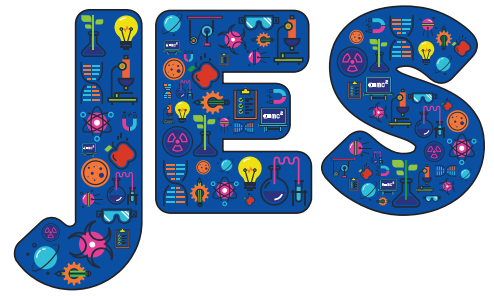


Epistemic insights: Climate justice and sustainability through an interdisciplinary lens

● Lewis Morgan ● Sophie Nelson



Abstract

With rising average global temperatures resulting in the drastic transformation of our planet, the necessity for climate change education has never been more apparent. The severity of the transformation is outlined by Begum (2022) who reports that 'The impacts of climate change and extreme weather events have adversely affected, or caused the loss of ecosystems including terrestrial, freshwater, ocean and coastal ecosystems, including tropical coral reefs; reduced food security; contributed to migration and displacement; damaged livelihoods, health and security of people; and increased inequality' (p.9).

This article will explore how a Climate Ambassador knowledge exchange project, delivered across ten primary schools in Leeds, developed pupils' and teachers' knowledge and understanding of climate change, climate justice and sustainability, whilst developing a sense of belonging to understanding and taking positive actions that support mitigation of this global issue.

Underpinned by the principles of the Epistemic Insight approach (Billingsley et al, 2018), adopting a multidisciplinary approach, sessions attempted to break through the barriers that climate change education and, often science itself, present. The project ran for twelve weeks and culminated in a team of 'Climate Ambassadors' from each primary school attending a conference, based at Leeds Trinity University, where pupils and teachers shared both their learning and their responses to 'big questions' about the climate and their place in tackling this global concern.

Keywords: Climate change, climate justice, sustainability, epistemic insight, multi-disciplinary, belonging

Introduction

'Climate literacy should not just be for decision makers of today: it is an essential life skill that our leaders of the future must possess' (Hoath & Dave, 2022, p.9). Although referring to school leaders in this context, the Hoath and Dave report outlines the importance of collective action of all. Changes in the earth's climate have been taking place at a rate that is unprecedented and, consequently, it is vital for young people to understand climate change, be educated about the related social issues and investigate how they are stakeholders in the climate crisis (IPCC Report, 2022).

For this to happen, it is imperative that teachers, as well as the young people whom they are teaching, feel prepared and confident in supporting meaningful collective action and understanding. Teaching the Future surveyed over 7500 teachers and found that 70% of teachers during their Initial Teacher Education, or since qualification, have not had training that is adequate for them to educate students on climate change (Teaching the Future, 2021). Underpinned by a recently published framework (Hoath & Dave, 2022), and continuing the success of a pilot project in 2022, our knowledge exchange project supported teachers,

leaders and teacher educators to begin to embed climate change, climate justice and sustainability into the curriculum, modelling and resourcing a series of sessions, accessible across the primary age phases (5-11 years).

We identified that learning about climate change involves complex scientific concepts, including Earth Systems, atmospheric chemistry, and long-term trends, which many find difficult to comprehend. Climate



change education often requires individuals to connect these scientific concepts with real-world impacts, societal issues and potential solutions. This interdisciplinary nature adds another layer of complexity, as learners need to navigate both scientific and socio-economic dimensions.

Furthermore, the children in our primary schools, and the communities around them, are confronted with increasingly significant and complex global challenges. These issues, specifically that of climate change, mean that the future demands a better understanding of scientific information and its use in everyday decision-making (Kaakinen *et al*, 2023). For our participants to be able to attempt to find solutions to these problems, the gap between their perceptions and views compared with scientific knowledge and understanding must be acknowledged. This aligns with Hoath and Dave (2022), as they suggest that at the core of sustainability and climate change education is the need for children and young people to be able to engage in collective action, adapt and apply their skills and knowledge in decision-making, whilst having sufficient knowledge to face future environmental challenges, and this was a key theme that ran throughout the project.

