Climate change PD Workbook

Session overview

A hands-on session equipping teachers to build student understanding from climate basics to ocean impacts, using curriculum-aligned activities that cultivate hope through action while exploring ready-to-use Ocean Heroes resources.

1. **Introduction** (nature of climate change & baseline knowledge)
2. **Core climate science** (basic mechanisms, evidence, ocean's role & blue carbon)
3. **Teaching approaches** (assertion vs scaffolding & curriculum-aligned approach)
4. **Student wellbeing** (addressing climate anxiety & balance of agency)
5. **Ocean Heroes resources** (rationale, features & overview)
6. **Q&A**

Addressing climate change in the classroom

Climate change can be posited as a simple array of science concepts. However, it may be better understood as a phenomenon reaching into every aspect of what it means to be human, addressing issues as disparate as money, politics, fairness, compassion, anxiety, trust, and even whether to have children. As we turn to address climate change with classes at the primary level, it is worth reflecting on how this holistic approach can impact both teaching and learning.

This complexity is heightened by the triadic nature of learning (González et al., 2005), where knowledge and attitudes flow between home, child, and educator. Each participant brings their own "funds of knowledge" to climate change discussions, creating a rich but potentially challenging learning environment.

What do you and your students bring to the classroom?

These prompts will help you explore how different perspectives and experiences shape climate change education in your classroom. By examining various aspects that influence teaching and learning, you can develop more inclusive and effective approaches to this complex topic.

Science understanding • What scientific concepts about climate do your students already understand well? • Which misconceptions from home environments do you commonly encounter? • How do gaps in your own scientific knowledge affect your teaching confidence?	**Values and worldviews** • How do family political perspectives influence student views on climate action? • What diverse cultural relationships with nature exist in your classroom community? • How do you maintain professional objectivity while acknowledging your own views?
Emotional response • What climate-related anxieties do students bring from home discussions? • How can coping strategies influence student resilience? • What emotional challenges do you face when teaching climate topics?	**Socioeconomic Context** • How do family circumstances shape students' views of climate solutions? • What assumptions about resources and actions influence our teaching? • How do our own socioeconomic experiences affect our approaches?

Further reading

González, N., Moll, L. C., & Amanti, C. (2005). Funds of knowledge: Theorizing practices in households, communities, and classrooms. Lawrence Erlbaum.

Ojala, M. (2012). How do children cope with global climate change? Coping strategies, engagement, and well-being. Journal of Environmental Psychology, 32(3), 225-233.

Lawson, D. F., et al. (2019). Children can foster climate change concern among their parents. Nature Climate Change, 9(6), 458-462.

Core climate and ocean science

Teaching ocean and climate science can feel daunting, particularly when approaching unfamiliar scientific concepts. This section provides essential subject knowledge to help you feel confident in delivering the Ocean Heroes unit. While we will explore these topics together during the session, do not feel you need to master everything at once. The key ideas are carefully structured within the Ocean Heroes lessons, supported by comprehensive background materials on the Encounter Edu website.

We know that every teacher comes with different scientific experience and knowledge. As we explore these core concepts, consider which areas you would like to develop further in your own understanding.

Use the emojis to mark areas you feel you need to focus on.

List of resources and topics

Greenhouse effect interactive	**Climate science timeline interactive**	**Climate science complexity and (un)certainty**
Explores core mechanisms of how greenhouse gases warm Earth's atmosphere 😊 😐 😱	Showing key science discoveries since the 1850s, and a lag in action 😊 😐 😱	Examines areas of certainty and emerging questions in climate science 😊 😐 😱
Evidence for climate change	**Climate change over time**	**Carbon sources, sinks and stores**
Presents multiple lines of evidence supporting climate change understanding 😊 😐 😱	Charts historical climate patterns and their natural vs human drivers 😊 😐 😱	Maps carbon movement through Earth's systems and human impacts 😊 😐 😱

How does climate change affect the ocean?	**All about blue carbon habitats**	**All about the continental shelf**
Outlines how climate change affects ocean systems and marine life 	Examines coastal ecosystems that capture and store carbon 	Explores this key marine habitat's role in carbon storage 

Links to resources

Interactive diagrams can be found at:
https://encounteredu.com/multimedia/collections/ocean-climate

All other articles can be found at:
https://encounteredu.com/cpd/collections/ocean-climate

Pedagogical approaches

Teaching about Earth's climate and ocean systems presents important pedagogical choices: do we begin with values and emotional connections, build up scientific understanding systematically, or find a way to combine both?

