respect for the natural world and its integral role in human life and survival. ▶ express their connectedness with nature, for example, through an artistic expression (e.g. art, music, writing, etc.).	Learners should be able to: ▶ participate in activities that connect students with nature, such as planting seeds, observing wildlife or creating art from natural materials. (See Key Concept 2 Ecosystems and Biodiversity). ▶ demonstrate responsible behaviours that reflect an understanding of human dependence on the natural world, including conservation, such as telling families the values of planting trees.
9-12 years	**KEY IDEA: Humans, nature and 'built systems' are interconnected.**		
	Learners should be able to: ▶ explain the concept of interconnectedness, with examples, demonstrating how different systems (human, natural, or built (infrastructure)) are interdependent (e.g. food supply, energy). For example, the food we buy in the grocery store is dependent on the natural systems which provide the conditions for food to grow, the human systems (social, cultural, economic structures and processes), such as those who are employed to harvest, prepare, and sell the food, and the built systems, which is all of the infrastructure (transportation systems, utilities, buildings) that are required for the food to be cleaned, packaged, shipped and sold at the store. ▶ trace the journey of a common item (like a fruit or vegetable) from its origin to their plate, highlighting each point of interconnectedness across natural, human and built systems.	Learners should be able to: ▶ reflect on and appreciate how different systems they encounter in their daily lives are interdependent. ▶ develop a sense of personal and collective responsibility to protect and enhance these interconnected systems for the well-being of all and social cohesion.	Learners should be able to: ▶ visit local farms, factories, or distribution centres to observe and document first-hand the various systems at play in the production and distribution of goods. ▶ illustrate visually and share with others the interconnectedness of various systems using real-life examples.

13-15 years

KEY IDEA: It is possible to make human, natural and 'built systems' more resilient.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ identify how climate impacts can affect human, natural and built systems (infrastructure). ▶ research and support explanations of how these systems could be made more resilient (e.g. reduce disruption or negative effects of climate impacts on food or energy systems).	▶ demonstrate a problem-solving mindset for finding solutions to climate risks and vulnerabilities.	▶ carry out an impact analysis of a select system (human, natural, built) and identify potential vulnerabilities. ▶ demonstrate actions that support the resilience of interconnected systems (e.g. how does reducing GHGs in manufacturing processes benefit natural systems, etc.) through role-playing or simulation.

KEY IDEA: One can design and implement strategies for improving the resilience of human, nature and built systems.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ demonstrate knowledge and understanding of characteristics of resilient systems, such as adaptive capacity, robustness, redundancy, flexibility, responsiveness, resourcefulness and integration. ▶ apply the principles of resilient systems to specific examples (e.g. how a forest, school, city infrastructure, farm could be more resilient to climate change).	▶ demonstrate a problem-solving mindset for finding solutions to climate risks and vulnerabilities.	▶ design a strategy to promote the principles of resilient systems using examples relevant for different audiences and contexts.

KEY IDEA: Resilience-building is enhanced through understanding cultural diversity and interdependence.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ explain the concept of interconnectedness in relation to cultural diversity (specifically focusing on regional indigenous knowledges and indigenous ways of knowing and practising interconnectedness). ▶ define the concept of resilience and identify how interdependence among diverse cultures can enhance community resilience in the face of challenges. ▶ investigate how culturally diverse perspectives broaden problem-solving (various ways of thinking and experiences), enhance adaptability, promote innovation and creativity, mitigate groupthink and how these processes contribute to developing resilient communities, practices, policies, and places.	▶ express appreciation for cultural diversity and the unique contributions of different cultures to community resilience (specifically emphasizing indigenous knowledges and ways of knowing for an understanding of interdependence and resilience). ▶ demonstrate respect for cultural differences and recognize the importance of inclusivity in resilience-building, especially for people who are burdened with disproportionate climate impacts (young people, women, indigenous people, and the global south). (See Key Concept 3 Climate Justice for disproportionate burden of climate impacts).	▶ organize and participate in activities that promote cross-cultural understanding, specifically prioritizing learning from groups that are disproportionately burdened by climate impacts.

16-18 years

KEY IDEA: Global citizenship involves taking climate action in our communities, countries and in line with global needs.

Learners should be able to: ▶ define global citizenship, understanding their roles and responsibilities as global citizens within interconnected (natural, human, built) systems that are threatened by climate impacts.	Learners should be able to: ▶ develop a sense of leadership and responsibility to act locally, in the context of global interconnected systems.	Learners should be able to: ▶ encourage family members to make environmentally-conscious choices, such as supporting local and organic food options, reducing meat consumption and using eco-friendly products. ▶ initiate or join a climate action club or environmental organization at school to raise awareness and implement sustainability initiatives. ▶ work with school administration to implement eco-friendly policies and practices such as climate friendly school infrastructure, engagement with the community, fostering collaborations and partnerships and climate change projects in school.

KEY IDEA: There are areas of especially high risk and vulnerability to climate change in different parts of the world.

Learners should be able to: ▶ identify areas of high risk of vulnerability or disruption in human global supply chains. ▶ identify areas of high risk of vulnerability of disruption in natural systems at the local/national/global levels. ▶ identify areas of high risk of vulnerability of disruption in infrastructure systems at the local/national/global levels.	Learners should be able to: ▶ feel a sense of responsibility to take action at the local/national/global levels to reduce areas of high risk of vulnerability in systems that provide for global human and planetary needs.	Learners should be able to: ▶ design (for example, through concept mapping) and share a systems view of the interconnectedness of human, natural, and built systems for one example (food, energy, consumer product).

18+

KEY IDEA: Leadership at a global level is necessary for addressing climate change.

Learners should be able to: ▶ demonstrate an understanding of the interconnectedness of human, natural, and built systems and how transformation in one area can influence others. ▶ evaluate and critically discuss real-world examples of how interconnected systems have demonstrated resilience or vulnerability in the face of challenges, like economic downturns, natural disasters or technological disruptions. ▶ analyse how different cultures and historical periods have understood and responded to the concepts of resilience and interconnectedness (with particular emphasis on indigenous ways of knowing and practices). ▶ recognize the importance of policy, governance and leadership in shaping the resilience of interconnected systems.	Learners should be able to: ▶ demonstrate a sense of responsibility and need for collective action. ▶ reflect on the importance of resilience and interconnectedness in their personal and professional lives.	Learners should be able to: ▶ devise strategies and solutions for enhancing resilience in complex, interconnected systems, considering both short-term tactics and long-term strategies. ▶ Take on leadership roles within youth organizations or clubs focused on environmental sustainability, climate action or disaster preparedness.

Topic 4.5. Urgency and community action

Climate change represents one of the most pressing challenges of our time, with far-reaching consequences that affect all parts of the natural world and human society. Its impacts, ranging from rising sea levels to intensified heatwaves, are increasingly evident and threaten the very fabric of ecosystems, economies, and communities worldwide. Urgency is an imperative because the longer we delay substantive action, the more irreversible and devastating these changes become. Climate action is not just a task for governments and large corporations. Community action is crucial because this is where tangible changes often occur. Collective efforts at the local scale, whether it's addressing food security, reducing waste, conserving energy, addressing transportation, or raising awareness, can significantly amplify global efforts to mitigate climate change. A combination of urgency and community action is essential to address this global crisis effectively and safeguard our planet for current and future generations.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Taking climate action is urgent.**		
	Learners should be able to: ▶ explain the urgency of taking climate action (reduce greenhouse gas emissions by 45% by 2030), with the use of evidence. ▶ identify actions that they can take to reduce GHG emissions at school (e.g. reduce food waste, walk to school, eat a plant-based diet, conserve energy, etc.).	Learners should be able to: ▶ show a sense of responsibility to support urgent climate action. ▶ show a sense of agency and ability to contribute to community climate actions.	Learners should be able to: ▶ Adopt sustainable practices such as turning off lights and electronics when not in use, use water sparingly during handwashing and brushing teeth, and avoid unnecessary waste by using reusable containers instead of single-use items. ▶ express care and concern for the natural world by nurturing plants, feeding birds or creating artwork that depicts the importance of protecting the environment.
9-12 years	**KEY IDEA: It is necessary to undertake climate action at the school level (if applicable).**		
	Learners should be able to: ▶ explain why schools taking climate action is important. ▶ identify what climate actions and policies the school or school board has in place.	Learners should be able to: ▶ demonstrate a sense of responsibility for participating in climate action at the school level.	Learners should be able to: ▶ initiate conversations with peers, teachers and school leaders about the importance of climate action and what actions, practices, and policies are in place.
	KEY IDEA: We can assess our school's climate action plans to improve them (if applicable).		
	Learners should be able to: ▶ apply critical thinking and problem-solving skills to assess whether the school is urgently taking climate actions as defined in the Paris Climate Agreement or by the IPCC reports. (For example, has the school declared a climate emergency? Is climate change mentioned in the strategic plan and is there a commitment to reduce GHG emissions? Does the school have a climate action plan to guide policy and practice to meet climate targets? Is there professional development funding put towards teacher CCE? Is there funding available for schoolyard greening?).	Learners should be able to: ▶ feel confident and capable to ask school or leaders to develop climate policies and plans to ensure schools are responsive to the urgency of action.	Learners should be able to: ▶ present their thinking/ideas/rationale for their school's climate actions and suggest improvements.

13-15 years	**KEY IDEA: It is necessary to undertake climate action at the community level.**		
	Learners should be able to: ▶ explain why taking action with others in your community is more powerful than individual action alone. ▶ identify what climate plans or actions the community has in place.	Learners should be able to: ▶ show a sense of responsibility for participating in climate action at the community level. ▶ appreciate the importance of working together with others to undertake climate action.	Learners should be able to: ▶ initiate conversations with peers, teachers and community leaders about the importance of climate action, what actions, practices, and policies are in place, and what might be done at the community level.
	KEY IDEA: We can assess our community's climate action plans to improve them.		
	Learners should be able to: ▶ apply critical-thinking and problem-solving skills to assess whether the municipality or local community leaders are urgently taking climate action as defined in the Paris Climate Agreement or by the IPCC reports. (For example, has the community declared a climate emergency? Does the community have a climate action plan or climate adaptation plan? Is there funding available for community-based climate initiatives?)	Learners should be able to: ▶ demonstrate a sense of responsibility and the ability to ask community leaders to develop climate policies and plans to ensure communities are responsive to the urgency of action.	Learners should be able to: ▶ present their thinking/ideas/rationale for how they assessed their community's climate actions and possible areas of improvement.
16-18 years	**KEY IDEA: National governments and international policies have an essential role to play in addressing climate change.**		
	Learners should be able to: ▶ analyse climate actions and policies that national and sub-national governments have committed to. ▶ assess whether national and sub-national climate policy and action are in alignment with internationally agreed upon climate targets (e.g. reducing GHGs by 45% by 2030 or limit warming to 1.5 degrees Celsius). ▶ using critical thinking, analyze the effectiveness and potential improvements of international policy or governmental actions (EN-ROADS Simulator[5] is effective for analysing mitigation strategies, Project Drawdown, Climate Tracker).	Learners should be able to: ▶ develop appreciation for the need to support strong climate leadership.	Learners should be able to: ▶ participate in discussions about governmental climate actions and policy in various contexts, such as through a Mock COP,[6] community forums; evaluate climate solutions using EN-ROADS.
	KEY IDEA: Climate leadership is important in society.		
	Learners should be able to: ▶ recognize the role of citizens to support strong governmental actions and policy to keep global warming under 1.5 degrees Celsius. ▶ evaluate climate leadership at the national/global levels, and gaps in policies or actions.	Learners should be able to: ▶ see themselves as leaders in addressing climate change.	Learners should be able to: ▶ take actions with others, whether as a leader or supporter, in addressing climate change, such as promoting usage of renewable resources in the community. ▶ develop recommendations for how to bolster climate leadership in society.

5 En-ROADS is a freely available online simulator that provides policy-makers, educators, businesses, the media and the public with the ability to test and explore cross-sector climate solutions: https://www.climateinteractive.org/en-roads/

6 A Mock COP is a youth-led and simulated COP meeting. It is adapted from a Model UN format and youth roleplay as international diplomats. For an example of how to design a MOCK COP see https://www.abdn.ac.uk/research/mock-the-cop-746.php. MOCK COP is also a conference that is organized by youth around the world: https://www.mockcop.org/

18+	**KEY IDEA: We can assess and support ambitious climate policy and societal change.**		
	Learners should be able to: ▶ critically assess existing climate policies, strategies, and international agreements, identifying gaps, strengths and areas for innovation. ▶ assess climate solutions and effectiveness for reducing GHGs by 45% by 2030 or limiting warming to 1.5 degrees Celsius (tools such as Project Drawdown, or EN-ROADS simulator are good resources). ▶ grasp the principles of transformational change, differentiating it from incremental change, in the context of equitable and sustainable futures.	Learners should be able to: ▶ develop their confidence and skills in leadership and advocacy for climate solutions. ▶ cultivate listening and stakeholder consultation skills for considering diverse perspectives on climate solutions.	Learners should be able to: ▶ propose innovative strategies and solutions for climate challenges, from a breadth of academic resources, integrating cross-disciplinary knowledge. ▶ share their proposals for climate solutions, strategies and actions for regional, national and international governments and stakeholders. ▶ take leadership roles within local community contexts, mobilizing knowledge and research from university into public society.
	KEY IDEA: Each person can show leadership in addressing climate change.		
	Learners should be able to: ▶ investigate the history of climate awareness, action and leadership, recognizing pivotal moments, key figures and major policy shifts. ▶ research and compare how different cultural narratives, beliefs, traditions and livelihoods influence perceptions of climate change and societal willingness to act.	Learners should be able to: ▶ model ethical leadership in climate action, prioritizing transparency, inclusivity, justice and long-term societal well-being. ▶ demonstrate a forward-looking perspective, considering the long-term implications of today's decisions for all people, especially those disproportionately affected by climate impacts and the planet's health.	Learners should be able to: ▶ explain complex climate issues in an accessible manner for diverse audiences, employing a range of formats from academic writing to public speaking. ▶ practice/demonstrate effective leadership and communication strategies for advocating for robust climate action, including framing arguments, leveraging media and influencing policy.

Topic 4.6. Tackling climate mis/disinformation

Climate change is a complex and pressing issue that requires collective understanding of the urgency and need to act. However, there are vested interests involved in financing, producing, and amplifying mis/mal/disinformation about climate change. Misinformation refers to false information that is not intended to cause harm, such as misunderstanding climate science. Malinformation refers to information that stems from the truth but is often exaggerated in a way that misleads and causes potential harm, such as greenwashing. Disinformation refers to false information that is intended to manipulate, cause damage, or guide people, organizations, or countries in the wrong direction, such as climate change denial. Social media platforms are where many young people find information about climate change. However, social media platforms are also where the majority of mis/mal/disinformation is spread about climate change. Developing critical media literacy skills can help learners detect and investigate mis/mal/disinformation.

	Cognitive	**Social and emotional**	**Behavioural**
5-8 years	**KEY IDEA: We learn from many different information sources.**		
	Learners should be able to: ▶ recognize that information can come from different sources like books, teachers, or screens (TV, computers). ▶ recognize and categorize the kinds of information sources they use regularly related to the weather or climate change.	Learners should be able to: ▶ reflect on how they 'know what they know'. ▶ recognize how they learn new things.	Learners should be able to: ▶ demonstrate making good environmental choices after learning about them from a book, teacher, or a video, such as remembering to turn off lights to save energy, recycling paper and plastic, or picking up litter at the park, showing that we can learn important things from different places/sources. ▶ perform simple searches on the internet related to facts on the environment such as flowers, animals, deserts etc.

	KEY IDEA: We can ask questions about information to know whether to trust the source.		
	Learners should be able to: ▶ demonstrate critical thinking skills by asking questions about the information they receive about climate change, such as 'Why?' or 'How do we know?' ▶ understand the difference between fact and opinion. ▶ show awareness that not everything seen on screens (like TV or computers) is true and that asking an adult or teacher is a good way to learn more.	Learners should be able to: ▶ appreciate that some information is shared with the intention to promote a certain point of view, and the importance of being aware of this. ▶ recognize who are the trusted adults in their lives and have confidence to approach them with questions about climate change.	Learners should be able to: ▶ demonstrate the ability to teach another learner how to assess the reliability and/or bias of a source. ▶ show that they can approach a trusted adult or teacher with their questions.
9 - 12 years	**KEY IDEA: We can be truth detectives.**		
	Learners should be able to: ▶ experiment with authenticating online information about climate change by practicing these steps: 1) check where the information comes from and ask if it is a trustworthy site and/or who wrote it, and if it might be a biased source; 2) doublecheck the facts by looking in other trustworthy places to see if they are saying the same thing; 3) look at what's being said (Is it fair? When was it written? Are there spelling mistakes?); 4) ask yourself whether it makes sense? (Does the story make sense or is too wild or unbelievable?) 5) ask an adult or teacher.	Learners should be able to: ▶ share stories of finding false information and how that makes them feel.	Learners should be able to: ▶ show increased confidence and independence in evaluating online information about climate change.
13 - 15 years	**KEY IDEA: It is necessary to identify fake news and disinformation, and to build media and information literacy.**		
	Learners should be able to: ▶ differentiate between mis/mal/disinformation through climate information examples provided by the educator. ▶ develop and apply critical media literacy skills to climate media found on social media.[7]	Learners should be able to: ▶ develop resilience and critical thinking skills to navigate an increasingly complex media landscape.	Learners should be able to: ▶ seek out reliable sources of information on climate change, fact-checking claims and sharing accurate information responsibly.
16 - 18 years	**KEY IDEA: Building resilience against climate misinformation.**		
	Learners should be able to: ▶ discuss how climate mis/mal/disinformation has been used by a range of actors to confuse the public in order to slow down effective action on climate change. ▶ identify science denial strategies (such as, fake experts, logical fallacies, impossible expectations, conspiracy theories and cherry-picking of data).[8]	Learners should be able to: ▶ identify how climate mis/mal/disinformation makes them feel.	Learners should be able to: ▶ promote accurate and evidence-based information on climate change. ▶ educate others about common science denial strategies used in climate misinformation.

7 See UNESCO's module four from Combatting Disinformation and Misinformation: https://webarchive.unesco.org/web/20230930110006/https://en.unesco.org/node/296053).