We regarded growing science capital as an important factor in how people can understand and interact with the global challenges. The concept of science capital, developed and expanded upon through the Science Capital Teaching Approach (Godec *et al*, 2017), is positioned as increasing the understanding of how different forms of capital (scientific literacy, attitudes, experiences) work together to shape an individual's engagement with science (Archer *et al*, 2017). The overall aim of measuring and investigating the level of someone's science capital is to close the current STEM gap and to get more children and young adults to engage in STEM subjects (Padwick *et al*, 2023). Dr Anjana Khatwa, Earth Scientist and presenter, outlines that '*much of the narrative concerning climate change naturally sits within the STEM subject area*' (Hoath & Dave, 2022, p.9). However, what happens if you have low science capital? What happens if you believe that science isn't for you and that you feel so disconnected with the subject that you can't help or contribute to helping find a solution? If we position tackling climate change, addressing climate justice and sustainability as being part of the STEM subjects, then offering this restricted lens to view the problem and solutions may not be sufficient. A multi-disciplinary approach must be adopted, and our project aimed to bridge this gap by utilising the Epistemic Insight approach (Billingsley *et al*, 2018).

Rationale: Why use epistemic insight as an approach to tackling climate change education?

Whilst many consider teachers to be 'in the business of' imparting knowledge to their pupils, rarely might they expect teachers to encourage pupils to interrogate the very nature of knowledge, how this is acquired and what 'truths' underpin their beliefs. And yet, creativity and critical thinking are recognised by the Organisation for Economic Co-operation and Development (OECD) as essential skills required by young people to solve the complex problems of the future (OECD, 2019). It is widely acknowledged that global warming is one such problem, with future generations set to experience stronger negative effects of climate change in years to come (IPCC, 2022), and therefore it is essential to explore practical strategies that teachers can integrate into their curriculum. In addition to developing both pupils' and teachers' knowledge and understanding, this should also seek to empower young people to act against climate change (Schreiner *et al*, 2005) and encourage creative and critical engagement with the topic, to enable them to respond to the effects of this global issue with meaningful actions (Stevenson *et al*, 2017).

Epistemic insight, defined as 'knowledge about knowledge' (Billingsley *et al*, 2018), builds upon the view that the epistemic goal of education should extend beyond providing pupils with a predetermined body of 'true beliefs' to call upon and, instead, develop cognitive agency by enabling pupils to determine truths for themselves (Pritchard, 2013). Acknowledging that pupils '*need a working knowledge of how disciplines can work together to address real-world questions*' (Billingsley & Hazeldinmay, 2020, para.2), the approach was taken because it offers an opportunity for interdisciplinary learning, which encourages pupils to see



beyond the constraints of individual subject disciplines and enables them to appreciate both the power and limitations of science (Billingsley, 2017). Use of the 'Discipline Wheel', discussed below, allowed the organisation of knowledge and the application of critical thinking when answering 'big questions'.

Research suggests that, where attempts are made to include climate change in the curriculum, links are most often made with the knowledge base underpinned by the science and geography curricula and, yet, the issue is far more holistic (Greer *et al*, 2023). The increasing effects of climate change will have an impact upon almost all aspects of our lives and thus it is the role of educators to not only impart knowledge and challenge misconceptions around the topic, but also to instil a sense of belonging that enables pupils to connect to the issue and value their own role as contributors to positive solutions.

Monroe *et al* (2017) recognise that a common theme of effective climate change education relates to making content personally relevant and meaningful to learners, and Hodson (2003) acknowledges that *'those who act are those who have a deep personal understanding of the issues (and their human and environmental implications) and feel a personal investment in addressing and solving the problems'* (p.657). By creating and exploring 'big questions' relating to this issue and instigating discussion across the subject disciplines, pupils are invited to make these connections, share their own experiences and beliefs, and evaluate different perspectives. This, in turn, makes the climate change discussion accessible to all pupils, shattering the *'subject silos'* (Billingsley & Hazeldinmay, 2020) that often alienate those with low self-efficacy, or interest in STEM subjects, inviting everyone to join the climate conversation.