Both topics involve complex systems that directly affect students' lives, while also presenting opportunities for hope and positive action. Your approach may depend on your students' needs, your teaching context, and your own confidence with these interconnected topics.

Consider these guiding questions as you explore the two approaches below:

- What understanding do your students already have of climate and ocean systems? This might range from direct experience to media coverage to classroom learning.
- How much curriculum time can you dedicate to building foundational knowledge of how these systems interact?
- What level of emotional engagement do your students already have with environmental issues? Are they more connected to local or global concerns?
- How confident do you feel teaching key concepts like the carbon cycle, marine ecosystems, and climate processes?
- What local contexts and community connections could support learning about climate and ocean change?
- How might you balance teaching about environmental challenges while maintaining hope and agency?

Many teachers find that combining elements of both approaches works best - using emotional connections to spark interest while gradually building scientific understanding of Earth's interconnected systems. The key is finding the right balance for your specific context. As you read through the characteristics of each approach below, consider which elements would best serve your students' needs and your teaching style.

Basic Assertions Approach

A values-first method that builds environmental behaviours, emotional resilience, and competencies without requiring deep scientific understanding, focusing on developing care for self, others, and the environment through practical engagement and emotional connection.

Pros	Cons
• Enables early action and habit formation before cognitive complexity develops • Reduces cognitive load on young learners • Creates immediate positive environmental behaviours • More accessible for all ability levels • Can begin at any age/stage • Supports emotional connection to environmental issues	• May lead to an oversimplified understanding • Could create resistance if not aligned with home values • Risks being seen as indoctrination rather than education • May not provide tools for deeper critical thinking • Could create difficulty transitioning to more complex concepts later • Might foster guilt without understanding

Scaffolding Approach

A systematic building of scientific concepts and understanding that follows the primary curriculum progression, gradually constructing a comprehensive grasp of ocean and climate science through connected learning of underlying principles and processes.

Pros	Cons
• Builds robust scientific understanding • Develops critical thinking skills • Enables informed decision-making • Provides a foundation for advanced concepts • Integrates well with existing curriculum • Supports evidence-based reasoning	• Takes longer to reach action-oriented outcomes • May be too complex for some learners • Requires more teacher expertise/confidence • Could delay environmental engagement • Risk of cognitive overload • May prioritise knowledge over action

Further reading

Basic assertions/values-based approach

- Chawla, L., & Cushing, D. F. (2007). Education for strategic environmental behavior. Environmental Education Research, 13(4), 437-452.
- Kollmuss, A., & Agyeman, J. (2002). Mind the gap: Why do people act environmentally and what are the barriers to pro-environmental behavior? Environmental Education Research, 8(3), 239-260.

Scaffolding/knowledge-building approach

- Shepardson, D. P., Niyogi, D., Roychoudhury, A., & Hirsch, A. (2012). Conceptualizing climate change in the context of a climate system: Implications for climate and environmental education. Environmental Education Research, 18(3), 323-352.
- Wynes, S., & Nicholas, K. A. (2019). Climate science curricula in Canadian secondary schools focus on human warming, not scientific consensus, impacts or solutions. PloS one, 14(7), e0218305.

Discussing both approaches

- Monroe, M. C., Plate, R. R., Oxarart, A., Bowers, A., & Chaves, W. A. (2019). Identifying effective climate change education strategies: A systematic review of the research. Environmental Education Research, 25(6), 791-812.

Ideas for an assertion-based approach

The assertion-based approach to climate and ocean education can be systematically developed through four key areas. Each area builds different aspects of environmental understanding and action while connecting to existing school priorities and frameworks. From establishing core environmental values to developing practical competencies, these elements can be introduced gradually and tailored to your school context.