8 Accompanying lesson plan for Cranky Uncle here: https://tropicsu.org/wp-content/uploads/2022/01/Lesson_Plan_Humanities_Cranky_Uncle.pdf

18+	**KEY IDEA: How do biases affect climate action: investigating climate communication and social cognition.**		
	Learners should be able to: ▶ identify effective messaging (the role of framing, storytelling, visual communication of data and emotional engagement in communicating climate science). ▶ learn about cognitive biases in terms of how confirmation bias or cognitive barriers limit climate action.	Learners should be able to: ▶ reflect on how societal beliefs and attitudes towards climate change have influenced their own thinking.	Learners should be able to: ▶ apply effective communication strategies in climate action efforts and in their work and activities that is devoid of mis/mal/disinformation on climate change.
	KEY IDEA: Learning about and responding to a history of delayed climate action.		
	Learners should be able to: ▶ examine varied regional responses to climate change, identifying successes and reasons for challenges (e.g. public perception, economic reliance on fossil fuels, role of communication, beliefs of government on climate action). ▶ analyze historical delays in climate policies and socio-political reasons behind them. ▶ investigate the role of industries, such as fossil fuel companies, in shaping and sometimes delaying climate policies. ▶ investigate organized efforts to sow doubt about climate science and delay action.	Learners should be able to: ▶ appreciate the potential role of science in driving policy decisions, and the importance of citizen action to ensure that this science is considered.	Learners should be able to: ▶ apply techniques for identifying and debunking misinformation related to climate change in their work and daily life

Key concept 5

Post-carbon economies

Key topics

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Definition

A post-carbon economy focuses on the economic impact of carbon energy dependence and climate change, and aims to achieve sustainable development by incorporating environmental and societal considerations. Some mechanisms and financial instruments have been developed to facilitate the transition to a post-carbon economy. It is essential to recognize the problems associated with the unlimited growth-centric model and to gain a solid understanding of how climate change affects our economics and what the transition costs, the drivers and funding sources of the transition are.

Some important areas in this key concept include the circular economy, energy consumption and carbon emissions, and green finance. In a circular economy, the systems-focused sustainable materials management approaches are usually employed in production processes and economic activities, which facilitate the reuse of the materials/resources to keep their value for a longer time. Resource consumption and waste generation could be reduced through superior product design and business models. Related to resource consumption, carbon emission is one of the most important determining factors in climate change, and some market mechanisms (e.g. carbon trading) have been introduced in order to reduce carbon emissions. Another fast-growing area is green finance, which involves finance and investment activities (e.g. issuance of green bonds) that help combat climate change and improve environmental performance. Various parties such as individuals, businesses, governments and non-profit organizations play important roles in the post-carbon transition. Youth leadership is among the driving forces for actions to combat climate change and support the post-carbon transition.

Key ideas and learning outcomes per age group

Topic 5.1. Economic growth and development

There is an urgent call for thorough reflection on the problems associated with the unlimited growth-centric model in which many negative externalities in economic activities are overlooked. Those externalities have a significant impact on social welfare and the environment. It is important to understand why we need to embed sustainability, equity and well-being within our economic systems and what potential paths are available for achieving the SDGs.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Resources are essential for our life; scarcity is a feature of many resources.**		
	Learners should be able to: ▶ give examples of resources that humans depend on, e.g. air, water, food. ▶ define what it means if a resource is scarce.	Learners should be able to: ▶ reflect on their experience when facing a shortage of certain resources, e.g. feeling thirsty when not having access to water.	Learners should be able to: ▶ develop simple strategies to save resources (e.g. water harvesting and water saving).
	KEY IDEA: Growth is a process of increasing in physical size, amount, value, maturity and significance.		
	Learners should be able to: ▶ give examples of growth they have observed, such as the growth of plants, etc. ▶ explain the resources needed in those examples of growth, e.g. sunshine and water are needed for the growth of plants.	Learners should be able to: ▶ recall how they feel when growth cannot be achieved or continued due to a lack of resources.	Learners should be able to: ▶ help grow plants (e.g. trees/flowers) in their home or school and observe their growth and resource inputs. ▶ save in piggy banks and observe and record how their savings grow.
9-12 years	**KEY IDEA: Human life and development require natural resources; many resources are limited and not replaceable over a human lifetime.**		
	Learners should be able to: ▶ identify various resources (e.g. water, energy, fuels, minerals, etc.) that humans use to live and thrive. ▶ recognize that some resources are limited (e.g. minerals) and not able to be replenished. ▶ explain the importance of natural resources in economic activities and recognize that some are scarce. ▶ analyze the relationships between the availability of natural resources, economic activities, and the environment.	Learners should be able to: ▶ demonstrate an awareness of the delicate balance between resource availability and economic development.	Learners should be able to: ▶ apply sustainable resource management practices in daily life and activities using reusable containers, composting or recycling.

KEY IDEA: Some things we do may benefit ourselves but be harmful to the environment or society, resulting in negative externalities.

Learners should be able to: ▶ explain the concept of negative externality. Some economic activities (e.g. production of goods/services or consumption of goods/services) can have a negative effect on other parties who are not directly involved in such activities. ▶ explain through examples how the actions of involved parties involved could have an unintended effect on parties who are uninvolved.	Learners should be able to: ▶ reflect on the possibility that there can be a conflict of interest between benefits they enjoy and those enjoyed by others, and to understand this ethical tension. ▶ demonstrate a belief that everyone (including themselves) has a responsibility to consider how their behaviour affects social goods.	Learners should be able to: ▶ discuss with their families or peers about the relation between a person's own interests and those of a wider group/social good.

13-15 years

KEY IDEA: There are many negative externalities in economic activities, which have a significant impact on social welfare and the environment.

Learners should be able to: ▶ present and compare examples of negative externalities such as pollution, carbon emissions (see Concept 1 Climate Science Topic 1.2 Greenhouse Gases and Topic 1.5 Avoiding Pollution and Key Concept 2 Ecosystems and Biodiversity), and explain why they are classified as negative externalities. ▶ argue through the use of evidence that in negative externalities, economic activities of one party impose costs on another party (e.g. society, the environment) as an indirect effect.	Learners should be able to: ▶ reflect on their own economic activities from which negative externalities may stem. ▶ value that all persons/groups should consider negative externalities in their economic activities.	Learners should be able to: ▶ take steps to change their economic activities in order to reduce negative externalities by advocating for sustainable practices and making informed consumer choices.

KEY IDEA: Some fiscal, financial and social measures can help reduce the effects of negative externalities.

Learners should be able to: ▶ list and compare measures that help reduce the effects of negative externalities, e.g. tax, subsidies, regulations. ▶ describe the mechanisms of some forms of measures, e.g. tax on goods/services resulting in negative externalities (The tax compensates for the value loss due to negative externalities). ▶ research and analyze the measures used by the central and local governments in their country. ▶ explain the important roles that governments and regulators can play in reducing the negative effects of negative externalities.	Learners should be able to: ▶ reflect on their own role in influencing government actors that can institute measures to address negative externalities.	Learners should be able to: ▶ critically evaluate the effectiveness of local/national measures and develop a plan for possible improvements.

16-18 years

KEY IDEA: There are distinctions between economic growth and development. Economic development is a broader concept including both economic growth and the sustainable change made for the well-being of inhabitants. Infinite growth is not possible and high resource exploitation has come at a cost to people and the planet.

Learners should be able to:

- define the concept of economic growth (i.e. increase in value of produced goods/services in an economy), and list and contrast some measures of economic growth, e.g. percentage of the increase in real gross domestic product (GDP); percentage of the increase in GDP per capita; percentage of the increase in gross national product (GNP) (including foreign trade); percentage of the increase in GNP per capita.
- explain how historically, economic growth has been closely related to the consumption of fossil fuels that lead to carbon emissions and climate change. Nations at COP28 agreed to transition away from fossil fuels.
- describe and illustrate through a national case example how economic development consists of both income increases and improvements in other social well-being and environmental factors (e.g. education, health, environment); and how economic growth is related to resource exploitation and climate change.
- make arguments for the limitations of the traditional economic growth-centric measures, explain roles of international collaboration and partnerships in fostering economic growth in post-carbon economies.

Learners should be able to:

- value the importance of incorporating social and environmental factors when assessing the results of economic development.
- feel concern about the economic costs of inaction in combating climate change. If no actions are taken, the world could potentially lose significant percentages of GDP due to the damages caused by climate-related disasters.

Learners should be able to:

- evaluate the economic growth in their region by using data and measures, and propose ways to promote sustainable economic growth.

KEY IDEA: Sustainable development, in general, refers to the development that 'meets the needs of the present without compromising the ability of future generations to meet their own needs' (United Nations World Commission on Environment and Development, 1987). The current model of economic growth and consumption is a driver of the climate crisis.

Learners should be able to:

- identify problems associated with the economic growth-centric model (for instance, excessive non-sustainable economic growth could result in negative externalities such as pollution).
- explain that sustainable development holistically considers the effect of economic activities on economic growth, environment, and society.
- argue that the current non-sustainable growth-centric model is a driver of climate change, and that we should aim for sustainable development and growth. (See Key Concept 3 Climate Justice Topic 3.3 Historical and Economic Processes.)
- compare sustainable and unsustainable growth using examples or data.

Learners should be able to:

- feel 'intergenerational' responsibility when conducting economic activities to achieve growth.

Learners should be able to:

- working with peers, advocate for the importance of sustainable development in family, school and community.

18+	**KEY IDEA: There are some important determinants of sustainable development, including factors associated with production, consumption, and distribution.**		
	Learners should be able to: ▶ explain how factors in production affect sustainable development, e.g. if the materials used in production result in toxic emission, they could cause environmental and health harm, thus impairing sustainable development; explain and describe how factors in consumption affect sustainable development. For instance, purchasing local or organic products could support sustainable farming in agriculture, which can help protect biodiversity and environment. (See Key Concept 2 Ecosystems and Biodiversity Topic 2.4 Human Relation to Nature.), and explain how some factors in distribution affect sustainable development, e.g. income inequality presents big challenges on the way to achieve sustainable development. ▶ critically discuss the effects of trade on climate change. (For example, a negative effect could be that trade expansion may increase pollution in some countries; a positive effect could be that trade may facilitate the diffusion of new technologies in combating climate change.) ▶ explain that there are many challenges on our way to achieve sustainable development, and there are needs for significant behavioural changes at individual, business, and societal levels. ▶ recognize the role of innovation and technological advancements in driving economic growth in post-carbon economies.	Learners should be able to: ▶ recognize that our personal consumption amount and behaviour have a significant impact on sustainability.	Learners should be able to: ▶ discuss with peers and people in the community what roles we could play in helping to achieve sustainable development. ▶ conduct and share the results of interviews with local or organic food stores to investigate their business models and practices. ▶ conduct and share the results of interviews with some stakeholders (e.g. business owners, consumers, policy-makers, etc.) to understand their view about sustainable development.

KEY IDEA: There are methods/indicators for evaluating a country's development, including both economic and human development dimensions.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ describe methods/indicators developed to assess development and sustainability. For example, the Human Development Index (HDI) developed by the United Nations measures development in three dimensions: health and longevity, education, and living standard (GDP per capita in purchasing power parity terms); the World Bank employs the 'development diamonds' method which is based on four socioeconomic factors: life expectancy, gross primary (or secondary) enrolment, access to safe water, and GNP; and other indicators (e.g. Gini coefficient as a measure of income, wealth or consumption inequality). Note: GDP is the abbreviation for Gross Domestic Product; GNP is the abbreviation for Gross National Product. ▶ argue why the assessment of a country's development should not be based solely on traditional indicators (such as GDP and PPP per capita), but also on human development and environment-related indicators (e.g. 'Green GDP'). Note: PPP is the abbreviation for Purchasing Power Parity. ▶ compare different methods/indicators for development and critically discuss their effectiveness in assessing development. ▶ use the methods/indicators to assess and analyse their country's development.	▶ reflect on their personal view of development. ▶ recognize and value the importance of including the human dimensions, in addition to the economic one, when evaluating a country's development.	▶ critically assess different methods/indicators and share their advantages and limitations to a school or community audience. ▶ advocate the importance of public involvement in environmental and social impact assessments. ▶ develop skills that are required to support policy goals in post-carbon economies.

KEY IDEA: Some alternative economic models (e.g. the circular economy, regenerative economics, degrowth economics) have been developed to tackle environmental and/or social challenges (e.g. climate changes, pollution, loss of biodiversity, etc.). There are also some subfields (e.g. environmental economics, ecological economics, energy economics) with specific focuses on environmental, ecological, energy, and/or social dimensions.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ present the principles of some main alternative economic models such as the circular economy, regenerative economics, and degrowth economics. ▶ describe and differentiate between the main focuses of some climate/environment-related subfields of economics such as environmental economics, ecological economics, and energy economics. ▶ critically review some research in climate/environmental related subfields of economics.	▶ recognize the importance of taking a critical perspective on various alternative economic models.	▶ compare and contrast alternative economic models with standard economic models for their country, and present these to others.

Topic 5.2. The circular economy and everyday life

The circular economy is a sustainable alternative to the linear economy, which is based on the assumption that we have continuous access to infinite natural resources. It is essential to understand the problems of the 'take-make-waste' model (which the linear economy is based on) and recognize the limits of natural resources. Some key elements of a circular economy are introduced: the material life cycles, converting 'trash' into 'treasure', and product designs. The main aim is to help learners gain an understanding of how a circular economy could reduce waste and emissions, save the environment and enhance sustainability.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: There are different ways to deal with things that you no longer need.**		
	Learners should be able to: ▶ describe options they have other than throwing things away when they no longer need them, e.g. leave them in a storage unit, bin them, give them to others.	Learners should be able to: ▶ recognize that the option they choose has a consequence, (See Key Concept 6 Sustainable Lifestyles Topic 6.7 Sustainable Waste Practices.) ▶ appreciate the importance of preserving and utilizing items that have value and can still be beneficial to others, rather than discarding them unnecessarily.	Learners should be able to: ▶ apply sustainable disposal practices in their own life and the life of their family.
9-12 years	**KEY IDEA: Our perception of and relationship to waste depends on social, economic, and cultural contexts. Waste for some people may be valuable to others.**		
	Learners should be able to: ▶ recognize that what we consider to be waste may be valued by someone else. ▶ identify various channels/facilities through which the 'waste value' could be recovered.	Learners should be able to: ▶ be aware that different people may value things differently in part due to their social or economic situations (e.g. living standard).	Learners should be able to: ▶ observe and investigate the available channels/facilities available for waste management and make use of these. (See Key Concept 6 Sustainable Lifestyles Topic 6.7 Sustainable Waste Practice.) ▶ help manage waste produced by their family.
	KEY IDEA: The economic redemption value of 'waste' depends on factors such as the condition of an item, value of the raw material, recovery costs, etc.		
	Learners should be able to: ▶ list and explain factors that can determine the value of something that would otherwise be known as 'waste', e.g. the scarcity of the raw material could lead to a high redemption value of 'waste'. ▶ provide examples of local market mechanisms for value redemption, e.g. a flea market or vintage store. ▶ identify and estimate the value of waste, using an example from everyday life.	Learners should be able to: ▶ evaluate what they consider to be 'waste' or 'unusable' in their own lives and which of these things may not be seen as 'waste' by others. ▶ recognize and value that the recovery of waste value is good for the environment.	Learners should be able to: ▶ consider and discuss with their families the best channels for waste management.
13-15 years	**KEY IDEA: The basic assumption of the traditional 'linear' economy is that there are infinite natural resources. The circular economy recognizes the limits of natural resources.**		
	Learners should be able to: ▶ explain and compare the assumptions of the linear economy model and those of the circular economy model.	Learners should be able to: ▶ express their concerns over the traditional linear economy model and recognize its negative impact on resources and the environment.	Learners should be able to: ▶ advocate the positive effect of the circular economy on the environment and society.

KEY IDEA: The linear economy takes a 'take-make-waste' approach, whereas the circular economy focuses on 'Reduce, Reuse, and Recycle" (3Rs) in order to save resources, minimize generation of waste, and reduce greenhouse gas emissions and pollution. The original 3Rs model has also evolved into various versions (e.g. 5Rs – Refuse, Reduce, Reuse, Repurpose, Recycle)

Learners should be able to: ▶ discuss the problems associated with the 'take-make-waste' model. (See Key Concept 6 Sustainable Lifestyles Topic 6.7 Sustainable Waste Practice.) ▶ explain 3Rs in a circular economy i.e. Reduce: reduce the use of materials/ resources in design and production; Reuse: try to reuse products where possible; Recycle: recycle waste to turn it into new products or production materials. ▶ describe and contrast the elements of the 4Rs and 5Rs in a circular economy. ▶ discuss how the circular economy model could be helpful in addressing waste (especially hazardous waste) and pollution (including plastic pollution) problems. (See Key Concept 1 Climate Science Topic 1.5 Avoiding Pollution and Conserving Resources.)	Learners should be able to: ▶ appreciate the benefits of employing the circular economy model. ▶ recognize the responsibilities (at the individual and societal levels) related to 3Rs in the circular economy.	Learners should be able to: ▶ introduce the 3Rs, 4Rs and 5Rs principles of the circular economy to people in their school and community.

16-18 years

KEY IDEA: To achieve 3Rs in a circular economy, some strategies (e.g. product eco-design) can be developed in economic activities.

Learners should be able to: ▶ describe how different product designs could be helpful in exercising 3Rs (For example, designers should ensure that materials are reusable many times, and the product is repairable and can be disassembled.) ▶ assess and explain how product eco-design can help reduce the use of materials/resources and preserve the value of the materials. ▶ design a new product that reflects eco-design.	Learners should be able to: ▶ recognize that there is a need to call for more social responsibilities for businesses.	Learners should be able to: ▶ consider eco-design features when purchasing a product. ▶ raise awareness and encourage appreciation of the eco-design feature in their family and community.

KEY IDEA: The lifecycle approach in a circular economy considers the environmental impact of all stages of a product's life.

Learners should be able to: ▶ identify and illustrate different stages of a product's life, including raw materials-manufacturing-transportation-consumption-life end. ▶ detail the economic activities entailed in each stage and their potential impacts on the environment. ▶ critically assess how the lifecycle approach could help minimize the overall negative environmental impact throughout the product's life.	Learners should be able to: ▶ acknowledge that producers should consider the environmental impact during the whole process of product development.	Learners should be able to: ▶ implement a lifecycle approach in personal consumption habits.

18+	**KEY IDEA: There are new business models such as the sharing economy that have eco-design features.**		
	Learners should be able to: ▶ explain the concept of the 'sharing economy', characterized by sharing products/resources to optimize their use and reduce costs. ▶ investigate how the sharing economy can involve the use of 'big data' and the pros and cons of that in this context. ▶ identify sharing economy companies. ▶ critically discuss the impact of the sharing economy on the environment and society.	Learners should be able to: ▶ appreciate eco-friendly features of some products and services, while recognizing that there could be some problems (e.g. possible misuse of information in such data-driven economy models as the sharing economy).	Learners should be able to: ▶ apply principles of the sharing economy into personal consumption practices.
	KEY IDEA: There is a need for a global initiative to maximize the benefits of a circular economy.		
	Learners should be able to: ▶ argue why international cooperation is important for advancing the circular economy. ▶ identify and analyze factors that are necessary for an effective global cooperation, such as data- sharing and regulatory changes. ▶ research how circular economy practices look different across countries, and what factors influence such differences (e.g. economic conditions, culture).	Learners should be able to: ▶ appreciate the value of promoting circular-economy practices around the world.	Learners should be able to: ▶ participate in global or local initiatives to promote and advance the circular economy.