Asking 'big questions': The Climate Ambassador Project

Over twelve weeks, ten groups of 'Climate Ambassadors', a group of Key Stage 1 (ages 5-7) and Key Stage 2 (ages 7-11) children, and their teachers, from primary schools across Leeds, engaged in weekly sessions based on climate change, climate justice and sustainability. In many schools, the 'Climate Ambassadors' had to write an application letter to be part of the group because the interest in the project was so high. Acknowledging that research indicates that to deliver effective climate education, teachers themselves require a broad knowledge and understanding of the topics (Leve, 2022), academics worked alongside teachers to co-create session plans and resources prior to each session, combining subject-specialist knowledge and classroom pedagogy. Working collaboratively was important, as academics needed key information about the context of the classroom and school to enable material to be as accessible as possible. Due to the numerous widespread locations of schools involved, sessions mainly took place online, where teaching ideas and materials were discussed.

Initial sessions, led by teachers and leaders in participating schools, elicited pupils' prior knowledge and conceptions of the content, before developing understanding of key terminology and learning about the evidence for, and causes of, climate change. In addition, sessions also explored the inequities related to climate justice and the concept of sustainability; exploring opportunities for learners themselves to *'take the individual and collective action to change society and care for the planet'* (UNESCO, 2023, para.1). To extend the reach of this learning, within each session a simple aide-mémoire was created by participants, in various forms, such as a thought cloud, a picture, a glossary of subject language, or a significant fact, with an expectation that this would be shared, post-session, with colleagues and the wider student body.

Aware that instigating action is *'partially an outcome of knowledge but also depends on attitudes and beliefs, and it is these attitudes and beliefs that will affect what students learn and take away from our classrooms'* (Busch & Osborne, 2014), and following several sessions developing knowledge and understanding, the Epistemic Insight framework was introduced. By introducing the Discipline Wheel (Billingsley & Hazeldinmay, 2020, para.2) and the concept of 'big questions', both teachers and pupils were asked to consider how the themes of climate change and climate justice bridge subject disciplines, and were encouraged to explore the strengths and limitations of subject specialisms and how this informs our thinking and perceptions (Billingsley *et al*, 2018).



Figure 1. A summary table of the suggested timeline of the sessions.

	Key questions to think about...	What is the aim?
Initial sessions	<ul style="list-style-type: none"> • What do children already know about climate change? • Where can we learn more about climate change? • What is causing climate change now and what has led to these changes? • What cause is having the biggest impact? • What can I do and where do I fit in? • What can I get my family, friends, school, community to do? • What is climate justice? • Why is climate justice important? • Who in the world is most affected by climate change? 	<ul style="list-style-type: none"> • To elicit pupils' prior knowledge and understanding • Develop an understanding of key terminology and learning about the evidence for, and causes of, climate change • Explore the inequities related to climate justice and the concept of sustainability • Explore opportunities for learners themselves to take individual and collective action • To begin to develop a sense of belonging to and ownership of the potential positive solutions for climate change
Building on understanding and organising knowledge	<ul style="list-style-type: none"> • What is a 'big question'? • How do we form a 'big question'? • How do we answer a 'big question'? • What is the Epistemic Insight framework? • How can I use the Discipline Wheel? 	<ul style="list-style-type: none"> • Consider how the themes of climate change and climate justice bridge subject disciplines • Explore the strengths and limitations of subject specialisms and how this informs our thinking and perceptions • Select a 'big question' and use the Discipline Wheel to identify subject disciplines that could contribute to a response
Forming and answering the 'big question'	<ul style="list-style-type: none"> • What is our project 'big question' going to be? • What are we going to produce as the outcome for our project? 	<p>Possible ways of sharing your 'big question' and what you did could be...</p> <ul style="list-style-type: none"> • Produce a poster, factsheet or leaflet • Record a group presentation • Create an advert – written, or for TV! • Create a PowerPoint and present it to the group • Write letters and read them to the group • Create a breaking news story or create a newspaper • A comic book • Artwork • Record a group song, dance or rap

Figure 2. Epistemic Insight Discipline Wheel (Billingsley et al, 2018)