The framework below provides practical examples of how each area can be implemented, with specific ideas that can be successful in primary settings. Many of these suggestions may align with initiatives already happening in your school, allowing you to build on existing practices rather than starting from scratch. Consider which elements would most effectively support your students' development and your school's environmental journey.

Traditional environmental values

- Pro-environmental behaviours, e.g. school recycling monitors
- Environmental citizenship, e.g. Eco-Schools Green Flag program
- Basic understanding of human-nature relationship, e.g. school garden and growing food
- School value statements and ethos, e.g. linking to the UN Sustainable Development Goals and sharing these across displays and in assemblies

Emotional intelligence & wellbeing

- Self-care practices, e.g. mindfulness including in natural settings
- Building emotional resilience, e.g. through PSHE curriculum
- Developing environmental empathy, e.g. through nature time and wildlife surveys
- Links to PSHE objectives, e.g. exploring responsibility for the wider world

Social-emotional development

- Care for others, e.g. community gardening and environmental projects
- Building community connections, e.g. working with local environmental groups
- Supporting spiritual development, e.g. exploring environmental ethics
- Promoting democratic values, e.g. through eco-committees or school council

Competency building

- Teamwork and leadership, e.g. group environmental projects and ambassador programs
- Planning and problem-solving, e.g. designing and maintaining school environmental initiatives
- Communication and advocacy, e.g. presenting to different audiences and engaging decision-makers
- Curriculum integration, e.g. using environmental monitoring for data handling

Scaffolding approach through the curriculum

Understanding how to teach ocean and climate science effectively requires careful consideration of how concepts build over time. This progression map shows how existing National Curriculum content in key stages 1 and 2 creates foundations for understanding climate and ocean science, even though these topics are not explicitly mentioned.

This guidance helps address a key tension in primary education: while the DfE's climate change strategy emphasises the importance of climate education, core concepts like photosynthesis, respiration, the carbon cycle, and climate change itself are not explicitly included in the primary curriculum. However, by identifying and building on existing curriculum foundations, we can help students develop meaningful understanding of these concepts, particularly in upper KS2 where many students are already encountering climate change through media and daily life.

Rather than introducing climate change as a standalone topic, this scaffolded approach helps you identify and strengthen crucial building blocks in students' understanding. From basic needs of living things in key stage 1, through to complex environmental relationships in upper key stage 2, each phase can develop key concepts that support deeper comprehension of ocean and climate systems. This progression also creates strong foundations for KS3, where these concepts become explicit curriculum content.

The guide below maps these progressions across Science, Geography and PSHE. For each key stage, you'll find:

- Core curriculum content that supports ocean and climate understanding
- How these elements connect to build scientific and geographical comprehension
- Ways to make explicit links between familiar topics and environmental concepts

Use this progression to:

- Identify foundations you can build upon in each year group
- Make connections between familiar topics and ocean/climate concepts
- Plan how to strengthen key understanding at each stage
- Ensure students develop both knowledge and values systematically
- Prepare students for more detailed study of these topics at KS3

Key stage 1 (Years 1 & 2)

Subject	Development of ocean and climate science
Science	
• Animals including humans (basic needs) • Plants (basic needs) • Simple food chains • Living things and habitats (basic needs in habitats and simple dependencies) • Materials and uses	This foundational KS1 content provides crucial building blocks for understanding climate and ocean science. The study of animals' and plants' basic needs creates early awareness of how living things require specific conditions to survive - a concept that can be powerfully illustrated through popular polar habitat studies at this age. Simple food chains introduce the concept of interconnectedness in nature. The habitat studies in Year 2 establish the vital concept that living things are adapted to their environments and depend on specific conditions, laying groundwork for understanding ecosystem vulnerability to change. The exploration of materials and their uses builds early understanding of how substances interact with their environment.
Geography	
• Locational Knowledge (understanding of world's continents and oceans) • Human & Physical Geography (global climate patterns, weather, seasons, and basic geographic vocabulary for natural and human-made features including beaches, cliffs, coasts, seas, and oceans) • Fieldwork (environmental observation and basic	The introduction to continents and oceans, combined with learning about global hot and cold regions, creates a vital spatial framework. The focus on weather patterns and seasonal changes is especially important as it helps children begin distinguishing weather events from longer-term patterns. Regular weather observation and simple data collection build crucial scientific skills. The physical vocabulary focusing on coastal features directly supports later learning, while the inclusion of both human and physical features helps establish early understanding of how human activities interact