Topic 5.3. Climate change and our economies

Extreme weather events (e.g. heatwaves, storms, droughts, floods) are becoming more frequent and severe. These events can have dramatic negative impacts on our life and economic activities. A large number of fatalities and significant economic losses are caused by such events. Real life examples are used in the introduction of this topic, and both scale and scope are addressed.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Different weather conditions can affect people's daily lives (e.g. availability of some products under certain weather conditions).**		
	Learners should be able to: ▶ describe how weather conditions, such as sun, rain and snow, affect their activities (e.g. shopping) (See Key Concept 1 Climate Science Topic 1.1 Weather, Climate, and Climate Change). ▶ observe the damages caused by extreme weather conditions (e.g. floods, droughts, hailstorms, etc.).	Learners should be able to: ▶ show awareness of people's preferences when it comes to the weather and how weather can affect their activities (e.g. travelling or shopping). ▶ explain inconveniences (e.g. availability of public transportation or food products in stores) they experience under certain weather conditions.	Learners should be able to: ▶ discuss with their parents or peers the costs to repair such weather-related damages.
9-12 years	**KEY IDEA: Climate change-related extreme weather events can cause significant physical damage to assets/facilities.**		
	Learners should be able to: ▶ explain the direct costs/physical damages (e.g. damage to houses and roads) caused by climate change-related weather events. ▶ select and research a climate change-related weather event in their community or country, and the costs and damage incurred.	Learners should be able to: ▶ recognize the shocking scale and scope of the direct damage caused by climate change-related events and feel empathy for those most affected by extreme weather events. (See Key Concept 4 Resilience-Building and Key Concept 3 Climate Justice.)	Learners should be able to: ▶ discuss with their families, friends/ classmates about the effects of these climate change-related weather events.

	KEY IDEA: Climate change-related extreme weather events can affect people's lives and the functionality of public services.		
	Learners should be able to: ▶ explain human harm caused by climate change-related weather events (e.g. deaths due to heatwaves) and their impacts on the operations of businesses/public services. ▶ describe with illustrations how climate change-related extreme weather events could affect the functionality of public services (e.g. the disruption of public transportation due to flooding). ▶ research and present a local or national example of a climate-change extreme weather event and its effects on businesses and public services.	Learners should be able to: ▶ reflect on personal experiences in extreme weather conditions (if any). ▶ empathize with the suffering of those who are affected by climate change-related events and show their compassion (See Key Concept 3 Climate Justice).	Learners should be able to: ▶ identify ways to assist those experiencing extreme weather conditions in their community or country.
13-15 years	**KEY IDEA: Some business sectors (agriculture, fisheries, and forestry) could be significantly impacted by climate change.**		
	Learners should be able to: ▶ identify sectors (e.g. agriculture, fisheries, and forestry) most vulnerable to climate change. ▶ explain why and how these sectors are vulnerable to climate change (e.g. the crop growth requires an appropriate range of precipitation and temperature). ▶ explain the concept of the blue economy – the sustainable use of ocean resources to benefit economies, livelihoods, and ocean ecosystem health.	Learners should be able to: ▶ recognize that the damage caused by climate change could significantly affect businesses, especially small family businesses on which many local people rely for a living.	Learners should be able to: ▶ engage with peers on some possible mitigation measures for the negative impact of extreme weather events on local businesses.
	KEY IDEA: In addition to direct costs/damages caused by extreme weather events, there are also indirect/latent costs associated with climate change, such as insurance costs and investments required in public infrastructure.		
	Learners should be able to: ▶ provide examples of indirect/latent costs associated with different weather conditions. ▶ explain, with the use of examples, how indirect/latent costs increase due to extreme weather conditions.	Learners should be able to: ▶ recognize that the high direct and indirect costs associated with climate change may be unaffordable for some businesses, especially small family businesses on which many local people rely for a living.	Learners should be able to: ▶ explore and explain to local people the public infrastructures/facilities built to mitigate/adapt to climate change in their local area. ▶ raise public awareness of the direct and indirect costs associated with extreme weather conditions, and propose plans to support those who (e.g. small local businesses) cannot afford such costs.

16-18 years

KEY IDEA: There is evidence that both the frequency and severity of climate change-related weather events and disasters have increased significantly over time. These events have significant impact on economic activities.

Learners should be able to:

- identify and use climate-related data sources (e.g. IPCC, Germanwatch) to acquire information related to climate change and related economic impacts.
- analyze and present data showing historical trends related to climate change (e.g. temperature) in their country or community.
- investigate how climate change-related losses (including economic/financial losses) are measured in databases and research articles.
- use data to demonstrate the frequency and severity (including economic and financial losses) of extreme weather events in a particular locality.

Learners should be able to:

- express their concerns about the significance and magnitude of the negative economic consequences of climate change and find support in sharing their concerns with others.

Learners should be able to:

- introduce the impact of climate change on economics and present some empirical evidence (based on a review) to school/family/community audiences.
- analyse the number and severity of local climate change-related weather events by using historical data and present the results to the local community.

KEY IDEA: Adaptation and mitigation mechanisms can work as tools to limit the negative economic consequences of climate change.

Learners should be able to:

- explain the concepts of 'adaptation and 'mitigation'. ('Adaptation' generally refers to adapting to changing climate, while 'mitigation' refers to reducing climate change through various channels/by taking certain actions such as cutting back on heat-trapping greenhouse gases) (See Key Concept 1 Climate Science and Key Concept 4 Resilience-Building).
- present and compare strategies for adaptation (e.g. installing better-draining systems; buying weather-related commercial insurance) and mitigation (investing in technologies to reduce carbon emissions), and recognize the significant costs for employing those strategies.

Learners should be able to:

- feel the urgency of developing adaptation and mitigation measures and be motivated to implement such measures.

Learners should be able to:

- Participate in a workshop or school club activities that raise awareness on the benefits and economic costs associated with existing adaptation and mitigation mechanisms and propose improvements.

18+

KEY IDEA: Climate change can exert its impact on the global economy and finance via various 'transmission channels' such as the physical disruption of businesses, transition risk and liability risk.

Learners should be able to:

- describe examples of transmission channels: physical disruptions (e.g. asset destruction and business disruption), transition risk (e.g. business relocation costs and devaluation of assets), and liability risk (e.g. property buyers and investors could be exposed to climate-related liability risk).
- use empirical evidence to show how business/economic performance is affected by climate change/risk via these channels.

Learners should be able to:

- identify inequalities across different groups or regions in terms of the resources available for managing climate change risk and feel compassion for those most vulnerable to economic impacts resulting from climate change (See Key Concept 3 Climate Justice).

Learners should be able to:

- advocate for sustainable practices and policies that reduce vulnerability to climate change impacts, both at individual and collective levels.

	KEY IDEA: There are various sources (including both public and private) for financing climate adaptation and mitigation activities. Some activities require close international cooperation.		
	Learners should be able to: ▶ recognize the significance of both public and private funding sources, including government grants, subsidies, and private investments, in financing climate adaptation and mitigation efforts. ▶ identify and evaluate various financial instruments such as green bonds and climate risk insurance, considering their effectiveness and limitations in addressing climate change. ▶ discuss the challenges posed by climate change on a global scale, emphasizing the need for international collaboration and financial resources to implement adaptation and mitigation measures. (See Key Concept 3 Climate Justice, Topic 3.4 Transformed Futures) ▶ highlight the potential of youth entrepreneurship in driving innovation and providing financial solutions to combat climate change, emphasizing their role in developing sustainable initiatives and addressing environmental challenges.	Learners should be able to: ▶ demonstrate awareness of the social responsibilities underlying financial initiatives to support climate adaptation and mitigation. ▶ recognize that some regions/areas are more vulnerable to climate risk than others and show concern for people living in those countries/regions/localities. (See Key Concept 3 Climate Justice Topic 3.1 Contemporary Manifestations.)	Learners should be able to: ▶ introduce climate adaptation and mitigation financial instruments to the community and raise awareness of these uses. ▶ explore opportunities to engage with stakeholders (e.g. business managers, policy-makers, etc.) to discuss the challenges and call for global collaborations. ▶ advocate for organizational policies and initiatives that prioritize climate resilience and sustainability at home, school or in the workplace.

Topic 5.4. Energy consumption and carbon emissions

Energy consumption and carbon emissions are among the most important determining factors in climate change. They are also closely related to economic growth and development. Therefore, it is essential to understand the trend and pattern of energy consumption and carbon emissions. There are also some market mechanisms (i.e. carbon trading) that have been developed with the aim of reducing carbon emissions.

	Cognitive	**Social and emotional**	**Behavioural**
5-8 years	**KEY IDEA: Energy is required in everyday life.**		
	Learners should be able to: ▶ recognize that many items/appliances in their home and elsewhere require energy so that they can operate, e.g. lighting, refrigerator, TV, microwave oven. ▶ explain what type of energy is required by each appliance, e.g. electricity is required for a TV set; natural gas is required for a gas oven, etc. ▶ observe energy use at home and other places (e.g. restaurants, shops).	Learners should be able to: ▶ realize their dependence on energy to support everyday lifestyles at home and other places.	Learners should be able to: ▶ explain to family members the different sources of energy used.

	KEY IDEA: Many energy resources are scarce.		
	Learners should be able to: ▶ explain and illustrate the basic concept of scarcity. (Scarcity may be observed if the demand for an item is higher than its availability.) ▶ describe how energy is produced from the use of productive resources, and the availability of many natural resources is limited.	Learners should be able to: ▶ express interest in conserving energy use.	Learners should be able to: ▶ cultivate energy-saving behaviours, e.g. turn off the light when leaving a room.
9-12 years	**KEY IDEA: There are two kinds of energy resources: non-renewable and renewable.**		
	Learners should be able to: ▶ explain the distinction between non-renewable and renewable resources. (See Key Concept 1 Climate Science Topic 1.6 Renewable Energy.) ▶ compare and contrast renewable and non-renewable resources and explore the potential impact of the use of each type of resource on the local environment.	Learners should be able to: ▶ feel concern about whether resources are renewable or not, given their impact on the environment.	Learners should be able to: ▶ make informed choices about energy consumption and resource utilization (See Key Concept 6 Sustainable Lifestyles Topic 6.2 Renewable Energy Use.)
	KEY IDEA: Renewable energy (i.e. energy produced from renewable resources such as solar, wind, etc.) plays an important role in climate change mitigation due to lower CO_2 emissions as compared with non-renewable energy (i.e. energy produced from non-renewable resources such as coal, oil, etc.).		
	Learners should be able to: ▶ explain how CO_2 emissions contribute to global warming. (See Key Concept 1 Climate Science.) ▶ defend why the use of renewable energy has a smaller impact on the climate, compared to the use of non-renewable energy.	Learners should be able to: ▶ express concern that the environmental damage caused by the use of non-renewable energy is bigger than that caused by the use of renewable energy.	Learners should be able to: ▶ raise public awareness of the role of renewable energy in the post-carbon transition.
13-15 years	**KEY IDEA: Overall energy consumption has been continuously expanding, and there is global evidence that energy consumption leads to greater carbon emissions**		
	Learners should be able to: ▶ present and contrast trends of global energy consumption by using publicly available data sources. ▶ describe the positive correlation between energy consumption and carbon emissions. (See Key Concept 6 Sustainable Lifestyles.) ▶ recognize that energy access plays an important role in economic growth, while high energy consumption can also lead to greater emissions that contribute to global warming and climate change.	Learners should be able to: ▶ assess and reflect on personal and family energy consumption behaviours.	Learners should be able to: ▶ discuss with their families their energy consumption behaviours and ways to reduce this consumption. (See Key Sustainable Lifestyles Topic 6.3 Responsible Consumption.)

KEY IDEA: Renewable energy capacity has been increasing rapidly at the global level, and one important driver is technological innovation

Learners should be able to: ▶ use publicly available data/information at the global/national levels to show trends of increased renewable energy shares in the overall energy mix. ▶ explain how technological innovation, among other factors (e.g. policies), drives the growth of renewable energy, e.g. new technologies help improve the efficiency of solar/wind power facilities. ▶ investigate technological innovations in each type of non-renewable energy, showing how general mechanisms of technology help improve performance. ▶ develop a critical understanding of various views about renewable energy sources and their economic implications. (See Key Concept 2 Ecosystems and Biodiversity.)	Learners should be able to: ▶ value the importance of technological innovation in boosting renewable energy. ▶ demonstrate an interest in keeping up with technological innovations related to renewable energy. ▶ evaluate the influence of cultural and social norms on the adoption of renewable energy and sustainable practices in a post-carbon economy and show their compassion.	Learners should be able to: ▶ identify existing and potential technological innovations in renewable energy sources in use in their community or country.

16-18 years

KEY IDEA: There are many CO_2 emission measures, including production-based emissions and consumption-based emissions

Learners should be able to: ▶ explain the difference between production-based emissions and consumption-based emissions. ▶ demonstrate familiarity with relevant data sources, e.g. datasets from the Intergovernmental Panel on Climate Change (IPCC) and World Bank. ▶ explain and contrast different measures of CO_2 emissions.	Learners should be able to: ▶ reflect on the environmental impact of their daily lives.	Learners should be able to: ▶ advocate for sustainable solutions in daily life.

KEY IDEA: Energy efficiency presents an enormous potential to mitigate climate change while contributing to sustainable development and resource efficiency.

Learners should be able to: ▶ explain how energy efficiency improvements are one of the most important means for reducing greenhouse gas emissions. ▶ describe how energy efficient technologies and designs use less energy while providing the same or a better output. ▶ critically discuss the distinctions and the relations between energy efficiency and economic efficiency.	Learners should be able to: ▶ recognize the importance of energy conservation and improving energy efficiency in achieving sustainable development.	Learners should be able to: ▶ identify and present to members of the community important factors that could affect energy efficiency locally/nationally. ▶ engage in conversation about resource use and energy conservation.

18+	**KEY IDEA: Some structured financial activities (often referred to as 'green finance') support green projects and help achieve better environmental performance.**		
	Learners should be able to: ▶ explain the practice of green finance and how it can help in achieving the SDGs. ▶ compare green finance and conventional finance. ▶ explain the general mechanism of green bonds, a debt security instrument with the purpose of financing environmental or climate projects.	Learners should be able to: ▶ demonstrate critical awareness of 'greenwashing', that is, companies presenting their business activities or products (including financial products/services) in misleading ways to give the impression that their activities or products are more climate/environment-friendly than they actually are.	Learners should be able to: ▶ integrate understanding of green finance into financial decisions in daily life, projects, research and the professional work environment.
	KEY IDEA: Carbon pricing is a market-based mechanism aimed at lowering carbon emissions. Two common methods of carbon pricing are taxes on carbon and carbon trading		
	Learners should be able to: ▶ explain the rationale of carbon pricing. ▶ debate the merits and demerits of carbon trading. ▶ research on and critically review the carbon pricing policies and practices in different countries.	Learners should be able to: ▶ reflect on personal values and beliefs about environmental conservation and carbon management.	Learners should be able to: ▶ apply knowledge of carbon pricing principles to personal and professional decisions.

Topic 5.5. Our roles in a post-carbon economy

We all have roles and responsibilities in the transition to a post-carbon economy. It is important to identify our tasks and understand what behaviours and actions can contribute to the adaptation and mitigation of climate change, as citizens, consumers, businesses, local/central governments, regulators, etc. Technological and financial innovations and international cooperation are also important success factors in the post-carbon transition.

	Cognitive	**Social and emotional**	**Behavioural**
5-8 years	**KEY IDEA: Care for our environment will contribute to our individual and social well-being.**		
	Learners should be able to: ▶ describe individual actions that can be taken to care for the environment (See Key Concept 6 Sustainable Lifestyles.) ▶ provide examples of things they already do to help the environment, e.g. helping their families and schools sort waste.	Learners should be able to: ▶ recognize the link between their actions and the environment and acknowledge their responsibility to care for the environment.	Learners should be able to: ▶ discuss with their families their living habits and what might be changed to improve environmental protection. (See Key Concept 6 Sustainable Lifestyles Topic 6.3 Responsible Consumption and Topic 6.7 Sustainable Waste Practices.)
9-12 years	**KEY IDEA: Our behaviours as buyers or users of products can help save energy and protect the environment.**		
	Learners should be able to: ▶ identify responsible consumption behaviours, e.g. buying greener products, reusing items. (See Key Concept 6 Sustainable Lifestyles, Topic 6.3 Responsible Consumption.) ▶ explain how responsible consumption can help conserve resources and preserve the environment.	Learners should be able to: ▶ recognize the responsibilities we (as buyers or users) have to care for the environment and society.	Learners should be able to: ▶ consume products more responsively, e.g. use an item with more care to extend the duration of the product life.

13-15 years

KEY IDEA: In a circular economy, we can play an active citizen role by exhibiting responsible circular behaviours throughout our consumption process.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ describe different stages of the consumption process: purchase, use, and action at the end of the product life. ▶ provide examples of circular behaviours during each stage of the consumption process (for example, upcycle an item at the end of its original life – an old broken drawer can be repaired and converted to an under-bed storage box). ▶ advocate for the economic and environmental benefits of responsible circular behaviours. (See Key Concept 6 Sustainable Lifestyles, Topic 6.3 Responsible Consumption).	▶ enjoy the pleasure of giving new life to a used item.	▶ explore and share with family and peers' creative circular economy ideas (e.g. upcycling practices).

16-18 years

KEY IDEA: Producers' commitments to embed circular features in product design and consumers' preference for such products can help achieve better environmental outcomes.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ explain the circular features producers/consumers can consider in product design, e.g. features related to ease of disassembly, recyclable materials used, ease/cost of repair, etc. ▶ describe how producers can play an important role in a circular economy. ▶ analyze why consumers' preference or choice matter in this context.	▶ recognize that their product preference or choice (as consumers) could have an impact and influence producers' decision, and that individuals' consumption behaviours have implications for carbon footprint. ▶ feel a sense of responsibility for making such consumption choices.	▶ support eco-designed products when making purchasing decisions.

KEY IDEA: Community-wide interests and awareness are important for implementing a circular economy. There are many channels through which interests and awareness can be raised

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ explain why public (community) engagement is necessary for achieving the goals of saving resources and protecting the environment. ▶ propose some ways to raise interest and awareness in the community. ▶ implement strategies for recognizing the presence of greenwashing. (See Key Concept 4 Resilience-Building Topic 4.6 Tackling Climate Mis/Mal/Disinformation).	▶ appreciate the contribution of technological and financial innovations in the effort to address climate change. ▶ reflect on technological innovations that have taken place in their lifetime impacting carbon emissions and that they have personally experienced or observed.	▶ employ various methods (e.g. posters, social media campaigns etc.) to raise community awareness about the environmental problems we face and how our behavioural changes can have a positive impact. ▶ observe and investigate current behaviours in their local community, and suggest changes that need to be made. ▶ identify local/national organizations addressing climate change and consider joining or aligning with them.