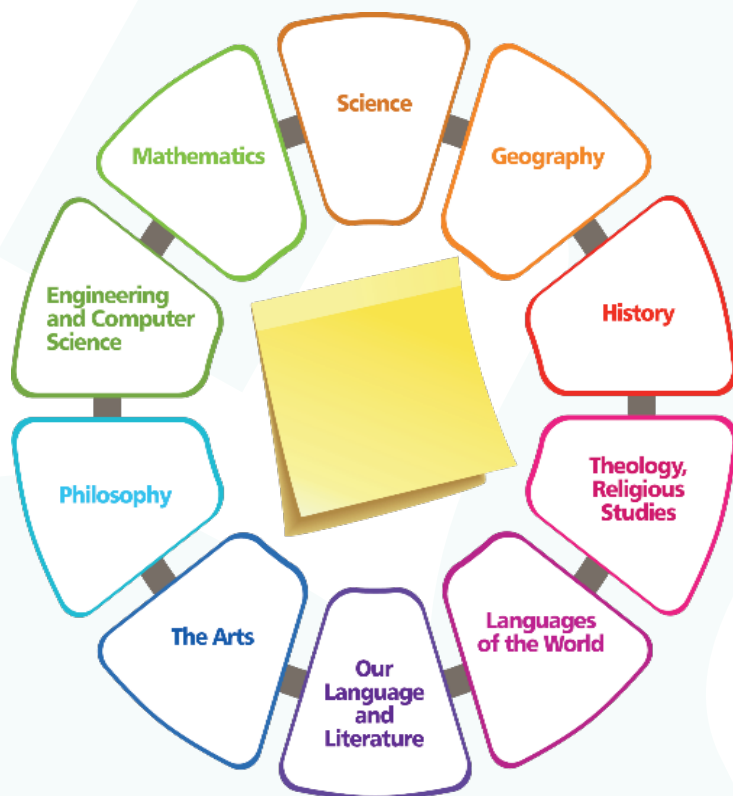
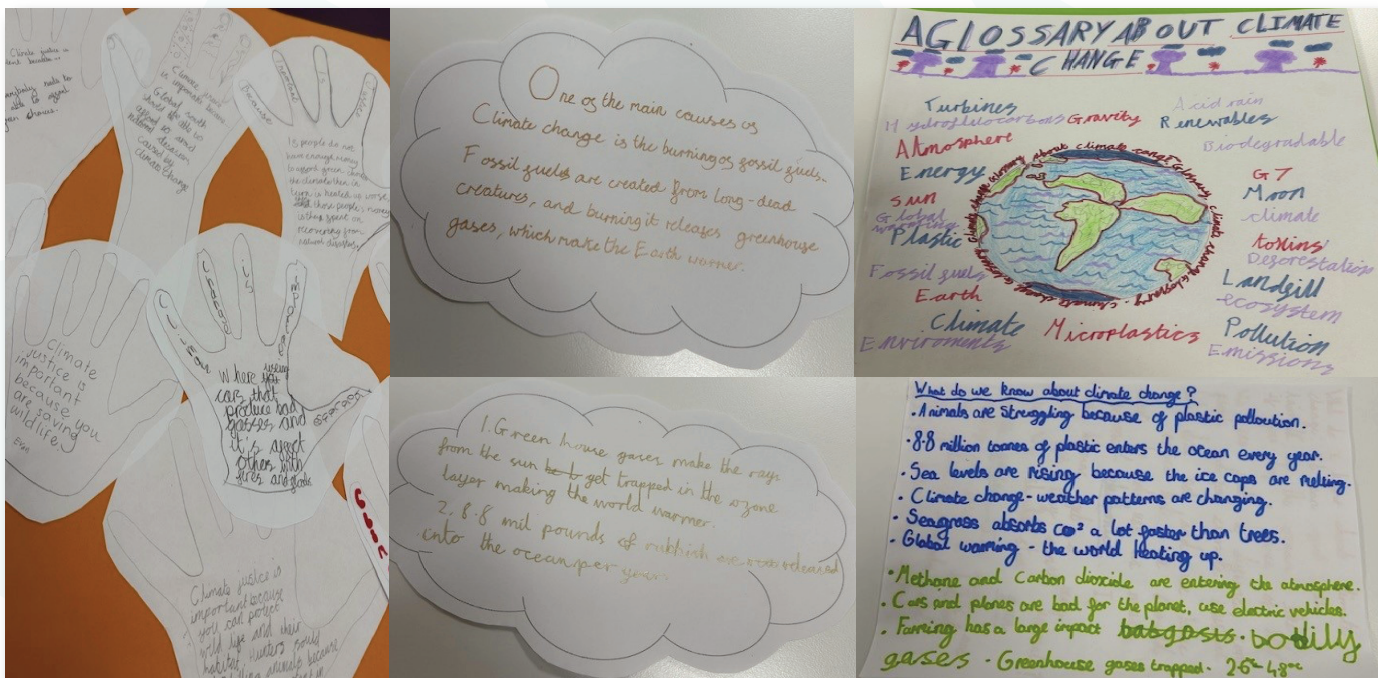