data collection techniques in local area)	with natural systems.
PSHE	
• Caring for the local environment • Taking responsibility for own environment (classroom, playground) • Introduction to idea of shared responsibility	The focus on caring for the local environment helps establish an early emotional and practical connection to environmental stewardship. When children learn to take responsibility for their immediate environment like the classroom and playground, they develop tangible experience of environmental care. The introduction to shared responsibility is particularly valuable as it plants the seeds for understanding collective action - helping children grasp that protecting our environment requires cooperation. This early development of environmental ethics creates an important attitudinal foundation that helps make later learning feel personally relevant.

Lower key stage 2 (Years 3 & 4)

Subject	Development of ocean and climate science
Science	
• Plants (functions) • Complex food chains • Classification and Groups • Living things and habitats (environmental change, human impact, positive/negative changes) • Rocks/fossils • States of matter	Complex food chains in Year 4 build on earlier learning to help students understand more sophisticated ecological relationships and dependencies. Classification skills in Year 4 help students recognize and appreciate the diversity of marine life, enabling them to understand how different species are uniquely adapted to their environments and may respond differently to environmental changes. The plant functions work in Year 3 deepens understanding of how plants respond to and depend on their environment, particularly focusing on water transport and growth requirements. The living things and habitats content in Year 4 is particularly valuable as it explicitly addresses environmental change and human impact, introducing the concept that changes can be both positive and negative - a crucial foundation for understanding environmental protection and restoration. The rocks and fossils unit provides two key building blocks: understanding that Earth has changed over time and leaves evidence in rocks, and introducing the concept of fossils as ancient buried materials we dig up and use for energy. States of matter in Year 4 helps students understand how materials can change form and how water exists in different states - linking directly to geography work on the water cycle and laying foundations for understanding sea ice processes.
Geography	
• Locational Knowledge (understanding of key topographical features	Building on KS1's world knowledge, students now develop understanding of climate zones and topographical features, particularly coasts. The focus

and land use patterns, including how they change over time) • Place Knowledge (comparative analysis of regions' human and physical characteristics) • Human & Physical Geography (understanding of climate zones, settlements, land use, natural resource distribution, and water cycle) • Fieldwork (practical skills in observing, measuring, and recording geographic features using varied data collection methods)	on changes over time and land use patterns introduces the crucial concept that environments aren't static. The comparison of different regions' characteristics helps students understand why environmental changes affect different areas differently. The introduction to natural resource distribution and the water cycle is particularly valuable, creating clear links between human activity and natural processes. The enhanced fieldwork skills build crucial scientific literacy for understanding environmental change.
PSHE	
• Community responsibility • How people's choices affect others' lives • Steps they can take to help protect environment • Introduction to sustainability • Local environmental issues • Beginning to understand global citizenship	Moving beyond KS1's focus on immediate environments, students now engage with community responsibility and begin to understand how actions have broader impacts. The explicit connection between personal choices and their effects on others helps students begin to grasp complex concepts like environmental justice. The introduction to sustainability adds the crucial dimension of long-term thinking. The focus on local environmental issues provides concrete examples that bridge to understanding larger-scale changes, while the introduction to global citizenship helps students understand why environmental protection requires international cooperation.