18+

KEY IDEA: All members of society – citizens, businesses, investors, financial intermediaries, local/central governments, regulators, etc. – have a role to play in the transition to a post-carbon economy

Learners should be able to:

- recognize that citizens can act as responsible consumers, recyclers, investors etc.
- describe how business and corporate decisions made by managers could have a significant impact on the environment and society.
- explain and provide examples of how the demand, preference or reactions of investors to firms' environmental and social performance have significant financial and economic consequences.
- research how governments and regulatory bodies can be an important driving force for adoption of sustainable practices.

Learners should be able to:

- acknowledge and value that everyone (including themselves) is responsible for the environment and future generations.
- appreciate that businesses and firms should assume corporate social responsibilities to protect the environment.
- reflect on their potential engagement in post-carbon policy reform and business activities as an investor activist, citizen activist, or (future) employer/employee.

Learners should be able to:

- follow the news in the media on activities and campaigns (e.g. Fridays for Future strike) of fighting climate change, and discuss those activities and their impact with peers, family and people in the community.
- actively communicate with relevant parties about areas that need to be improved and promote positive changes.
- critically review and research how economic policies can promote climate actions in both local and global contexts and provide suggestions on possible improvements.

KEY IDEA: Technological and financial innovations are important for a post-carbon transition. Youth green knowledge and skills can foster innovation research and are essential to meet the requirements for green jobs.

Learners should be able to:

- explain why technological innovations are important for combating climate change and facilitating the post-carbon transition (for example, new technologies that improve the efficiency of solar panels).
- describe how financial innovations could provide useful adaptation and mitigation tools for combating climate change (for example, carbon offset markets, green bonds and weather derivatives).
- define green skills as the knowledge, abilities, values and attitudes needed to live in, develop and support a sustainable and resource-efficient society. Green jobs can facilitate the post-carbon transition.
- discuss the possible limits of these innovations and the challenges of deploying new technologies.

Learners should be able to:

- value the importance of raising public awareness of the challenges we face and how our behaviours can help protect the environment.

Learners should be able to:

- introduce technological and financial innovations to their workplace and/or community and raise awareness of the availability of the techniques and tools.
- investigate the supply and demand in local green job markets.
- develop some skills (through various sources) that are required in the green job market.

KEY IDEA: There is a call for international cooperation to fight climate change.

Learners should be able to:

- explain how climate change is a global problem and affects all people on our planet.
- defend why international cooperation is urgently needed to address climate change.
- discuss with peers the opportunities and challenges we face in international cooperation in combating climate change.

Learners should be able to:

- feel the urgency and importance of international cooperation in the global climate agenda.
- recognize that the debate related to energy transition and post-carbon economies could be different across regions. It is important to incorporate interculturality and regional/local contexts into such discussions.

Learners should be able to:

- identify national/international organizations addressing climate change and consider joining or aligning with them.
- propose global strategies that can be taken collaboratively, using research to transition to a post-carbon economy.

Key concept 6

Sustainable lifestyles

Key topics

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Definition

A sustainable lifestyle means:

- being cautious and conscious of how we interact with the world around us;
- recognizing how our personal choices and habits as well as systemic changes could affect our planet where humans and nature coexist in harmony to support present and future generations;
- finding ways for all living organisms to live better, healthier, safer, more resilient and connected lives.

Living a sustainable lifestyle necessitates a significant level of awareness and commitment through which we acknowledge that the Earth's resources are finite and so we should limit our habits of expending in order to protect and improve our environment.

Adopting a sustainable lifestyle is a decision-making process integrated with conscious actions that ensure principles of environmental, social, and economic sustainability as well as a clear understanding and evaluation of good practices.

People adopting sustainable lifestyles prioritize using natural and renewable resources rather than creating more waste and pollution and destroying environmental resources. In this way, they reach a state of 'environmental equilibrium' and 'ecological balance'. They are aware of the impact of their choices in food, products, home appliances, shopping, travel, transportation, energy use, water use, land use, and so on. By making simple personal choices as well as advocating for systemic changes, they can easily make their life more sustainable and more enjoyable.

Choosing a sustainable lifestyle does not mean giving up things or reducing our quality of life. On the contrary, it symbolizes feeling more fulfilled and happier because of contributing to a better world. With individual and collective behaviours that serve as the guarantors of sustainable lifestyles and systemic changes, the entire world benefits and gets to live in cleaner and healthier conditions.

Sustainable lifestyles improve the quality of our lives, protect our ecosystem, and preserve natural resources for current and future generations. Given that our present choices and everyday habits have enormous and long-term impacts on future generations, practicing a sustainable lifestyle reflects ethical actions and envisages a safe and liveable future for everyone. Sustainable lifestyles create and maintain conditions where there is no poverty or hunger but peace, justice, a decent life, and equal access to clean water and energy, health care, education and fair work.

Key ideas and learning outcomes per age group

Topic 6.1. Engagement with nature

Engagement with nature refers to spending time in green spaces and bringing nature into everyday life for the benefit of mental and physical well-being. Connection with nature includes farming, planting trees, growing flowers, exercising outdoors, spending free and unstructured time in nature, being around animals, relaxing in the garden, doing free play and exploration, and enjoying the sights and sounds of nature around us. In certain cultures, engagement with nature is ancestral and spiritual (e.g. animals are spiritually connected with individuals and supernatural creatures or forces that need to be respected and protected).

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Human beings have an innate need to connect with nature**		
	Learners should be able to: ▶ explain how humans are a part of nature and do not exist apart from it. ▶ explain what engagement with nature refers to in terms of human health and happiness. ▶ illustrate the benefits of connecting with nature for concentration, learning, and creativity.	Learners should be able to: ▶ express their emotions about the beauty, power and diversity of the natural world. ▶ evaluate their own connection with nature concerning its impacts on their physical, emotional and social comfort. ▶ recognize that engagement with nature is needed for human health and well-being.	Learners should be able to: ▶ speak to their family and friends about the conservation of nature and natural organisms. ▶ maximize their time spent in nature (as applicable) for their health and well-being. ▶ invite others to connect with nature and communicate how it generates positive emotions and facilitates motivation.
9-12 years	**KEY IDEA: There are different pathways for connecting with nature: sensory contact; emotional bond; taking time in nature; thinking about the meaning of nature; showing love and care for nature; and exploring with nature**		
	Learners should be able to: ▶ define the concepts of physical and psychological well-being through engagement with nature. ▶ describe and compare the major pathways for connecting with nature (sensory contact; emotional bond; taking time in nature; thinking about the meaning of nature; showing love and care for nature; and exploring with nature). ▶ research and reflect on how people connect with nature in different parts of the world and how they do so in their own (local) context.	Learners should be able to: ▶ recognize that urban life could be associated with increased levels of stress and depression to be eliminated by connection with nature. ▶ compare their mood and feelings between spending time in a green area within the city (park, green schoolyard) and in a busy street. ▶ embrace the connection with nature through cognitive, emotional, and physical pathways. ▶ Share with others how they feel about the diverse values and traditions of indigenous cultures in their relationship with nature.	Learners should be able to: ▶ carry out activities in nature as a part of their daily life that make them feel happy and healthy. ▶ tell stories about the positive impacts of spending time in nature. ▶ apply different strategies (e.g. field trips to forests, rivers, seas, or agricultural lands) to connect with nature in terms of cognitive, emotional, and physical connectedness. ▶ discover new methods such as games to enjoy connecting with nature.
13-15 years	**KEY IDEA: Nature is our best ally in tackling the climate crisis and human misery. Nature helps clean our air, purify our water, produce food and medicines, reduce chemical and noise pollution, slow floodwaters and cool our streets.**		
	Learners should be able to: ▶ define the concept of nature and assess its significance for the climate crisis. ▶ analyse critically the dualism between humans and nature leading to disconnectedness. ▶ defend the benefits of exercising, sports and adventuring in nature for health and quality of life. ▶ explore and present our dependence on nature for different needs (food, air, water, energy, raw materials, etc.) and life functions (health, social benefits, economic regeneration).	Learners should be able to: ▶ express support for ecological balance with reference to local and global ecosystems. ▶ discuss in groups different types of nature activities needed for improving life balance. ▶ experience nature mindfully through the five senses and feel its function of making life better. ▶ share with family and friends their feelings, sensitivity, appreciation and respect for nature.	Learners should be able to: ▶ maximize their engagement with nature through sensory exposure, simple physical activities and nature visits, or scientific enquiry. ▶ support and participate in community engagement activities preserving natural areas for future generations. ▶ practice habits of exercising, sport, and adventuring in nature to increase fitness. ▶ raise awareness on the role of nature in moderating our climate.

16-18 years

KEY IDEA: Nature and biodiversity are necessary for humankind to build stronger, more resilient societies that can respond to the challenges of today and tomorrow.

Learners should be able to:

- describe with the use of evidence the manifold threats posed to nature and biodiversity (including habitat loss, deforestation, fragmentation, overexploitation, invasive species, etc.) (See Key Concept 2 Ecosystems and Biodiversity).
- illustrate the health benefits of outdoor activities such as biking, hiking, walking, sailing, skiing and applicable outdoor activities for the local context.
- argue for the importance of active, healthy, fun, and meaningful outdoor activities in promoting good health.

Learners should be able to:

- exchange with peers about the need to redress humanity's relationship with nature.
- cultivate sensitivity to nature and biodiversity for today and tomorrow.
- feel responsible for the physical, psychological, social and economic impacts of their own sedentary and urbanized lifestyle.
- build emotional connections with nature and biodiversity by expressing their feelings in the form of writing, music or drawing.

Learners should be able to:

- share with family/school/community the impact humanity has on nature and biodiversity (in the oceans and lands through biomass loss, acidification, pollution, etc.).
- advocate for the conservation of nature and biodiversity on multiple grounds, for example by writing to a local politician, posting on social media, or speaking with family and friends.
- take steps to integrate healthy, fun, and meaningful outdoor activities into their everyday life.
- encourage others to engage in active, healthy, fun, and meaningful outdoor activities, for example, by sharing their experiences on social media .

18+

KEY IDEA: There are communities for whom access to nature is obstructed or nearby nature is inhospitable.

Learners should be able to:

- describe and critique inequalities in access to the environment and problematic consequences in their surroundings as well as in the wider world.
- develop knowledge and understanding of diverse perspectives and global awareness of other cultures.

Learners should be able to:

- appreciate the health, social and economic benefits of (indoor) planting and farming.
- feel committed to promoting health and well-being for themselves, their family, and others through (indoor) planting and farming.
- express, in a group, the importance of incorporating alternatives for the natural connection of communities for whom access to nature is obstructed or nearby nature is inhospitable.
- express support for communities to access resources using local technologies available.

Learners should be able to:

- explore growing plants and vegetables at home, in the classroom or in the community.
- campaign for expanding natural reserves and overcoming threats to local business, industry, and livelihoods.
- work with policy-makers to improve legislation for making urban and rural areas more permeable to wildlife through the establishment of wildlife corridors, environmental schemes, restoration ecology, etc.
- argue against destructive environmental practices that cause the loss of nature, wildlife and biodiversity, for example, by writing letters to decision-makers, writing an article in the school newspaper or by posting in online communities..
- develop or join community projects that promote collective and climate-friendly practices, enterprises and careers.
- negotiate the rights of different groups based on justice, shared values and ethical principles to live in natural places.

Topic 6.2. Renewable energy use

Renewable energy use refers to utilizing the energy derived from natural sources that could be replenished at a higher rate than they are consumed and that does not put the source in danger of depletion or disappearance. Renewable energy includes solar, wind, hydro, geothermal, ocean and bioenergy, and these are effective alternatives to fossil fuels. Considering its reliability, stability and affordability, renewable energy has its own merits and harms to nature, humanity and economy.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: There are different sources of renewable energy which exist naturally (such as solar, wind, hydro, geothermal, ocean and bioenergy) as an effective alternative to fossil fuels**		
	Learners should be able to: ▶ exemplify the main sources of renewable energy (solar, wind, hydro, geothermal, ocean and bioenergy). (See Key Concept 1 Climate Science, Topic 1.6 Renewable Energy.) ▶ demonstrate how using or not using renewable energy would help nature and humanity.	Learners should be able to: ▶ embrace the significance of using renewable energy in daily life as an effective alternative to fossil fuels. ▶ share stories in groups about the need of people in different parts of the world for reliable, stable, and clean energy to live sustainably.	Learners should be able to: ▶ share with family and community members why alternative sources of energy are needed for nature and future generations. ▶ seek out renewable sources of energy for use in their homes and immediate vicinity.
9-12 years	**KEY IDEA: Different sources of energy are used in different parts of the world for different purposes**		
	Learners should be able to: ▶ identify and categorize what sources of energy are used in different parts of the world, and in their own (local) context (Consider the rural community contexts where firewood is used as fuel for cooking, which does not involve cutting down trees, but rather collecting them). ▶ explain what renewable energy is and how it is produced. ▶ assess harmful impacts of using renewable vs. non-renewable energy on the environment, society, and economy.	Learners should be able to: ▶ share stories on the sensitivity to the energy conditions in vulnerable contexts and settings around the world and what they feel about the stories. ▶ demonstrate a sense of responsibility about the use of energy that does not put the source in danger of getting depleted or disappearing.	Learners should be able to: ▶ work with others (e.g. classmates, school authorities, local governments) to encourage a plan for their local community to make responsible choices based on the pros and cons of using renewable and non-renewable energy sources. ▶ adjust their personal energy use so as to adopt a sustainable lifestyle. ▶ disseminate information to others about the use of renewable energy, for example by posting on social media.
13-15 years	**KEY IDEA: Using renewable energy helps cut energy prices and reduce dependence on fossil fuels**		
	Learners should be able to: ▶ define and compare the concepts of efficiency, sufficiency, and stability through renewable energy sources. ▶ discuss how renewable energy use could help drive environmental, social and economic sustainability ▶ critique unsustainable trends and systems of energy provision and consumption across the world. ▶ research and contrast different strategies for reducing energy consumption in terms of social, economic, and ecological life. (See Key Concept 1 Climate Science, Topic 1.6 Renewable Energy).	Learners should be able to: ▶ discuss in a group about the value of renewable energy practices and actively listen to what others think. ▶ appreciate cheap, reliable and affordable energy available from renewable sources of energy. ▶ express support for renewable domestic energy supply and decentralized energy systems for communities.	Learners should be able to: ▶ demonstrate strategies and practices to achieve efficiency, sufficiency, and stability in energy use in daily life such as by reviewing energy use in their school . ▶ motivate others to use renewable energy and communicate how renewable energy helps reduce dependence on fossil fuels, for example by conducting campaigns, performance, or sharing online . ▶ apply principles to choose the most appropriate renewable energy strategy in any given situation and context, including their own. ▶ campaign for more efficient energy consumption by use of energy-friendly appliances and equipment.

16-18 years

KEY IDEA: Policies and approaches for renewable energy use could reduce carbon emissions and lower the future risks of climate change

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ examine and compare different policies and approaches for energy consumption in terms of environmental impacts, safety, security and health issues. ▶ explain and present with the use of data how policies and approaches could influence energy production, supply, demand and usage. ▶ demonstrate knowledge of external hazards and conflicts related to conventional energy use.	▶ compare and discuss with peers renewable energy policies and approaches that ensure reduced global warming and improved public health, safety and resilience. ▶ recognize the effectiveness of renewable energy in reducing the overall carbon footprint and adverse effects of climate change. ▶ feel responsible for the environmental, social, and economic impacts of their own individual lifestyle related to energy use.	▶ undertake participatory actions for energy policies and approaches creating positive impacts on the environment and public health. ▶ promote solutions for energy use in changing weather conditions. ▶ work with stakeholders (school principals, leaders, counsellors, teachers, peers, parents, etc.) to participate in the development of policies and approaches for renewable energy use within their schools/ community (e.g. through school and student projects). ▶ take on their role as active citizens by promoting the creation of renewable energy systems that suit the needs of humanity and nature. ▶ reduce their use of and dependency on conventional energy sources.

18+

KEY IDEA: Building materials (such as machines and batteries) for renewable energy systems could have negative environmental, social, and economic impacts.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ critique the sustainability of sources used in the production of materials for renewable energy. ▶ assess renewable energy sources in terms of their reliability, intermittency, ease of storage, and politics (See Key Concept 1 Climate Science, Topic 1.6 Renewable Energy).	▶ value all types of natural assets at local, national, regional, and global levels for a sustainable lifestyle. ▶ criticize excessive use of critical minerals in producing renewable energy. ▶ show solidarity with the people working in the extraction process of critical minerals required for renewable energy.	▶ identify and promote solutions for the supply, demand, storage and trading associated with renewable energy. ▶ apply strategies to eliminate the negative impacts of renewable energy on nature and biodiversity. ▶ engage in real-world projects and collaboration with diverse partners and organizations to promote sustainability-driven ventures in building materials for renewable energy systems.

KEY IDEA: There is a need to develop and scale-up renewable energy policies, technologies, and systems.

Learners should be able to:	Learners should be able to:	Learners should be able to:
▶ research and provide examples of how energy policies, technologies, and related systems could affect the daily lives of citizens at the local, national, regional and global levels (See Key Concept 1 Climate Science, Topic 1.6 Renewable Energy). ▶ analyse different renewable energy models and their suitability for alternative solutions to produce safe, reliable, and sustainable energy use.	▶ acknowledge the need for cooperation/collaboration for new and innovative technologies and systems for sustainable energy use. ▶ envision the positive impact of sustainable energy technology and policies in society at both macro and micro levels. ▶ recognize the value of inter-institutional and multi-sectoral policies for renewable energy.	▶ find solutions for the scarcity of materials required for the production of renewable energy. ▶ develop a vision of reliable and sustainable energy production, supply, and usage in their job sector. ▶ manage their own energy usage considering its efficiency, sufficiency, and stability. ▶ take active responsibility to reduce energy waste as a strategy to encourage energy efficiency.