Figure 3. A collection of work that the children completed in the initial sessions, based around knowledge and understanding.



Following this exploration, each team of Climate Ambassadors selected a 'big question' related to the session content that they had encountered and used the Discipline Wheel to identify subject disciplines that could contribute to a response. For example, the question 'Why doesn't everyone make an equal contribution to tackling climate change?' provoked discussion across the disciplines of science, geography, philosophy and psychology.



Some examples of other 'big questions' are:

- Global North or the Global South. Who is to blame?
- Do I need to care about climate change?
- Who is to blame for climate change?
- Why should I try to be sustainable in my daily life?
- How will climate change affect me?

To present their findings, Climate Ambassadors were subsequently invited to a Climate Ambassador Conference at Leeds Trinity University, where they were asked to present evidence produced during sessions, deliver their response to their 'big question' through a chosen medium, such as a poem, news report or piece of drama, and share the wider impact of the project in their school. Some examples are shown in Figure 4.

An example of a poem created by St Chad's C E Primary School exploring Climate Justice through the lens of different subjects:

*Why doesn't everyone do the same,
To tackle global warming and make a change?*

*We need to be creative and make the links,
Let's hear what the geographers think...*

*The Global North, the Global South,
The different between, is what it's all about.
The climate divide isn't fair,
The biggest culprits go on without care.*

*The space between the nations,
causes a lack of communication,
The distance clouds our understanding,
And our knowledge needs expanding.*

(St Chad's C E Primary School, n.d.)

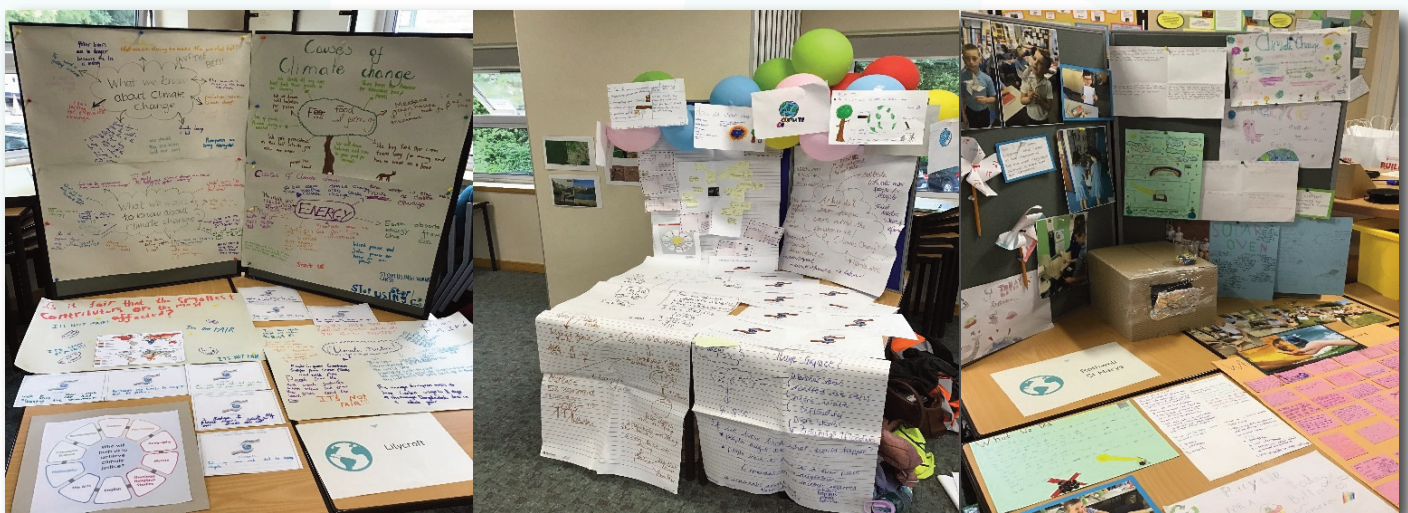


Figure 4. Examples of what each school produced alongside the presentation of their big question.