Upper key stage 2 (Years 5 & 6)

Subject	Development of ocean and climate science
Science	
• Animals including humans (transport of water and gases in the body - potential extension to respiration and the carbon cycle) • Properties and changes of materials (understanding combustion as an irreversible change, demonstrating that new materials are formed) • Living things and their habitats (using classification keys for marine organisms, classifying based on observable characteristics) • Evolution and inheritance (identifying how animals and plants adapt to the environment and that adaptation may lead to evolution; recognising that changes in environment may leave some organisms less able to survive and reproduce)	While detailed cellular processes are taught in key stage 3, upper key stage 2 provides important foundations. Students develop a basic understanding of gas exchange - learning that living things use oxygen and produce carbon dioxide (respiration), while plants take in carbon dioxide and produce oxygen (photosynthesis). This introduces a simple model of carbon movement between air and living things. Students learn that burning materials creates new substances through irreversible changes. This helps them understand how fossil fuel combustion releases carbon dioxide. This combines with their earlier gas exchange knowledge to show how human activities can affect the movement of carbon dioxide between air, oceans and living things. Students use classification keys to identify and group marine organisms based on observable characteristics, building scientific skills while developing knowledge of ocean biodiversity. The links to evolution and adaptation help them explore how marine and other life depend on specific environmental conditions. This helps them understand why changes in ocean conditions from climate change (like warming or acidification) might affect different species' survival in different ways.
Geography	
• Locational Knowledge (understanding of	Building from Lower KS2's climate zones, the study of environmental regions and biomes helps students

environmental regions, key physical/human characteristics, and major cities) ● Human & Physical Geography (knowledge of biomes, vegetation belts, rivers, water cycle, natural resource distribution including energy, and patterns of economic activity and trade) ● Fieldwork (skills in collecting and analysing data from multiple sources to draw conclusions)	understand how climate patterns create distinct ecosystems - crucial for grasping how climate change affects different regions differently. The explicit inclusion of vegetation belts helps students understand natural carbon storage systems. Rivers and the water cycle knowledge builds toward understanding ocean-atmosphere interactions. The focus on natural resources distribution and energy helps students understand both our current dependency on fossil fuels and the potential for alternative energy sources. The enhanced fieldwork skills, now including data analysis from multiple sources, build crucial scientific literacy for engaging with climate evidence.
PSHE	
● Community responsibility ● How people's choices affect others' lives ● Steps they can take to help protect the environment ● Introduction to sustainability ● Local environmental issues ● Beginning to understand global citizenship	Building from earlier environmental responsibility, students now explore how decisions have impacts at multiple scales - local through to global. The focus on resource allocation helps students understand equity issues in both causing and addressing environmental change. The emphasis on shared responsibilities develops their understanding that environmental protection requires collective action. Most importantly, the inclusion of practical ways to carry out these responsibilities helps students move from understanding to action, while maintaining an age-appropriate focus on positive engagement rather than overwhelming concerns.

Student wellbeing in climate and ocean education

The teaching of climate change and ocean literacy requires careful consideration of student wellbeing, particularly in how we approach emotional support while fostering meaningful engagement with environmental challenges. When teaching about climate and ocean change there are two main aspects to consider:

1. Intergenerational justice

2. Importance of agency

Addressing intergenerational justice

The discourse around climate change often places undue burden on young people through rhetoric about the "next generation saving the planet." This responsibility-shifting has significant psychological impacts, as documented by Hickman et al. (2021), who found that 59% of young people surveyed were very or extremely worried about climate change, with many reporting feelings of betrayal by government inaction. The psychological impact of framing climate action as solely youth responsibility extends beyond immediate anxiety. Studies by Marks et al. (2021) demonstrate how this approach can lead to decreased sense of efficacy and increased eco-anxiety among young people.

The issue of intergenerational justice comes sharply into focus when we examine how politicians and celebrities often praise the 'next generation' as planetary saviours while avoiding accountability for damage done over past decades. Burke et al. (2022) show that this transfer of responsibility to future generations, while current decision-makers avoid action, creates significant psychological distress in young people. This shifting of responsibility, especially through individual behaviour change programmes, can drive climate anxiety and lead to feelings of anger and apathy.

To address these challenges, schools can create structured opportunities for students to engage with decision-makers. This means enabling young people to ask, demand, and persuade adults to take meaningful action on climate change, whether those adults are school leaders, community representatives, or politicians. Such engagement requires real frameworks and opportunities within the school, supported by senior management and governors who are willing to commit resources and take action.