Topic 6.3. Responsible consumption

Responsible consumption means buying products having minimum or no negative impact on the environment and resources, creating a balance between what nature is giving us and what we are giving back. Responsible consumption ranges from conscious habits of buying and shopping to mindful choices of packaging and clothing.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: There are essential things that people need to survive, and there are things that people want but do not need for survival.**		
	Learners should be able to: ▶ differentiate between needs and wants. ▶ analyse their possessions considering the concepts of needs and wants. ▶ explain what overconsumption is and how it is demonstrated.	Learners should be able to: ▶ express which material possessions they are most attached to and why. ▶ reflect on meanings attributed to material possessions in different parts of the world. ▶ feel responsible for the environmental, economic, and social impacts of their own individual habits as a consumer.	Learners should be able to: ▶ develop a habit of responsible consumption by asking for only what they need and consuming less. ▶ build shared goals with others to minimize material possessions. ▶ make decisions against overconsumption in daily life. ▶ raise awareness of others to conserve resources, reduce waste and be mindful of their consumption habits.
9-12 years	**KEY IDEA: Responsible consumption aims to 'do better with less' and maintain a level of well-being by reducing resource use.**		
	Learners should be able to: ▶ define and illustrate what is responsible consumption. ▶ review their habits of buying and shopping in light of the concept of responsible consumption. ▶ clarify and provide examples of how individual choices of consumption influence climate and exhaust the planet's life support systems.	Learners should be able to: ▶ acknowledge that responsible consumption is a promise of good health and a reduced cost of living. ▶ feel empathy with communities whose livelihoods are influenced by consumption practices of other people across the world. (See Key Concept 4 Climate Justice, Topic 4.1 Contemporary Manifestations and Topic 4.3 Historical, Economic and Political Processes). ▶ embrace the need for responsible consumption for ecological balance and conservation.	Learners should be able to: ▶ apply the most appropriate principles to their buying behaviours (such as avoiding disposable items, buying products with long lifespans, minimal packaging, in concentrated forms and in bulk). ▶ raise awareness of others to make informed and responsible consumer decisions aligned with ecological sensitivity. ▶ speak out for anti-consumerism tendencies in their multiple communities and networks (e.g. family, school, local, national, global, etc.).
13-15 years	**KEY IDEA: There are various channels to promote responsible consumption (such as labels, campaigns, media, social networks, or educational programmes).**		
	Learners should be able to: ▶ identify and compare different channels of influence for promoting responsible consumption. ▶ analyse and reflect on their own engagement with various channels of communication, considering which might be used to promote responsible consumption.	Learners should be able to: ▶ appreciate the role of different channels in promoting responsible consumption. ▶ self-question motivations to promote responsible consumption in their multiple networks.	Learners should be able to: ▶ make use of different channels to promote responsible consumption. ▶ encourage others to engage in everyday practices for responsible consumption. ▶ participate in the dissemination of sustainable consumption.

	KEY IDEA: Planned obsolescence (designing products to break quickly and become out of date or useless in a short time) increases the pressure on natural resources and encourages continuous resource extraction.		
	Learners should be able to: ▶ explain what planned obsolescence is and how it is created. ▶ research a case of planned obsolescence and develop a sustainable alternative.	Learners should be able to: ▶ reflect critically on planned obsolescence and its contribution to environmental degradation. ▶ self-monitor practices to avoid and prevent planned obsolescence.	Learners should be able to: ▶ take steps to rebalance their habits of using, buying and reusing products. ▶ take initiatives to combat planned obsolescence in their multiple communities and networks (e.g. family, school, local, national, global, etc.).
16-18 years	**KEY IDEA: There are various factors that influence consumer behaviours: (1) psychological factors (motivation, perception, belief, and attitude); (2) personal factors (age, occupation, economic circumstances, lifestyle, personality, and self-concept); and (3) social (reference groups, family, roles, and status).**		
	Learners should be able to: ▶ analyse and describe different patterns of consumer behaviours and underlying factors influencing them. ▶ reflect on and map the factors that influence their own consumer behaviours.	Learners should be able to: ▶ reflect critically on social and cultural norms that work against responsible consumption.	Learners should be able to: ▶ identify and implement innovative ways to challenge psychological and personal orientations that promote overconsumption or non-sustainable consumer behaviours.
	KEY IDEA: Unsustainable patterns of consumption are root causes of the triple planetary crises of climate change, biodiversity loss and pollution.		
	Learners should be able to: ▶ research and explain the changing patterns of consumption globally and the associated external hazards that are contributing to the planetary crisis.	Learners should be able to: ▶ reflect critically on their own individual consumer behaviour in light of the needs of the natural world, other people, cultures and countries, and future generations.	Learners should be able to: ▶ actively change their consumption habits so that they better serve the needs of the planet. ▶ build partnerships for decreasing biodiversity loss and pollution through responsible consumption.
18+	**KEY IDEA: There can be a gap between consumers' attitudes towards responsible consumption and their actual behaviours**		
	Learners should be able to: ▶ distinguish between attitude/belief and action/behaviour in relation to responsible consumption. ▶ specify and illustrate the role of attitudes and behaviours in promoting a culture of sustainability.	Learners should be able to: ▶ demonstrate beliefs, attitudes, and values consistent with a culture of sustainability. ▶ interact closely with people adopting responsible consumption behaviours to get inspired.	Learners should be able to: ▶ tangibly bring the culture of sustainability into existence through their personal actions, choices, and behaviours. ▶ raise awareness of others about the gap between the values of responsible consumption and actual practices, and the need to address this gap.
	KEY IDEA: There is a need to advance the sustainable utilization of natural resources (such as water, land, air, mines, etc.) by designing efficient, 'green' management systems in farms, industry, construction, and manufacturing.		
	Learners should be able to: ▶ evaluate the root causes of unsustainable practices in different occupational sectors. ▶ research and compare opportunities across different sectors locally/nationally for reducing environmental impact (See Key Concept 2 Ecosystems and Biodiversity, Topic 2.4 Domestication and Agriculture).	Learners should be able to: ▶ appreciate the need for system-level changes to achieve sustainable utilization of natural resources. ▶ place value in designing efficient, 'green' management systems in farms, industry, construction or manufacturing.	Learners should be able to: ▶ create a vision and a plan for reliable and sustainable utilization of natural sources in different sectors locally/nationally. ▶ exhibit skills of leadership and advocacy to initiate positive changes for green management of resources in their community. ▶ apply system-level thinking and problem-solving competencies to introduce green occupations and the greening of the workplace.

Topic 6.4. Sustainable living spaces

Sustainable living places refer to happy, healthy, low-carbon and non-toxic places where people can live and strengthen their connection with nature through a vision and understanding of a shared ecosystem. Criteria for sustainable living spaces range from eco-friendly design and landscaping to construction and building materials. In this context, not only homes and neighbourhoods but educational institutions, campuses or schools could also be considered as living spaces to be designed sustainably.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Sustainable living spaces are beneficial for people and the planet as being secure, durable, affordable and healthy.**		
	Learners should be able to: ▶ explain and provide examples of what is a sustainable living space. ▶ list and compare the advantages of sustainably constructed living spaces for health and happiness. ▶ explain the impacts of less sustainable living spaces on the well-being of families and communities. ▶ evaluate their own living space concerning its impacts on their physical, emotional, and social comfort. ▶ defend the benefits of living in sustainable spaces (such as their being secure, durable, affordable, and healthy).	Learners should be able to: ▶ build emotional connections with green (plant) and blue (water) spaces to live sustainably. ▶ appreciate the existing, sustainable qualities of their living spaces and the comforts these provide. ▶ empathize with people deprived of secure, durable, affordable and healthy places to live sustainably.	Learners should be able to: ▶ make use of sustainable living spaces for their physical, mental and social well-being. ▶ develop simple strategies to communicate the importance of sustainable living spaces in their immediate vicinity.
9-12 years	**KEY IDEA: Creating sustainable living spaces helps reduce environmental impacts, save money, improve quality of life, and reduce threats to humans, animals, and biological diversity**		
	Learners should be able to: ▶ define the concepts of quality of life, functionality and nature-friendliness through sustainable living spaces. ▶ compare toxic and non-toxic environments with respect to their impacts on humans, animals, and plants. (See Key Concept 2 Ecosystems and Biodiversity.)	Learners should be able to: ▶ reflect critically on high-carbon environments and their impact on ecology, society, and economy. ▶ show solidarity with humans, animals, and plants living in vulnerable habitats influenced by toxic environments.	Learners should be able to: ▶ argue for sustainable living spaces and their positive impacts. ▶ demonstrate strategies and practices to achieve quality of life, functionality, and nature-friendliness in living spaces. ▶ organize field trips and site visits to sustainable living spaces for exposure to sustainable design principles. ▶ propose practical solutions in their local/national environments for the major threats presented by toxic environments to human life, wildlife, and biodiversity.
13-15 years	**KEY IDEA: There are numerous ways of designing and building sustainable spaces across all areas of social and economic life.**		
	Learners should be able to: ▶ contrast different strategies for designing and building sustainable spaces and using sustainable materials, considering social, economic, and ecological considerations. ▶ argue against unsustainable trends in systems of city planning, landscaping, and construction trends nationally and across the world.	Learners should be able to: ▶ express support for green (plant) and blue (water) spaces in every neighbourhood to promote active lifestyles and bring nature closer to people's doorsteps (especially in urban communities).	Learners should be able to: ▶ make use of sustainable designs and materials that are eco-friendly, recyclable, and biodegradable (as applicable). ▶ advocate with family and friends for energy-efficient lighting and rainwater harvesting systems. ▶ promote sustainable systems in public spaces in their locality.

16-18 years

KEY IDEA: Integrating green (plant) spaces and blue (water) spaces throughout cities balances urbanized development, leading to a safe place for city residents/visitors.

Learners should be able to:

- clarify how policies and approaches for sustainable living spaces tackle the climate crisis
- examine and compare different policies and approaches for sustainable living spaces in terms of environmental impacts, safety, security, and health issues, with attention to local/national levels.
- research and present the changing availability of green and blue spaces in urban areas and external hazards and conflicts related to urbanized development.
- discuss the different ways that nature can exist in urban areas.

Learners should be able to:

- express support for sustainable living spaces.
- feel motivated to strengthen their resilience and adaptive capacity to climate-related challenges through sustainable living spaces.
- Foster sensitivity, appreciation and respect for the rights of city residents/ visitors for green and blue spaces.

Learners should be able to:

- undertake community actions for policies and approaches for sustainable living spaces.
- work with stakeholders (school principals, leaders, counsellors, teachers, peers, parents, etc.) to create sustainable living spaces within their schools and communities.
- take on their role as active citizens in the integration of green and blue spaces in cities (if applicable).

18+

KEY IDEA: There is a need to develop and scale-up policies, technologies, and systems for designing and managing natural or semi-natural areas. Such policies might address flooding, water wastage, pollution, destruction, deforestation and loss of biodiversity

Learners should be able to:

- research and explain the roles of indigenous cultures in preserving and enhancing sustainable environments in the local and national contexts.
- analyse different models and their suitability for solutions to produce safe, reliable and sustainable living spaces. (See Key Concept 2 Ecosystems and Biodiversity.)
- argue how policies for city planning, landscaping and construction affect the daily lives of citizens at the local, national, regional and global levels.

Learners should be able to:

- attach importance to the sustainability of indigenous beliefs and practices for better, stronger and more resilient societies, locally, nationally and in other regions.
- value different cultures that encourage beliefs and practices promoting a sustainable lifestyle at local, national, regional and global levels.
- emphasize the need for cooperation/ collaboration for new and innovative technologies and systems for natural and semi-natural areas.
- express support for sustainable practices, enterprises and careers.

Learners should be able to:

- specify the roles of indigenous cultures in preserving and enhancing sustainable environments, especially in the local and national contexts.
- engage in real-world projects and collaboration with diverse partners and organizations to promote indigenous cultures.
- discuss with others how designing and managing natural or semi-natural areas could help drive environmental, social, and economic sustainability.
- demonstrate critical and entrepreneurial skills that foster a sense of global citizenship and active contribution to sustainable living spaces within their communities and beyond.

Topic 6.5. Sustainable mobility

Sustainable mobility is a concept for (mostly) affordable, accessible, energy-efficient, and 'green' modes of transportation. These modes balance current and future needs and improve social equity, health, the resilience of cities, and productivity of urban-rural linkages. Sustainable mobility includes walking, cycling, rail freight, carpooling/vanpooling and electric, low-carbon or alternative-fuel vehicles with low/zero emissions.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: There are different forms of transportation. Various energy sources are used by different transportation vehicles.**		
	Learners should be able to: ▶ explain why individuals and communities need transportation. ▶ compare different forms of transportation and the various energy sources used by different transportation vehicles. ▶ assess the environmental impacts of different forms of transportation used by individuals and communities. ▶ explain different benefits to nature and society of adopting sustainable mobility such as walking, cycling and public transportation, through the use of examples and evidence.	Learners should be able to: ▶ feel respect for individuals and communities using different forms of transportation, especially sustainable ones. ▶ appreciate the need of people in different parts of the world for affordable, accessible, energy-efficient and green mobility to live sustainably.	Learners should be able to: ▶ adopt sustainable mobility (as applicable). ▶ develop a habit of choosing or asking for transportation that is more sustainable. ▶ advocate with family and friends for free and easy movement at school, at home or in other settings.
9-12 years	**KEY IDEA: Different modes of sustainable transport (including walking, cycling, rail freight, carpooling/vanpooling and electric, low-carbon or alternative-fuel vehicles) are effective alternatives to conventional modes.**		
	Learners should be able to: ▶ differentiate between sustainable and unsustainable vehicles and analyse their respective advantages and disadvantages. ▶ investigate the sources that are used for transportation and travel in different parts of the world and in their own (local) context and propose sustainable solutions. ▶ classify, compare and rank different modes of transport as sustainable (walking, cycling, rail freight, carpooling/vanpooling, and electric, low-carbon or alternative-fuel vehicles). ▶ evaluate advantages and disadvantages of different transportation fuels (i.e. fuel efficiency, renewable). (See Key Concept 5 Post-Carbon Economies.)	Learners should be able to: ▶ acknowledge that alternative modes of transportation are needed for the sake of the planet and people. ▶ demonstrate an awareness that not all forms of transportation require a non-renewable energy source.	Learners should be able to: ▶ investigate the sources that are used for transportation and travel in different parts of the world and in their own (local) context and propose sustainable solutions. ▶ promote with family and friends sustainable modes of transportation, with the use of facts and with reference to the local environment. ▶ make choices about the mode of transportation they use, based on the economic, social and environmental costs and benefits of different transportation fuels.

13-15 years

KEY IDEA: The carbon footprint is an important concept that indicates the impact of people's transportation choices on CO_2 emission levels.

Learners should be able to:

- define the concept of the carbon footprint produced by transportation and describe its significance for climate change.
- calculate their personal as well as their community's contribution to CO_2 emissions by their individual and collective habits of transportation.
- compare the carbon emissions caused by different modes of transport.
- discuss the advantages of using cycling as a form of sustainable transportation.
- identify what conditions and restrictions make an area or route more or less walkable.

Learners should be able to:

- recognize the importance of reducing carbon emissions produced by transportation.
- value cycling for its positive impacts on the planet and people.
- appreciate the benefits of regular walking.

Learners should be able to:

- propose solutions for reducing their carbon footprint because of their transportation choices, both as individuals and as a community.
- create clubs at the community level and come up with sustainable mobility activities.
- promote the use of cycling as a low or zero-carbon transport mechanism.
- identify and implement ways to overcome the factors that impede regular walking.
- increase their walking habits as a form of transportation (as feasible). (Consider the contexts where walking is the only chance to get to school and populations walk long distances without using any vehicles).

16-18 years

KEY IDEA: Policies and approaches for adopting sustainable tourism, travel and transportation reduces carbon emissions and lowers future risks of climate change.

Learners should be able to:

- research and explain policies and approaches influencing green practices in tourism, travel, and transportation.
- examine and compare sustainable mobility policies in terms of environmental impact, energy efficiency, and public health.
- define shared mobility and multi-occupant vehicles, describing their benefits like reduced pollution, emissions, and traffic congestion.

Learners should be able to:

- feel motivated to influence policies and approaches promoting sustainable tourism, travel and transportation in their community.
- feel committed to sustainable mobility practices.

Learners should be able to:

- work with stakeholders (school principals, leaders, counsellors, teachers, peers, parents, etc.) to participate in the development of policies and approaches for sustainable transportation from/to their schools and communities.
- adopt practices involving a multi-occupant vehicle such as carpooling/vanpooling (if applicable).
- motivate others to seek opportunities for sharing a multi-occupant vehicle (if applicable).
- advocate for sustainable tourism, travel, and transportation, highlighting benefits such as reduced global warming, safer transport, lower congestion and improved health.

18+	**KEY IDEA: The reduction and elimination of carbon emissions caused by unsustainable modes and systems of travel (i.e. air travel) is a crucial step for tackling climate change.**		
	Learners should be able to: ▶ analyse the use of unsustainable modes and systems of travel (i.e. air travel) at the local/national/global levels. ▶ evaluate different models and their suitability for alternative solutions to produce safe, reliable, and sustainable mobility. ▶ illustrate how policies for mobility affect the daily lives of citizens at the local, national, regional and global levels. ▶ explain how technologies for sustainable mobility could help drive environmental, social and economic sustainability.	Learners should be able to: ▶ feel concern about unsustainable modes and systems of travel and the power of strong interest groups lobbying against stricter policies. ▶ appreciate the need for cooperation/ collaboration for new and innovative technologies and systems for sustainable mobility.	Learners should be able to: ▶ propose ideas to reduce and eliminate emissions from unsustainable modes of travel (i.e. air travel). ▶ demonstrate skills of leadership and advocacy to initiate positive changes in their community for using sustainable modes of travel. ▶ integrate detailed knowledge of travel, tourism and transport in different contexts to propose solutions for sustainable mobility. ▶ create a vision for reducing travel and disseminating green transport services (such as electric trains and cars and walking or cycling as an alternative to driving high emission vehicles). ▶ engage in gender discussions on sustainable mobility and some of the exceptions to make for women and children.
	KEY IDEA: Digitalization and artificial intelligence (AI) play a key role in making transport more efficient and less polluting, through automated mobility and intelligent traffic management systems		
	Learners should be able to: ▶ research and evaluate the functionality and efficiency of digitalization and automatization for sustainable mobility. ▶ analyse critically the value addition of big data generated to understand sector/market needs and take advantage of digital platforms to access data for learning purposes.	Learners should be able to: ▶ value all types of digital assets for sustainable mobility at local, national, regional and global levels.	Learners should be able to: ▶ investigate the impact of digitalized transportation systems and infrastructures for local industry and business and propose solutions to enhance efficiency and reduce pollution. ▶ make use of digitalization and AI to identify and apply measurements of sustainable mobility for affordability, accessibility and energy-efficiency.

Topic 6.6. Sustainable diets

Sustainable diets refer to eating healthy, accessible, affordable, secure, local, and culturally relevant food produced and delivered in a way that reflects conscious awareness of its impact on the planet and people. Sustainable diets include fresh, wholesome and nutrient-dense food rich in vegetables, fruits, whole grains, nuts, and legumes. As a part of sustainable diets, culturally appropriate diets refer to safe and nutritious food that meets the diverse tastes and needs of people according to their cultural beliefs and practices.

	Cognitive	**Social and emotional**	**Behavioural**
5-8 years	**KEY IDEA: Malnutrition and poor diets have physical and psychological effects on children's life.**		
	Learners should be able to: ▶ realize that some people do not have enough food while others eat too much. ▶ explain the negative effects of malnutrition and poor diet on children's physical and psychological well-being.	Learners should be able to: ▶ feel empathy with children suffering from malnutrition and poor diet. ▶ self-question dietary habits at home, at school or in other settings.	Learners should be able to: ▶ adopt a sustainable diet (as applicable). ▶ build shared goals with peers and family members to eat healthy food.