Implications for practice

Through engaging with the project, teachers and pupils identified both an increased knowledge and understanding regarding climate change, climate justice and sustainability, and a greater sense of belonging, feeling both motivated and accountable for contributing to climate action.

'This is an important issue and I want to share ways we can make a difference with other children in my school and the community' (Year 3 student, age 8-9).

'I didn't realise how climate change affected different people and places across the world. I think if we can educate more people about this, they will want to make a change' (Year 5 student, age 10-11).

'Participating in this project has developed my confidence in teaching about this important and sensitive subject. I have a much greater understanding of the topic and how to approach this with the children in my class, and I have been able to share this with the wider school' (Year 5 teacher & Science Subject Lead).

'Our Climate Ambassadors are developing a range of initiatives to educate others and promote active engagement in tackling the climate crisis...Look out for our weekly tips on Twitter and upcoming events' (St Chad's C.E. Primary School, n.d.).

In research conducted by UCL's Centre for Climate Change and Sustainability Education surveying teachers' practice and professional development in relation to climate change and sustainability education, Greer *et al* (2023) identify a strong trend relating to those teachers who have accessed professional development based on the subject, and those who include this 'often' or 'very often' in their teaching. This correlates with feedback from teachers and subject leaders participating in the project, who acknowledged increased confidence in delivering this content and making meaningful connections across the curriculum, far beyond the Climate Ambassador sessions.

In addition to increased competence in the delivery of climate education, by introducing the Epistemic Insight approach, teachers and pupils have been exposed to an exciting opportunity to work beyond and across the compartmentalisation of subjects (Billingsley *et al*, 2018), reinforcing the idea that *'Big questions and complex real-world problems can rarely if ever be addressed through science alone'* (Billingsley & Hazeldinmay, 2020).

Competente (2019) reports upon the lack of content and teaching strategies offered to pre-service teachers regarding climate change and, as lecturers in Initial Teacher Education, we have witnessed the benefits of this knowledge exchange through the engagement of academics across a range of subject specialisms and the impact that the project has had upon their identity as credible climate educators and instigators of change. This has in turn enabled us to reflect upon meaningful incorporation of the topic, and pedagogical approach, across the curriculum of our trainee teachers, continuing to reinforce the benefits of the interdisciplinary nature of the Epistemic Insight approach (Billingsley *et al*, 2018).

Conclusion

The positive impact of the project on the understanding of climate change, climate justice and sustainability, seen within the quotes above, and the value of an interdisciplinary approach have resulted in a desire to expand the project's reach, extending the offer to a much wider partnership of schools and pupils. We feel that the knowledge gained throughout the twelve weeks can be nurtured and further developed by working alongside some 'subject knowledge-rich' experts in workshop style sessions. Using 'subject knowledge-rich' experts in the workshops is important, as Calderhead and Miller (1985) expressed the need for high levels of subject knowledge in teachers as they are then able to tailor their knowledge of the content, which is hopefully abundant, to the context of the classroom or school. Given the vast range of experience and knowledge of climate change that commonly exists, this is an essential skill for being able to educate successfully on climate change. The intended workshops will be designed to build upon the children's existing knowledge and embed an ever-deeper sense of belonging to the subject, providing



a better opportunity to cover some of the more complicated issues relating to climate change. Now that teacher confidence and competence has risen, we are excited to include the teachers in the tweaking and reviewing of resources and sessions so that, again, a wider sense of belonging from the teaching staff is achieved and they can become the subject knowledge-rich experts teaching the future of tomorrow.

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Lewis Morgan, Senior Lecturer in Primary Education, Leeds Trinity University.

E-mail: l.morgan@leedstrinity.ac.uk

Sophie Nelson, Senior Lecturer in Primary Education, Leeds Trinity University.

E-mail: s.nelson@leedstrinity.ac.uk