Connection with local action groups plays a crucial role in building hope and agency. Schools should actively seek partnerships that create opportunities for classes to take collective action, or bring individuals and organisations into schools to demonstrate how adults are making a difference. As Ojala (2012) emphasises, exposure to examples of hope, whether through curriculum case studies or visiting speakers, is vital for maintaining student engagement and well-being.

Developing agency

Agency in climate and ocean action manifests in two distinct forms. External agency involves creating tangible opportunities for students to take action, advocate, organize events, and engage with decision-makers. Equally important is internal agency - creating spaces and mechanisms for students' concerns to be heard and acknowledged, whether through discussion forums, feedback walls, or other channels of expression. Stevenson et al. (2019) highlight how this dual approach to agency can help build lasting environmental engagement while supporting emotional well-being.

The **My School ACTS** Framework provides a structured approach to climate and ocean action:

- Advocate - we ask those responsible to make the change
- Compassion - we act with compassion towards others and the world, even if we disagree with them
- Together - we celebrate coming together to take collective action
- Solutions - we think of new ways of doing things that decrease harm to people and the planet

This framework can be embedded within broader school structures that support both action and well-being. Schools should establish clear pathways for student advocacy while ensuring appropriate emotional support is available. This might involve dedicated time for environmental initiatives, clear channels for student voice, and regular opportunities for community engagement.

The role of community connections cannot be overstated. Regular interaction with environmental practitioners, partnerships with local action groups, and meaningful involvement of parents and governors all help create a supportive ecosystem for climate education. These connections help demonstrate that action is possible and that young people are not alone in their concerns about environmental challenges.

Success in climate and ocean education requires careful balance. While we must be honest about environmental challenges, we should also ensure that young people feel supported rather than overwhelmed. Through structured support, meaningful agency, and clear pathways for action, educators can help students engage with these crucial issues while maintaining their emotional well-being.

Further reading

Hickman, C., Marks, E., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., ... & van Susteren, L. (2021). Climate anxiety in children and young people and their beliefs about government responses to climate change: a global survey. The Lancet Planetary Health, 5(12), e863-e873.

Marks, E., Hickman, C., Pihkala, P., Clayton, S., Lewandowski, R. E., Mayall, E. E., ... & van Susteren, L. (2021). Young People's Voices on Climate Anxiety, Government Betrayal and Moral Injury: A Global Phenomenon. SSRN Electronic Journal.

Burke, S. E. L., Sanson, A. V., & Van Hoorn, J. (2022). The Psychological Effects of Climate Change on Children. Current Psychiatry Reports, 24(1), 1-10.

Ojala, M. (2012). Hope and climate change: the importance of hope for environmental engagement among young people. Environmental Education Research, 18(5), 625-642.

Stevenson, K. T., Peterson, M. N., & Bondell, H. D. (2019). The influence of personal beliefs, friends, and family in building climate change concern among adolescents. Environmental Education Research, 25(6), 832-845.

Using Ocean Heroes resources

The Ocean Heroes unit emerged from a collaboration with the Convex Seabed Survey, a 5-year research project exploring how the seabed stores carbon and helps tackle climate change. Examining this in the context of current environmental crises, and research into effective primary teaching approaches, the unit addresses a fundamental challenge: how to meet both curriculum demands and environmental education needs.

There is a key tension at the heart of primary climate education - while it features prominently in the DfE's sustainability strategy, climate change is not explicitly mentioned in primary programmes of study. This unit responds by creating appropriate challenge for upper primary classes while building carefully on foundations provided by existing curriculum topics. The approach is enriched by introducing environmental and human 'helpers' - from blue carbon habitats to inspiring individuals - who demonstrate positive action on climate and nature.

Building on the curriculum mapping outlined above, which shows how existing content from Key Stages 1 and 2 creates foundations for understanding Earth's systems, the nine lessons proceed as follows:

The resource can be downloaded from:
https://encounteredu.com/teacher-resources/ocean-heroes-science-geography-ages-7-11