	KEY IDEA: Buying and eating local food is an important way of living sustainably.		
	Learners should be able to: ▶ differentiate between local and non-local food. ▶ explain why eating local food helps to protect the environment.	Learners should be able to: ▶ reflect on their own and other people's habits of buying and eating locally. ▶ demonstrate compassion to local farmers/producers providing local food for local communities.	Learners should be able to: ▶ make mindful decisions leading to consuming local food. ▶ influence family members and friends about the importance of consuming local food.
9-12 years	**KEY IDEA: Sustainable diets not only have a low environmental impact but are healthy and economical**		
	Learners should be able to: ▶ explain why eating local food helps to promote human health as well as the local economy. ▶ identify and illustrate the benefits of following sustainable diets (accessible, safe, equitable, and culturally appropriate).	Learners should be able to: ▶ value eating sustainably given the many benefits to health, the environment and local economy. ▶ empathize with people deprived of accessible, safe, equitable and culturally appropriate diets to live sustainably.	Learners should be able to: ▶ apply relevant sustainability principles to their consumer and eating behaviours. ▶ encourage environmentally friendly ways of disposing of leftover food and wrappings.
13-15 years	**KEY IDEA: Sustainable eating involves selecting food that not only provides a balanced diet for the body but also facilitates the conservation of the environment.**		
	Learners should be able to: ▶ explain how sustainable food is grown or produced in ways that promote healthiness as well as positive environmental and social impacts. ▶ describe how individual habits of eating influence the climate and exhaust the planet's life support systems. ▶ exemplify the main drivers and root causes of unsustainable diets at the individual, local, national and global levels. ▶ analyse the environmental impacts of diets containing animal-products.	Learners should be able to: ▶ embrace the need of the planet for sustainable diets for ecological balance and conservation. ▶ feel empathy with communities whose livelihoods are influenced by unsustainable food production. ▶ self-monitor habits of meal planning, grocery shopping and daily cooking.	Learners should be able to: ▶ adjust their dietary habits to promote a sustainable lifestyle. ▶ encourage others to engage in everyday practices for eating sustainably.
16-18 years	**KEY IDEA: Sustainable diets are guided by the principles of renewability, resilience, health, equity, diversity, inclusion and interconnectedness.**		
	Learners should be able to: ▶ outline and describe the four dimensions of sustainable diets. ▶ provide examples of the four dimensions of sustainable diets, drawing on their own community. ▶ define the principles that guide sustainable diets. ▶ specify the roles and duties of different actors in promoting sustainable diets. ▶ calculate their personal as well as their community's contribution to CO_2 emissions by their individual and collective eating habits.	Learners should be able to: ▶ criticize social and cultural norms that do not support sustainable diets. ▶ reflect on their own values and those of others on sustainable diets. ▶ empathize locally, nationally, regionally and globally with vulnerable groups who are devoid of sustainable food. (See Key Concept 4 Climate Justice.) ▶ recognize the importance of reducing carbon emissions produced by unsustainable diets.	Learners should be able to: ▶ inspect their own individual as well as communal diets for any negative impacts on health, economy, society, culture, and environment and propose sustainable alternatives. ▶ influence decision-making processes related to public policies addressing sustainable diets. ▶ work with stakeholders (school principals, leaders, counsellors, teachers, peers, parents, etc.) to promote sustainable nutrition within their schools and communities. ▶ propose solutions for reducing their carbon footprint through diet choices both as individuals and as a community.

18+	**KEY IDEA: Diets with low environmental impacts contribute to food and nutrition security and to healthy lives for present and future generations.**		
	Learners should be able to: ▶ define the concept of food security and its four pillars through conscious eating behaviours. ▶ exemplify practices of food security in everyday consumption. ▶ exhibit knowledge of the intergenerational planetary effects of diets.	Learners should be able to: ▶ cultivate a sense of solidarity with people who have limited access to healthy, local, organic, low impact and seasonal diets. (See Key Concept 4 Climate Justice.) ▶ reflect on their own individual eating behaviour in light of the needs of the natural world, other people, cultures and countries and future generations.	Learners should be able to: ▶ develop a plan of sustainable diet based on a set of criteria of food security. ▶ engage in real-world projects and collaboration with diverse partners and organizations to promote food security within their communities and beyond. ▶ create a vision for present and future generations to follow diets with low environmental impacts and high food security.

Topic 6.7. Sustainable waste practices

Sustainable waste practices refer to recovering and reusing components of waste that still have an environmental, economic, and artistic value. These practices include composting, recycling, upcycling, and reuse activities that benefit the environment, impact the economy and support the transition to waste reduction and zero landfill.

	Cognitive	Social and emotional	Behavioural
5-8 years	**KEY IDEA: Sustainable waste practices aim to keep materials in use for as long as possible.**		
	Learners should be able to: ▶ explain what sustainable waste practices aim for and how they are achieved. ▶ present the advantages of keeping materials in use for as long as possible. ▶ explain what upcycling aims for and how it functions as art.	Learners should be able to: ▶ reflect on how long they use a range of materials in their everyday life. ▶ value different types of waste to reuse it with an artistic perspective. ▶ recognize their own artistic capabilities needed for creative use of waste.	Learners should be able to: ▶ demonstrate behaviours focused on prolonging the usage of materials, contributing to sustainability by maximizing their lifespan. ▶ raise awareness of others about the environmental impacts of improper waste disposal. ▶ demonstrate how creativity could be achieved through upcycling and share with family and friends.
9-12 years	**KEY IDEA: Sustainable waste practices aim to minimize the amount of solid waste that is disposed of in landfills or through incineration.**		
	Learners should be able to: ▶ define composting and explain its benefits (such as improving healthy plant growth, reducing erosion, conserving water, moderating soil temperature, etc.). ▶ research and highlight the importance of soil for a healthy environment. ▶ explain what landfill and incineration mean.	Learners should be able to: ▶ appreciate the way composting can help farming, planting, and soil. ▶ show sensitivity to waste practices in vulnerable contexts and settings around the world. ▶ embrace the positive impacts of sustainable waste practices on the environment, society and the economy.	Learners should be able to: ▶ develop a plan of composting-related activities for healthy soil and plant growth. ▶ take simple actions to promote sustainable farm practices at family, school and community level. ▶ engage in resource and knowledge exchange activities (physical or virtual) between the global north and the global south.

13-15 years	**KEY IDEA: Avoiding and reducing the amount of waste generated is the first priority for maximizing efficiency and reducing waste.**		
	Learners should be able to: ▶ critique and explain why avoiding and reducing the amount of waste is always a top priority. ▶ research a recycling process in the local community and propose ways to improve this process through a greater reliance on reusing components before recycling.	Learners should be able to: ▶ criticize social and cultural norms that do not support sustainable waste practices. ▶ prioritize avoiding or reducing waste generation. ▶ acknowledge that recycling comes last after all other waste management procedures are practiced.	Learners should be able to: ▶ implement resource-saving/waste-reduction strategies at home, at school or at work. ▶ contribute to decision-making processes about proper recycling as an environmental practice. ▶ adjust their recycling habits to promote a sustainable lifestyle.
16-18 years	**KEY IDEA: Sustainable waste practices refer to reusing components of waste that still have an environmental, economic, and artistic value.**		
	Learners should be able to: ▶ analyse different models for reusing components and their suitability for alternative solutions for sustainable waste practices. ▶ evaluate their habits of waste generation, waste reduction and waste management and their impacts on the environment, economy and society.	Learners should be able to: ▶ feel motivated to reuse components of waste. ▶ recognize recycling processes and technologies along with the economic and environmental benefits of recycling various materials.	Learners should be able to: ▶ promote sustainable waste practices, drawing on local and indigenous values. ▶ set up centralized collection points for recyclables, e-waste and hazardous waste to increase convenience. ▶ work with stakeholders (school principals, leaders, counsellors, teachers, peers, parents, etc.) to disseminate sustainable waste practices within their schools and communities (e.g. through school and student projects).
18+	**KEY IDEA: Reducing the amount of waste we create will not only save money but also conserve natural resources**		
	Learners should be able to: ▶ research and compare waste generation trends and impacts at the local, regional and national levels. ▶ classify, compare and rank different types of waste (including e-waste) at local, national, regional and global levels and links with a sustainable lifestyle. ▶ develop a strategy for reducing waste generation in their locality. ▶ illustrate how waste management policies affect the daily lives of citizens at the local, national, regional and global levels. ▶ outline and compare different waste management models and their suitability for alternative solutions to produce safe, reliable and sustainable waste management.	Learners should be able to: ▶ appreciate the economic and environmental benefits of waste reduction. ▶ emphasize the need for cooperation/collaboration for new and innovative technologies and systems to ensure sustainable waste practices. ▶ embrace the ways sustainable waste practices can help drive environmental, social and economic sustainability in the community. ▶ reflect critically on the sustainability of current patterns of waste management at the household, business and industry levels.	Learners should be able to: ▶ implement innovative ways to improve waste practices (waste generation, waste reduction and waste management behaviours) personally and in their community. ▶ develop critical and entrepreneurial skills that foster a sense of global and active citizenship for sustainable waste practices. ▶ engage in the design and execution of learner-led projects that demonstrate sustainable waste management practices. ▶ propose sustainable solutions for managing production, consumption, and the circular economy (See Key Concept 5 Post-Carbon Economies). ▶ discover new ways to increase the awareness of repurposing waste items.

Section 4

Implementation of the greening curriculum guidance

This section recommends how to design and integrate learning outcomes underlined in this Guidance into the curriculum in formal and non-formal education as well as within TVET to ensure that it enables learners to address the climate crisis.

Planners may wish to anticipate the following steps in designing, implementing and improving efforts to integrate learning outcomes into the curriculum:

- **Step 1.** Review existing education policies for footholds and rationales for strengthening the presence of greening education in the curriculum.
- **Step 2.** Establish and ensure inclusive participation of stakeholders in the curriculum development process, including youth and community members.
- **Step 3.** Decide on curricular strategies for infusing greening education within and across subjects and grade levels in schools, as well as recommendations for the non-formal education sector.
- **Step 4.** Develop a detailed curriculum that ensures action-oriented learner outcomes, including the use of transformative and 'place-based' pedagogy.
- **Step 5.** Prepare and pilot sample instructional resources within and across subject areas to test the new curriculum and solicit feedback from numerous stakeholders, especially youth.
- **Step 6.** Finalize, produce and distribute learning resources, including suggestions for assessment, with an associated communication and publicity strategy.
- **Step 7.** Provide substantive orientation to greening education for textbook writers, examination board staff and other stakeholders, and obtain any necessary approvals.
- **Step 8.** Provide educators with quality pre- and in-service training and continuous professional development opportunities, in cooperation with higher education institutions and CSOs.
- **Step 9.** Implement the Guidance through whole institution approaches and strengthen partnerships between schools, CSOs, municipal authorities and the private sector to implement greening education.
- **Step 10.** Monitor and assess the results of education programming on climate change competencies in an ongoing manner.

Each of these steps are addressed in this section. The reader may want to consult other resources for more detailed guidance on curriculum mapping, curriculum development and curriculum supports.[9]

9 For detailed guidance on curriculum mapping, curriculum development and curriculum support, consult UNESCO (2020) and Tibbitts et al (2023), found in the Reference section.

Step 1. Review existing education policies for footholds and rationales for strengthening the presence of greening education in the curriculum.

Policies for greening education gain legitimacy if they are tied to national education priorities (Benavot, 2014). Despite the clear and pressing need for the critical role that education plays in the climate crisis, many countries still face challenges. There are many reasons for this, including the absence of curriculum examples; overcrowded curriculum; a perception that climate change is appropriate only for the natural sciences or geography; and a lack of teacher capacity to address related issues. Moreover, some countries have de-centralized, federalist educational systems which adds an additional layer of complexity in organizing coordinated educational reform efforts nationally. It is important to address these barriers to including greening education in educational programming.

In a recent review of the status of climate education in 80 countries, while 87% have laws, policies or plans that include climate change relating to primary and secondary education, only 38% of countries have a national-level law, policy and strategy specifically focused on CCE (Tibbitts 2020, 2023). In another UNESCO review of 85 countries on their grade 9 natural science and social science syllabi, only 31% contained references to climate change (UNESCO, to be published 2024). Countries around the world are in the process of developing new national climate pledges – known as Nationally Determined Contributions or NDCs – under the Paris Agreement. As the world's largest provider of support to countries for NDC design, UNDP has found that a key factor for countries raising levels of climate ambition is popular support for policies that address climate change (United Nations Development Programme (UNDP, 2021).

Box 5. Examples of laws and policies supporting greening education

In **Chile**, climate change is addressed in pre-primary, primary and secondary education as part of a broader National Environmental Education Strategy. In **Ethiopia**, environment and climate change is covered as a cross-cutting issue in all study subjects for grades 1 to 12. In Indonesia, climate change was mainstreamed into the school curriculum in 2011. In the United Arab Emirates, a cross-curriculum framework as part of a Greening Education reform – intertwining literature, science, physics and the social sciences – was announced at COP28.

Source: GEMR, 2023

However, often national mandates do not trickle down and integrate into education policy to be implemented. ESD policies are often created as a standalone policy isolated from decisions such as educational planning, teacher training and budgeting (Benavot, 2014). Thus, the challenge of including climate change in education policy and laws is urgent.

The following strategies might help introduce and rollout greening education:

Link with existing international, regional and local frameworks and international agreements that recognize the role of education in the climate crisis. Such support might be found across a range of policies focused on the environment, climate change and education.

The global agreement on the 17 SDGs and their achievement by 2030 is one of the most significant leverages for integrating greening education in national policies. In particular such efforts would directly contribute to the country's progress in addressing SDG 4 on quality education Target 4.7 and SDG 13 on climate action and its Target 13.3.



SDG Target 4.7 : By 2030 ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture's contribution to sustainable development



SDG Target 13.3: improve education, awareness raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning

From the education sector, the international framework on ESD for the period of 2020-2030 called 'ESD for 2030', adopted by all Member States at UNESCO's General Conference and acknowledged by the UN General Assembly in 2019, is a basis for countries to implement ESD, including CCE, in their national policies. The ESD for 2030 Roadmap and the Country Initiatives on ESD are means to implement greening education at a national level.

From the climate change sector, the UNFCCC Article 6 and Article 12 of the Paris Agreement that call for Action for Climate Empowerment to empower all members of society to engage in climate action, through the six ACE elements – CCE and public awareness, training, public participation, public access to information, and international cooperation on these issues – are important agreements to ensure education is reflected in national climate actions. Also, national legislation on climate change provides a basis for the need for educating and raising awareness on climate change. For example, in the UK, there is Green Future, Declaration of a Climate Emergency, net-zero Greenhouse Gas emissions legislation and the Ten-Point Plan for a Green Industrial Revolution (Education for Sustainable Development Guidance. Executive Summary, March 2021) which contains a range of international standards that validate education's role in addressing the climate crisis.

Also, there is a growing call among young people that climate policies should include those that ensure their constitutional right to know about and be prepared for climate change, as shown through multiple court cases raised by young people in various countries. The UN General Assembly Resolution on the human right to a clean, healthy and sustainable environment (2022) and The UN Committee on the Rights of the Child's General Comment 26 for the implementation of the UN Convention on the Rights of the Child (2023), calls on governments to take action to protect boys and girls in the face of the deepening climate crisis.

Political commitments made at major international fora, such as those made at the UN Transforming Education Summit in 2022, climate change COPs, and the World Conference on ESD, may also help to accelerate policy integration.

Evidence of positive results of greening education programming. Use evidence that demonstrates young people's capacity to learn about climate change, cope with the existential threats that climate change offers, and undertake concrete actions aligned with sustainable development. Additionally, there is a need for more evidence/documentation of normative and behavioural change among children, youth, their families and school communities as a result of greening education, demonstrating the role of education in driving change for sustainable behaviour/sustainable lifestyles. Such evidence can be drawn from a range of local efforts, including those taking place in regions considered to be most vulnerable to climate change, and affecting specific vulnerable groups. Some of this evidence is presented in Section 2 of this Guidance.

Researchers have an essential role to play in understanding the results of education's role in the climate crisis, both within and outside the formal education system. Critical questions about what students should learn, how they should engage with climate-related phenomena, approaches to curriculum and instruction that afford these opportunities, and how effectively they learn over time, are best addressed through the use of validated, reliable measures. These include not only assessments to evaluate an individual learner's (and educator's) progress toward defined climate-related learning outcomes, but also observation protocols, instructional logs, surveys and other instruments that can help researchers evaluate all aspects of climate education programming in the formal and non-formal education sectors, including TVET. Such work represents a community-wide investment that will ultimately enable researchers to provide more definitive evidence for what works, for whom, in what contexts and why, when teaching and learning about the Earth's climate and climate change (Battacharya et al, 2020, p. 11).

Step 2. Establish and ensure inclusive participation of stakeholders in the curriculum development process, including youth and community members.

At the policy level, a well-developed national policy on greening and/or sustainability can be explicitly linked to education sector plans, as well as to the national strategic plan and policy framework on health and other sectors. Key stakeholders at the national level – ministries of education, environment and climate change, health and science and other leaders – play a central role in offering the policy and moral leadership that provides an enabling and supportive environment for such programming.

Diverse stakeholders can and should be involved in the planning and implementation of school-based and out-of-school education programmes. National and regional authorities, schools and communities should be engaged, at different stages and to different extents, in the development of national policy; updating of curricula; creation of mechanisms and plans for rolling out a new curriculum.

The recognition of children and youth as both environmental victims and actors continues to unfold in communities around the world, in the media and in research literature. Using a child and youth-focused theoretical lens, Biswas and Mattheis (2021) argued that climate strikes have been a powerful counterweight to formal education by allowing youth to self-educate and build their agency. This emphasizes the capacity-building of youth to act independently and trust youth-driven processes of learning and acting (Andersson & Öhman, 2016).

Box 6. Youth participation for a greener future in Ireland

Ireland is placing youth at the centre of government decision-making for ESD. Youth can participate through various initiatives such as the National Youth Assembly on Climate and the Children and the Young People's Assembly on Biodiversity Loss. Among other youth-led initiatives is the National Youth Council of Ireland Climate Justice Project.

Source: UNESCO. (2023, December 13). *How Ireland promotes youth engagement in education for sustainable development*. https://www.unesco.org/en/articles/how-ireland-promotes-youth-engagement-education-sustainable-development (Accessed 15 March 2024)

Understanding youth needs and perspectives is an essential starting point in designing a curriculum that will be relevant and effective in motivating learners to engage fully in efforts to address sustainability. Youth perspectives might be ascertained through a survey and through involving them in the conceptualization of the curriculum in the preparatory phase. Other experts in the field of ESD and climate change as well as family members and community stakeholders should ideally be involved. Having multiple stakeholders own the curriculum improves the chances of its successful adoption and implementation.

In some countries, education ministries have established National Advisory Councils and/or Task Force Committees to inform the development of relevant policies, improve the national curriculum and assist in the development and implementation of sustainability programmes. Council and committee members can often get involved in sensitization and advocacy efforts; review draft materials and improvements for national curricula and policies; and develop a comprehensive work plan for in-classroom delivery, together with plans for monitoring and evaluation. Other key stakeholders that can provide leadership and commitment include parents and parent-teacher associations; educational professionals and institutions, including teachers, headteachers, school inspectors and training institutions; the private sector; indigenous groups, religious leaders and faith-based organizations; teachers' trade unions; researchers; community and traditional leaders; CSOs, particularly those working on issues related to the environment and human rights; media (local and national); and relevant donors or outside funders.

Since there is such a wide range of stakeholders for greening education, it is sensible to think about the cultivation of partnerships between the government, CSOs, expert organizations, model schools and organizations supporting greening education. Community leaders, including indigenous persons, can pave the way for acceptance and support of education programmes implemented in formal and non-formal settings. Community leaders can also provide support for efforts to contextualize the content of the programme and partner with the schools and other non-formal education organizations for addressing sustainability in practical and locally focused ways. Hence the notion 'community as curriculum' (Field, 2017, p. 83).

'Champions' can help enhance awareness of, and a positive approach to, greening education. Champions are influential thought leaders, including politicians, celebrities, young people, religious leaders and others from inside and outside the educational field, who believe in the importance of the role of education in the climate crisis. They understand the local context and are valued by their communities. Through their networks, they can advocate at the national or local level, in parliament, in school or community settings; engage with the press; and use social media to raise awareness of the necessity to teach about climate change and the positive outcomes for both learners and society.

Step 3. Decide on curricular strategies for infusing greening education within and across subjects and grade levels in schools, as well as recommendations for the non-formal education sector.

Curricular strategies in the school setting can be multi-faceted, including the use of key carrier subjects, cross-disciplinary approaches and non-formal learning spaces. The development of such strategies will require clarity on the aims of this curriculum, learner competencies and outcomes, as well as links with existing educational standards. A greening curriculum strategy will thus benefit from a review by numerous stakeholders, such as those mentioned in Step 2.

Table 3 below presents examples of innovative curriculum strategies for infusing a selection of Section 3 topics across different subjects. These examples illustrate the ways in which greening education can take place across the humanities, social sciences and natural sciences.

Table 3 Examples of innovative curriculum strategies for infusing a selection of topics across different subjects

5-8 years		
	Learning outcomes	**Subjects**
Climate Science	**Topic 1.1** Generalize regular weather patterns as seasons and 'climate.'	**Social/environmental studies class or language class:** Ask learners to observe and describe daily weather (e.g. temperature, rain, wind) in their locality, and relate this to weather over the previous 12 months in terms of 'seasons,' through artwork, writing or drama. Develop a class activity to record what older people say about past weather patterns and consolidate the concept of 'climate'.
Ecosystem & Biodiversity	**Topic 2.2** Advocate for the memory of recently extinct species.	**Art class:** As a school community, create representations of extinct or nearly extinct local animals and create a festival to celebrate them.
Climate Justice	**Topic 4.4** Appreciate indigenous practices and relationships with the land	**Music class:** Ask learners to listen to and learn the lyrics and the meaning behind an indigenous song about the land.
Resilience-Building	**Topic 3.2** Appreciate the importance of safety during extreme weather events or climate disasters.	**Health class:** Ask learners to develop a list of actions they would take in different extreme weather events and discuss skills such as listening to adults, following rules, and working to help in a potential emergency.
Post-Carbon Economies	**Topic 5.1** Explain the resources needed in those examples of growth.	**Art class:** Organize an artwork competition with the theme of 'growth and resource' with an embedded session on the discussion of each piece of artwork from the perspective of the relation between growth and resource.
Sustainable Lifestyles	**Topic 6.7** Explain what upcycling aims for and how it functions.	**Art class:** Work with learners to collect used or unwanted materials; create a list of the items that may be used in their designs; design a space where they can work; and help them recreate new items from those materials and recognize their own artistic capabilities for creative use of waste.

9-12 years		
	Learning outcomes	**Subjects**
Climate Science	**Topic 1.2** Explain the concept of fossil fuels and greenhouse effect.	**Science class:** Ask learners to name some fuels in use in their society and discuss why some are called fossil fuels. Show that CO_2 is given off when fuels burn (using the limewater test, if available). Ask learners to draw scenes with human-induced CO_2 emissions (e.g. emissions by cars), depicting also signs of global warming. Introduce methane (the main component of 'natural gas') as a GHG that leaks into the air when oil and natural gas are extracted (adding to methane from other sources).
Ecosystem & Biodiversity	**Topic 2.1** Show appreciation for the aesthetics of nature and the dynamics of the ecosystem.	**Art class:** Ask learners to appreciate famous paintings about nature and landscape, preferably local ones; then ask learners to make their own depiction of local landscape revealing something that might be invisible; how can they draw/paint interactions between living things and other elements in the local landscape?
Climate Justice	**Topic 4.1** Identify and provide examples of harm's way, and those that help adapt to climate change.	**Language Arts class:** Ask learners to read a news article that features the human story of a climate-related event, conduct online research to learn more about the geographic location and socioeconomic status of the groups of people most and least impacted by the event, and write an essay that explains how these characteristics can either put people in harm's way or help them to adapt to the climate event.
Resilience-Building	**Topic 3.3** Demonstrate understanding of complex climate emotions.	**Art class:** After learners share their feelings around climate change and its impacts, engage the class in creating a visual representation of their feelings /thinking (hopeful, worried, angry).
Post-Carbon Economies	**Topic 5.3** Explain human harm caused by climate change-related weather events.	**History class:** Ask learners to review and summarize climate change-related extreme weather events in history. The scope of the review could be the local, national, or international level, depending on data access/availability. Both the magnitude (fatalities, economic losses, etc.) and frequency of these extreme events can be reviewed and discussed.
Sustainable Lifestyles	**Topic 6.4.** Show solidarity with humans, animals, and plants living in vulnerable habitats.	**History class:** Design an inquiry-based activity; first discuss and compare toxic and non-toxic environments considering the major threats to human life, wildlife, and biodiversity; then ask learners to research and analyze the influence of such threats on people's lifestyle in different periods of history and create a poster to share with their peers.

13-15 years		
	Learning outcomes	**Subjects**
Climate Science	**Topic 1.6** Discuss the advantages and disadvantages of renewable energy sources.	**Science/geography class:** Ask learners to identify non-renewable and renewable energy sources and prepare diagrams for each showing their scientific basis and a composite poster. Encourage them to take photos/video clips of local renewable energy sources, and to use these resources to raise enthusiasm for renewable energy among peers in school, in community-based organizations and online, as appropriate.
Ecosystem & Biodiversity	**Topic 2.6** Feel connected to local indigenous populations	**Geography/language class:** Ask learners to research how local Indigenous communities (or local elderly) have/had a respectful and close relationship to the natural environment. Encourage learners to think of how to apply such practices in the school/ community routine. Finally, ask them to design a project that can take place locally, inspired by their research, that is beneficial to local natural environments.
Climate Justice	**Topic 4.2** Regulate and express feelings of climate injustice for civic engagement	**Digital Media class:** Ask learners to create a mock poster for a school campaign encouraging the school community to take action on a local climate injustice.
Resilience-Building	**Topic 3.4** Apply the principles of resilient systems to specific examples	**Geography/health/science class:** After visiting a forest, school, city infrastructure, or farm, ask learners to consider climate risks to that area, then have learners consider both mitigation and adaptation strategies to increase the area's resiliency.
Post-Carbon Economies	**Topic 5.2** Appreciate the benefits of employing the circular economy model.	**Social science class:** Organize a field trip to an eco-design company to help them understand the benefits of the circular economy model and gain knowledge about how this can be embedded into product design. Learners can be asked to write a reflection essay and/or discuss what they have learned as well as the social implications of the model, after the field trip.
Sustainable Lifestyles	**Topic 6.3** Appreciate the role of different channels in promoting responsible consumption	**Physical education/sports class:** Brainstorm with learners to start a campaign (e.g. Run for Responsible Consumption; Cycle and Consume Less; etc.); through sports (running, walking, cycling, swimming, hiking, doing yoga, etc.); organize the event/programme with your school community or in your local district; and disseminate it through multiple networks.

16-18 years		
	Learning outcomes	**Subjects**
Climate Science	**Topic 1.1** Identify key findings of the most recent IPCC reports of greatest relevance to their own region/country.	**Science/geography/mathematics class:** Discuss with learners what international agreements and organizations are active in documenting global warming. Ask them to research the latest IPCC global warming projections and their basis. Ask students to rank the high, medium, and low warming projections on the basis of (a) desirability and (b) likelihood, giving their reasons, and to prepare graphics and PPT presentations to share their thinking with peers at school and with community-based organizations and online, as appropriate.
Ecosystem & Biodiversity	**Topic 2.6** Reduce negative human impact on animal communication.	**Project-based class:** Ask learners to identify and quantify scientifically various negative impacts they may have within the school environment/community on biodiversity (e.g. noise disturbance, intrusive gardening); then ask learners to develop an action plan to replace negative practices with positive ones.
Climate Justice	**Topic 4.1** Assess how climate injustice is a symptom of local and global social and economic relationships structured along unequal relations of power.	**Chemistry class:** Organize learners into groups to analyse water samples taken from different local water sources and then research potential sources of water contaminants found in the samples; compare findings across different groups and discuss the likelihood of exposure to these contaminants by communities near the different water sources where the samples were taken.
Resilience-Building	**Topic 3.6** Discuss how climate mis/mal/ disinformation has been used by a range of actors to confuse the public to slow down effective action on climate change.	**Media studies/english/communication class:** Have learners create a poster / presentation on how to detect climate denial strategies.

Post-Carbon Economies	**Topic 5.3** Introduce the impact of climate change on economics	**Mathematics/statistics class:** Ask learners to conduct a group research project on 'the impact of climate change on economics' by reviewing empirical evidence in the area, collecting relevant information from databases, calculating some indicators (e.g. average economic and financial losses during a period), and presenting their analysis to school/ family/ community audiences.
Sustainable Lifestyles	**Topic 6.5.** Motivate others to seek opportunities for sharing a multi-occupant vehicle.	**Mathematics/Accounting Class:** Design a group project activity; first discuss how sustainable mobility practices reduce carbon emissions and lower future risks of climate change; then ask learners to identify and apply necessary calculations/measurements for the affordability and energy-efficiency of multi-occupant vs. single-occupant vehicles (i.e. that they use in their daily commute).

18+ years		
	Learning outcomes	**Subjects**
Climate Science	**Topic 1.2** Explain the concepts of the CO_2 equivalency and Global Warming Potential of different greenhouse gases.	**Science/geography/mathematics class:** Ask learners to identify key GHGs, their potency and duration in the atmosphere, showing how these are reflected in their CO_2 equivalency and Global Warming Potential. Then have learners design and conduct awareness-raising and action research on emissions levels and reduction with local communities, education institutions, municipalities and businesses.
Ecosystem & Biodiversity	**Topic 2.4** Explain the influences of individual, familial, and collective choices in diets.	**Political science, philosophy, sociology, psychology or geography class:** Ask learners to organize a survey within their close community (schoolmates, family) to collect various views on the drivers and barriers for changing diets. Compare these results with scientific literature on the subject and conclude with solutions for convincing people to change behaviour.
Climate Justice	**Topic 4.3** Explain how affluence and overconsumption among the top 10% is harmful for the world's majority and to the natural world.	**Mathematics and statistics class:** Ask learners to combine international carbon emissions datasets with a population demographics dataset to calculate (or proxy) the emissions of the wealthiest strata of the population and compare this with the emissions of the poorest strata of the population.
Resilience-Building	**Topic 3.5** Assess climate solutions and effectiveness for reducing greenhouse gases	**Political science/geography/education, foundation/environmental science class:** Have learners complete the EN-ROADS simulator (https://en-roads.climateinteractive.org/scenario.html?v=24.3.0) and Project Drawdown (https://drawdown.org/solutions) to assess which climate policies are most effective to reach 1.5 degrees of warming, and/or which combination of policies.
Post-Carbon Economies	**Topic 5.5** Recognize that the debate related to energy transition and post-carbon economies could be different across regions.	**Political science class:** Hold a guided discussion forum/debate about why international cooperation is vital in combating climate change, what challenges are facing us and the possible ways of tackling the problems.
Sustainable Lifestyles	**Topic 6.2.** Envision the positive impact of sustainable energy technologies and policies in society at both macro and micro levels.	**Psychology/Statistics class:** Design a research-based activity; first discuss and provide examples of how energy policies and technologies could influence the daily lives of citizens; then ask learners to collect data about the citizens' adoption of renewable energy use and identify the relationships between energy technologies/policies and attitudes/ behaviours.

Designing a successful curriculum that equips learners with knowledge, skills, values and attitudes to tackle the climate crisis involves planning the intended curriculum, implementing it, and measuring its results. Definitions of the intended, implemented, attained and hidden curriculum are presented in Box 7.

Box 7. Intended, implemented, attained, and hidden curriculum

The *intended curriculum* is a set of formal documents that specify what the relevant national education authorities and society expect that students will learn at school in terms of knowledge, understanding, skills, values and attitudes to be acquired and developed, and how the outcomes of the teaching and learning process will be assessed. The intended curriculum applies also to organized learning in non-formal education settings.

The *implemented curriculum* involves the actual teaching and learning activities taking place in schools through interaction between learners and educators as well as among learners; that is, how the intended curriculum is translated into practice and actually delivered. It is also referred to as the 'curriculum in action' or the 'taught curriculum'.

The *attained curriculum* comprises the knowledge, understanding, skills and attitudes that learners actually acquire as a result of learning processes. It can be assessed through different means and/or demonstrated in practice, and it may also differ from the intended and the implemented curriculum

The *hidden curriculum* refers to unintended learning that takes place as a result of the culture of the classroom or school, relationships between students and teachers, as well as unintended features of the curriculum, such as gender or cultural bias.

Source: UNESCO-IBE, 2013.

When possible, the climate change curriculum should be designed so that it takes place over multiple years and includes sessions addressing a range of topics across different age levels. UNESCO (2023 b) presents some contextualized descriptions of what the different kinds of programmes and approaches to CCE look like in practice in different locations and settings. These are all possible approaches to be considered when developing a comprehensive curriculum that effectively addresses the climate crisis.

Box 8. Illustration of different programmes and approaches to education's role in the climate crisis

CCE is compulsory in primary and secondary schools in **Italy**. A specified hour per week is to be spent on climate change issues with the approach aimed at integrating sustainability and climate change at the core of Italy's school curriculum. Environmental themes have also been introduced as part of the compulsory Civic Education discipline and primary and secondary students participate in projects providing knowledge, skills and values for protecting the environment and the planet. Since 2018, teachers have received in-service training in citizenship education incorporating climate change, and through various guidelines, decrees and laws, the country has made clear its intention and commitment for all students to be climate-change literate.

Oman has developed a curriculum named 'Sustainability' covering six contemporary global environmental challenges: waste management, climate change, renewable energy, water conservation, afforestation, and carbon neutrality. This curriculum is accompanied by illustrative examples and teaching strategies.

In **Australia** the national curriculum includes 'Sustainability' as one of three cross-curriculum priorities. Each of the state and territory jurisdictions and, in some cases, individual schooling authorities determine the particular approach to be taken in their schools regarding sustainability and climate change in particular. While sustainability is listed as a priority, climate change is not specifically mentioned in the mandatory learning content of the national curriculum though there is reference to the impact of climate change and

the greenhouse effect in non-mandatory 'elaborations' sections. There is no specific mention of climate change or the core concepts of climate change in the achievement standards which form the basis for assessing students' understanding.

Following significant legislation on environmental education as a feature across the public and private sectors and all walks of life, each of **Argentina**'s provinces is required to address sustainability in their schools in some way determined at the local level. Many schools are utilising digital resources along with the teacher training and student workshop programmes conducted by Ecohouse, a not-for-profit organization which is authorised by the respective provincial education departments to offer their expertise to schools, free of charge. Ecohouse promotes action on sustainability and climate change and takes the position with teachers and students of 'see the problem, you can be part of the solution'.

The Integriete Gesamtchule School in Oyten, **Germany** aims to equip its students with the competencies required to solve critical issues with climate change and sustainability a key focus of learning. The school uses an interdisciplinary approach with ESD underpinning all that the school is and does. Students undertake individual interest projects as part of their learning with an expectation that they will not only research and understand the issues and causes of a particular climate change issue, present their findings to peers and others, but also take action based on what they have learnt and concluded.

The **Lebanese** American University requires undergraduates to take two of the three electives offered on sustainability and climate action: Water Security, Sustainable Food Systems and Sustainable Energy. For example, the water security course addresses climate change and water security, the human right to water, water availability locally and globally, water quality challenges, and SDG 6.0. The learning material includes lectures, videos, case study analyses, peer learning, field visits and attention to the latest news.

Source: UNESCO, 2023 b, pp. 10-12. Unpublished

Step 4. Develop a detailed curriculum that ensures action-oriented learner outcomes, including the use of transformative and 'place-based' pedagogy.

While the curriculum often sets out broad approaches and key areas to address, these need to be reflected in some detail in the syllabi for different school subjects as well as guidance to schools. Syllabi are often prepared by disciplinary experts from higher education backgrounds, supported by some practicing teachers, and it is important that these subject groups are brought on board with the transformative learning agenda. Interdisciplinary groups can review how the draft syllabi fit together to cover the intended learning outcomes, in an iterative process.

Greening education – whether in the formal or non-formal education sectors – should instil action-oriented learner outcomes, some of which are illustrated in Box 9.

Box 9. Extracurricular activities and greening education

Ghana's National Pre-Tertiary Education Curriculum Framework and **Morocco**'s 'One Student, One Tree, One School, One Forest' project have engaged an estimated six million students to plant seeds and cuttings in school grounds. **Romania** encourages outdoor adventure activities centred around harmony with nature with a focus on climate change. In **Qatar**, schools were encouraged to submit research projects on environmental issues in a competition.

Source: GEMR, 2023, p.5

Section 2 presented numerous pedagogical approaches associated with a successful curriculum that equips learners with necessary competencies to address the climate crisis. Greening education should involve participatory teaching methods that actively involve children and young people in both the learning of new content as well as action-based projects focused on their local environment.

Research suggests that there are five design elements that can help create the right conditions for green life skills to be leveraged for transformative outcomes:

(1) begin with a cognitive entry point

(2) enable an affective or emotional connection to that entry point

(3) create a safe space for existential reflection that challenges one's existing paradigm through critical inquiry

(4) develop a sense of ownership, or personal responsibility, and

(5) bridge to opportunities for empowered action or dissent.

While all five design elements are important to green life skills education, the cognitive and existential elements are particularly important for aligning green life skills with a more transformative, justice-oriented agenda (Kwauk & Casey, 2022, p. 9).

An effective greening curriculum will include an orientation towards local conditions and challenges, including climate change and other sustainability-related issues. Each locality has specific conditions, challenges and opportunities that can be addressed in the curriculum. It is important to note positive opportunities such as shifting to renewable energies as well as any local indigenous traditions that help to mitigate and adapt to climate change.

Some CSOs have specific practices for the localization of curriculum. For example, NGO CAMFED (the Campaign for Female Education), works in five African countries and has integrated climate change resilience within their curriculum through needs assessment methods addressing the needs of children and young people to help them embed climate resilience in their daily lives and careers.

Community mapping is another method that can be used to understand the area where the class or project will take place. This mapping considers not only the physical conditions of the local environment but also the needs and knowledge of local residents (Jane Goodall Institute Austria, n.d., p. 14). The Community mapping method helps to get a clear overview of the area where the class or group project is to be implemented, considering the needs of the local residents and their relationship to the environment. Furthermore, personal, local, and expert knowledge is included in this overview map. This enables a better insight into where, how and when a project can be realised, what the challenges are and what the possibilities for implementation are.

Step 5. Prepare and pilot sample instructional resources within and across subject areas to test the new curriculum and solicit feedback from numerous stakeholders, especially youth.

Resources for teaching about climate change are increasing and can be a helpful starting point for curriculum development once the aims of a greening curriculum have been established. Before finalizing teaching and learning resources, it would be wise to pilot some of the materials with future users. Draft materials incorporating the approaches described in this Guidance, addressing national priorities and using local examples, can be developed and tried out in schools, providing feedback in good time for textbook writers to embed improved content and pedagogical support to teachers.

There are well established methods for piloting new curriculum, including (a) providing feedback on the draft text; (b) trying out the curriculum in practice and providing feedback through the completion of brief surveys on how the lesson went; (c) and observations and interviews carried out by researchers on educator and learner experiences with the new curriculum. All of these techniques can be used not only to validate new learning materials but to offer practical suggestions for improvement. It is not unusual for draft curricula to underestimate, for example, how long group work takes, or the level of prior knowledge learners have on a topic. Piloting can help ensure that the teaching resources are feasible and effective in a range of learning environments. Educators can also offer examples or suggestions for how the curriculum might be more usable across different learning contexts.

This pilot work should be organized for (minimally) a subset of the learning materials, across different subject areas/themes and for different learner groups and ages. This will allow curriculum writers to learn about the different conditions in which the teaching resources will be used and to provide suggestions for educators for any necessary adaptations.

Step 6. Finalize, produce and distribute learning resources, including suggestions for assessment, with an associated communication and publicity strategy.

Textbooks that embed climate change content in a way that is supportive of effective pedagogy, teacher guides, and other state-endorsed teaching and learning materials, are essential for bringing the curriculum to life. Learners in both the formal and non-formal education sectors require resources to support learning inside and outside the classroom. Teachers should also be provided with the necessary support to carry out ESD activities, including teaching materials and professional development. Teachers may also need assistance in building their own lesson plans.

This Guidance includes numerous references to curricula developed by ministries, CSOs and inter-governmental organizations. Greening education encompasses not only knowledge and intellectual skills acquisition, but also socioemotional dispositions, such as a motivation to 'make a difference' and skills, such as being aware of one's values, the capacity to express one's thoughts, and the ability to work as part of a team. Skills related to specific actions, such as expressing one's point of view using facts and working as part of a team, can be assessed through 'naturalistic' products, such as the written work of learners, plans of action and project-related work, as well as the observation of learner behaviours.

Techniques for assessing learning objectives are closely linked with the ways in which the teaching and learning processes themselves are organized. Whenever possible, the teacher should not simply give a mark, but include constructive comments that note the strengths of the students' work as well as areas for improvement.

In some traditional education contexts, ESD learning might be focused on the gaining of knowledge and theories related to sustainable development. However, expected learning outcomes should cover the cognitive, social and emotional, and behavioural learning domains, calling for a wider scope of assessment. The areas of learner development that might be assessed are:

- understanding of content, remembering basic factual material
- skills in asking critical questions, analyzing problems, and designing new solutions to problems
- clarifying one's own values and understanding the perspectives or points of view of others
- motivation or interest to live sustainably and address climate change, both through individual behaviour and through collective action for system change
- envisioning more positive and sustainable futures
- application and action

(UNESCO, 2011, p. 8).

Learner assessment should therefore reflect the multifaceted goals intended for students and the diverse pedagogical methods used (individual work, small group work, project work, discussion, and so on). Given the broader goal of contributing to quality education, any assessment measures that are set up should ensure that it is being implemented equitably.

Step 7. Provide substantive orientation to greening education for textbook writers, examination board staff and other stakeholders, and obtain any necessary approvals.

Training of and support to textbook writers, whether employed by the Ministry of Education or private publishers, can play a crucial role in translating curriculum frameworks from policy to practice. The period between curriculum development and textbook revisions for the formal schooling sector can sometimes be several years, for financial or other reasons. Even if a new curriculum framework incorporates critical elements on key competencies for addressing the climate crisis, such delays mean that textbook writers are often given little time to prepare corresponding materials, which makes embedding new and contextualized content and supportive underlying pedagogy difficult. Building writer expertise and piloting sample materials for contextualized climate change materials ahead of time is thus a priority.

To implement the greening curriculum effectively, teachers must feel supported by a legal framework, the school management, and local authorities, and have access to training and resources. This is not the effort or the responsibility of any individual teacher, but rather should be a joint effort whereby all educators support each other and share experiences of implementing the programme.

Once the curriculum has been finalized, it will then be produced and disseminated through the normal channels of distribution. This might be accompanied by publicity around the release of the curriculum with key stakeholder groups. However, general awareness-raising materials might be developed and disseminated on an ongoing basis to help maintain interest in supporting greening education in schools and other settings. Awareness-raising and capacity development might be arranged for non-school actors such as young people and their families, inter-governmental organizations, CSOs, local authorities and community representatives.

Step 8. Provide educators with quality pre- and in-service training and continuous professional development opportunities, in cooperation with higher education institutions and CSOs.

Educators responsible for the delivery of a curriculum require training on the specific skills needed to address climate change accurately and clearly, as well as the use of active, participatory learning methods. New policies should address and support how pre- and in-service teachers are implementing ESD in the classroom as well as in non-formal education settings (UNESCO & Education International, 2021). Partnerships between education institutions and authorities should be encouraged to ensure that educators receive the necessary training prior to entering the classroom. In-service refresher courses can be delivered by both higher education institutions as well as CSOs.

Box 10 presents some teacher training initiatives that have taken place to support CCE.

Box 10. Climate change education and teachers

Modules and resources on CCE are available to teachers in **Thailand** and **Viet Nam**. In **El Salvador**, the 2019 Teacher Training Plan has a particular focus on climate change. In **New Zealand**, several resources for teachers are available online, including the Science Learning Hub, incorporating Māori principles. More structured training, such as professional development and pre-service training for teachers, is also available in some countries such as **Cambodia, Israel, Scotland** and **Uruguay**.

Source: GEMR, 2023, p.7

Many training strategies have been implemented effectively. These include:

- Short professional development experiences (workshops, webinars, conferences)
- Full courses
- Master teachers modelling pedagogical practices with their peers
- Online learning communities
- Direct collaboration between educators and climate scientists.

Shin and Akula (2021) suggest that training that clearly spells out how local actions translate into a local carbon footprint will help make climate topics come alive, and thus give teachers local examples to take into their classrooms. Teacher agency is an important factor in the achievement of social change through education. Beyond knowledge and expertise on how to teach about climate change, mandates that allow teachers the individual autonomy to make the national curriculum more local can be effective (Didham & Ofei-Manu, 2018).

Given the importance of implementing a whole-institution approach to CCE, training for school leaders may also be necessary to ensure that they are knowledgeable and motivated to support school-wide initiatives.

Step 9. Implement the Guidance through whole-institution approaches and strengthen partnerships between schools, CSOs, municipal authorities and the private sector to implement greening education.

Whole-institution approach. The quality and impact of efforts on climate change is dependent not only on the teaching process – including the capacity of teachers, the pedagogical approaches employed, and the teaching and learning materials used – but also on the whole school environment. The integration of greening education across an educational organization reinforces the 'skills-based' approach by providing opportunities to incorporate sustainable practices in daily routines.

> The Green School Quality Standard (UNESCO, 2024) developed through the Greening Education Partnership provides detailed recommendations for whole-institution approaches that are applicable in both formal schools and in non-formal learning environments. A whole-institution approach needs the involvement of the whole community in addressing participatory decision-making, school facilities and operations, teaching and learning, and community engagement.

In essence, the success of any climate change effort in an institution will be the result of concerted efforts by multiple stakeholder groups. School or institutional management is expected to take the lead in motivating and supporting these efforts, as well as in creating the appropriate climate for its implementation. From a classroom perspective, instructional leadership calls on teachers to lead children and young people towards a better understanding of climate change through discovery, learning and growth. In any atmosphere of uncertainty, the leadership abilities among managers and teachers can make the difference between a successful programme and a failed one.

In the school setting, students have an essential role to play in building support for greening education. Student councils, other student groups and individual youth leaders should be actively encouraged to provide input on the design, monitoring and evaluation of these programmes or to initiate dialogues with parents and other community members about the importance of addressing climate change in their lives.

Young people's perceptions and behaviours are greatly influenced by family and community values, social norms and conditions. Therefore, the cooperation and support of parents, families and other community actors needs to be sought from the outset and regularly reinforced.

Local CSOs serve as a valuable resource for schools and teachers to turn to for more information, or to invite as guest speakers on topics that reinforce or complement the curriculum. Some CSOs also have community-based environmental programmes in place.

Box 11 presents some specific strategies proposed by the UN Environment Programme for greening an educational institution.

Box 11. Greening strategies proposed by UNEP

The United Nations Environment Programme's The Little Book of Green Nudges summarizes the evidence about what types of nudges work well, explains how to implement exemplar nudges, and offers guidance for creating new nudges tailored to specific campus communities. Behavioural science shows that simple nudges towards everyday greener decisions can help people develop sustainable habits and live more in line with their environmental values. Nudges can be particularly powerful on higher education campuses, where students are developing routines and values that can last a lifetime.

Examples of effective nudges for campuses:

- Eliminate trays in cafeterias to reduce food waste
- Use appealing descriptions for plant-based dishes
- Make recycling bins eye-catching
- Provide more spaces for parking bicycles and fewer for parking cars
- Set up a group to share leftover food

Source: UNEP, GRID-Arendal & Behavioural Insights Team, 2020

Transformative education encompasses not only formal education, but also the non-formal and informal sectors. In the school setting, learner access to extra-curricular activities and youth-led after-school clubs can be organized relatively quickly, and in parallel to what might be a lengthy formal curriculum development process.

Critical competencies that enable individuals to address the climate crisis can be infused within training in eco-focused businesses as well as within the vocational training of the informal labour force. Such training can be linked with increased opportunities for environmental vocations, jobs that could help set a better course for communities (Iyengar & Kwauk, 2021).

In particular, UNESCO-designated sites such as Biosphere Reserves, Global Geoparks and World Heritage Sites, can be harnessed towards a better understanding of the complex and dynamic relationships between people and their natural environment, to elaborate and promote innovative educational content and learning activities.

There is no limit to the places where, and ways that, one can continue to learn about sustainability and climate change. Education can take place at nature-based museums, such as zoos, aquariums and nature centres. A USA study found that weathercasters are well positioned to educate their publics about the relationships between weather, climate and climate change; moreover, viewers of a public education programme that focused on climate change as part of the weather reports, were more likely to hold science-based beliefs about climate change (Zhao et al, 2014).

Within youth-created social movement organizations, such as Fridays for Future, youth engage in various forms of informal learning, often mediated through local face-to-face and social media groups. Many youths with pro-environmental attitudes use social media platforms to engage in interest-driven learning and activism on social media sites to learn and discuss climate change issues and engage in and coordinate actions in their local communities (Field, 2021).

For some youth, social media platforms create unparalleled opportunities to facilitate relationships where they can join a group or discuss ideas with like-minded peers or coordinate actions around environmental or social issues they are facing (Andersson & Öhman, 2016). Relational agency represents a shift from a personal to a collective sense of agency, important for collective action and advocacy for policy change.

Step 10. Monitor and assess the results of education programming on climate change competencies in an ongoing manner.

Understanding how well the curriculum is used (implemented curriculum) requires a monitoring system. Monitoring at the school level might include attendance records of students and teachers' documentation of pupil participation in classroom activities. A systematic approach carried out by a department of education might involve the development of indicators collected annually by educational authorities together with associated periodic reviews.

UNESCO noted in its 2019 report on Country Submissions under the United Nations Framework Convention on Climate Change that relatively few of the country submissions included quantitative data that could be used in global monitoring of progress. The overwhelming conclusion one derives from the literature on CCE interventions is that assessment of students' learning outcomes is mostly ad hoc, anecdotal and scant. Moreover, there are challenges relating to clarity of definitions and implementations of themes, variations of key term definitions, clarity of contents and approaches in learning activities.

Therefore, there are existing gaps and challenges in terms of measuring learning outcomes of greening education that need to be addressed when designing an education programme, particularly those that are intended to take place in the formal schooling sector. Ministries of education – along with their schools – will need to set up systems to monitor the implementation of the curriculum. The Greening Education Partnership is working with Member States to monitor their progress in the greening of curriculum, teacher training, education systems' capacities and communities.

There are some examples of national-level indicators as well as good examples of research at the local and sub-national levels that can inform national-level indicators and international-level indicators (Iyengar & Kwauk, 2021, p. 329). This data will need to be analysed regularly in order to ensure quality implementation and to organize additional support as necessary. Non-formal education programmes will also need to find ways to measure implementation and results to validate programme approaches and feed into their continuous improvement.

Mechanisms to establish continuous feedback and evaluation are needed to adjust and improve the curriculum on an ongoing basis, in order to ensure that it remains relevant and effective for meeting the changing needs of learners and society.

Large-scale assessment. Within the formal schooling sector, there may be national, subject-specific exams that might include content linked with climate change. Although these forms of assessment will not provide complex and holistic data on the implementation and results of the critical competencies for addressing the climate crisis, they can offer insight into how well students are learning the material. This data can also be disaggregated according to gender, ethnicity and/or location to better understand if successful engagement with these critical competencies is taking place across all learner groups. Cross-national large-scale assessments are increasing their coverage of climate change-related topics. Notably, the International Civics and Citizenship Study added to their 2022 assessment questions related to environmental sustainability, in addition to their long-standing questions related to civic engagement and young people's views of their political systems. There is also now a separate subdomain called Sustainability (International Association for the Evaluation of Educational Achievement (IEA), n.d.). In 2018 PISA included an assessment of 'global competence' that measures students' capacity to examine local, global and intercultural issues, to engage in open, appropriate and effective interactions with people from different cultures, and to act for collective well-being and sustainable development. As the test focuses only on the knowledge and cognitive skills students need to confront problems related to global and intercultural issues, the broader student questionnaire collects information on students' skills (both cognitive and social and emotional) and their attitudes towards global and

intercultural issues.. The four dimensions of 'global competence' potentially relevant for the transformational approach of greening education are: 1. the capacity to examine issues and situations of local, global and cultural significance; 2. the capacity to understand and appreciate different perspectives and world views; 3. the ability to establish positive interactions with people of different national, ethnic, religious, social or cultural backgrounds or gender; and 4. the capacity and disposition to take constructive action toward sustainable development and collective well-being (OECD, 2018, pp. 7-8).

Research. Researchers have an essential role to play in understanding the results of education's role in the climate crisis, both within and outside the formal education system. Critical questions about what students should learn, how they should engage with climate-related phenomena, approaches to curriculum and instruction that afford these opportunities, and how effectively they learn over time, are best addressed through the use of validated, reliable measures. These include not only assessments to evaluate an individual learner's (and educator's) progress toward defined climate-related learning outcomes, but also observation protocols, instructional logs, surveys, and other instruments that can help researchers evaluate all aspects of climate education programming in the formal and non-formal education sectors, including TVET. Such work represents a community-wide investment that will ultimately enable researchers to provide more definitive evidence on what works, for whom, in what contexts and why, when teaching and learning about the Earth's climate and climate change (Battacharya et al, 2020, p. 11).

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Annex

Key competencies for sustainability

- **Systems thinking competency:** the abilities to recognize and understand relationships; to analyse complex systems; to think of how systems are embedded within different domains and different scales; and to deal with uncertainty.
- **Anticipatory competency:** the abilities to understand and evaluate multiple futures – possible, probable and desirable; to create one's own visions for the future; to apply the precautionary principle; to assess the consequences of actions; and to deal with risks and changes.
- **Normative competency:** the abilities to understand and reflect on the norms and values that underlie one's actions; and to negotiate sustainability values, principles, goals, and targets, in a context of conflicts of interests and trade-offs, uncertain knowledge and contradictions.
- **Strategic competency:** the abilities to collectively develop and implement innovative actions that further sustainability at the local level and further afield.
- **Collaboration competency:** the abilities to learn from others; to understand and respect the needs, perspectives and actions of others (empathy); to understand, relate to and be sensitive to others (empathic leadership); to deal with conflicts in a group; and to facilitate collaborative and participatory problem-solving.
- **Critical thinking competency:** the ability to question norms, practices and opinions; to reflect on own one's values, perceptions and actions; and to take a position in the sustainability discourse.
- **Self-awareness competency:** the ability to reflect on one's own role in the local community and (global) society; to continually evaluate and further motivate one's actions; and to deal with one's feelings and desires.
- **Integrated problem-solving competency:** the overarching ability to apply different problem-solving frameworks to complex sustainability problems and develop viable, inclusive and equitable solution options that promote sustainable development, integrating the above-mentioned competences.

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Greening curriculum guidance

Teaching and learning for climate action

Young people are increasingly advocating for a reconsideration of how climate change and sustainability issues are addressed through the education system – to cultivate the knowledge, skills, values, and attitudes necessary to foster climate resilience, mitigate climate change, adapt to the new realities of climate crisis, ensure climate justice, and take action.

This guidance responds to the calls from young people for a holistic approach to climate change and sustainability in the curriculum, echoing the calls by the 2022 UN Transforming Education Summit. The guidance defines a common language on how quality climate change and sustainability can be reflected in the curriculum, by setting expected learning outcomes per age group (from 5-year-olds to 18+ age group, including lifelong learning approach). This is crucial for accelerating country-level action and joint progress monitoring on the global target of aiming to have 90% of countries in the world include climate change in curriculum by 2030, as set by the Greening Curriculum Working Group of the Greening Education Partnership.

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4 QUALITY EDUCATION

Sustainable Development Goals