



Climate-U

Transforming Universities
for a Changing Climate

Teaching climate change in the university

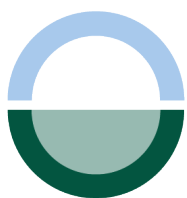
Transforming Universities
for a Changing Climate
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By Tristan McCowan

August 2022



UK Research
and Innovation



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August 2022

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Abstract

Climate change presents a series of challenges to those teaching in higher education. While it is crucial to integrate it across all disciplinary areas, there are various constraints stemming from curriculum overload, the complexity of the topic, and its contested and value-based nature. Nevertheless, engaging with the climate crisis can be a driver of positive change in university teaching and learning. This paper explores the potential of climate for pedagogical renewal in higher education through an assessment of three spheres of enquiry: the ontological (interdependence of human beings and the natural environment), epistemological (sources of valid knowledge, academic disciplines and diverse knowledge traditions) and axiological (climate justice, the limits of state authority and the nature of the good life). The teaching of these areas should be underpinned by the complimentary pedagogical foundations of critical questioning and deliberation, leading to a virtuous cycle of deepening of understanding and connection.

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1. Introduction

Teaching about climate change in the university has by now become not only crucial but also inevitable. Its importance stems from the pressing need for all people in the professional, civic and personal dimensions of their lives to be informed about the causes and effects of climate change, to have the critical capacities and imagination to forge alternatives for the future, and to have the skills and commitments to bring change individually and collectively. Yet it is also inescapable, since professional and general education in today's world cannot ignore the issue, given its increasing centrality to the changes underway in the earth's atmosphere, land and oceans, its flora and fauna, human health and well-being, and the political, economic and cultural dimensions of human societies.

It is hard, therefore, to argue against addressing climate change in higher education. Yet a clear mandate for its inclusion does not come with a clear recipe for how that should happen. Should we focus on ensuring that all students acquire the body of scientific knowledge on the changing climate and its causes? Should we equip all students with a set of climate-related competencies or skills on finishing their degrees? Should we provide a space for reflection on the moral and political dilemmas raised by the climate emergency? And what approaches to teaching and learning can best support these different aims?

Climate change in fact presents some particular challenges for lecturers in higher education. It is relevant to all disciplinary areas, though many non-specialists may feel themselves ill-equipped to incorporate the material into their classes. It has highly theoretical dimensions, and large bodies of scientific evidence, though is also a practical issue, involving changes to lifestyles and governance. It is also highly contested, and likely to fuel disagreements and even conflict in the classroom. These challenges may well discourage many of those teaching in universities from incorporating the issue into their teaching. This paper, however, will adopt a different standpoint. While not disregarding the above concerns, it argues that climate change in fact represents a driver for positive change in higher education, in spurring us on to bring shifts in teaching and learning that are long overdue, and enhance the transformative potential of the experience.

There is a growing body of literature on climate change education, drawing on the longer traditions of education for sustainable development and environmental education (e.g. Anderson 2012; Bangay & Blum 2010; Bryan 2020; Facer et al. 2020; Oberman & Sainz 2021; Tannock 2022). While most of this literature relates to the school level, there is an encouraging increase of accounts focusing specifically on higher education (e.g. Bush et al. 2017; Bussey 2010; Facer 2020; Fahey 2012; Nussey et al. forthcoming;

Senbel et al. 2014). Nevertheless, the literature is still dominated by specifications of what students should know and be able to do (whether conceptualised as climate knowledge, green skills or sustainability competencies), with an assumption that it is a straightforward step for educators to foster those capacities in students. It is important to address the pedagogical question head on, by valuing and aiming to understand the *process* as well as the *outcome* dimensions. Reflecting on processes – the moment of teaching and learning itself, and the interactions between students and lecturers – is important in part so as to provide those teaching in universities with tools to shape their own practice, but also to leave the door open for students to construct their own pathways and outcomes.

This paper should be read in conjunction with a previously published one (McCowan 2021) that focused on the location of climate change in the higher education curriculum. That paper argued that universities need to approach their provision for climate change as a 'topography', involving not only formal taught courses (classroom), but also student-led initiatives in the university (campus) and experiential learning beyond (community), through work experience and mobilisation. This study focuses specifically on the first of these three spaces – the teaching of climate change in the 'classroom' – understood not only as the literal room, but any space for formal (and most likely accredited) taught provision. It explores the possible ways in which climate change can be engaged with in the classroom – given its complex epistemic nature – and the implications that they have for student learning and society's ability to address the crisis. Inevitably, the questions of 'what' to teach and 'how' to teach are intertwined, and there are many crossovers between the curricular and pedagogical discussions.

While focusing on pedagogy, and on process as well as outcomes, this paper does not purport to be a comprehensive 'how to' on teaching climate change. There are many relevant approaches and techniques for engaging learners, fostering critical questioning, collaboration and application of knowledge that are covered in the broader literature on teaching and learning in higher education (e.g. Ashwin et al. 2020; Fry et al. 2008), and developments in digital technologies (e.g. Laurillard 2002) that are not dealt with in depth here. Furthermore, there will inevitably be contextualisation within particular locations and disciplinary areas. The focus here is on those aspects of climate change that can – possibly unexpectedly – be a spur to positive pedagogical transformation.

There are also important normative orientations to this paper that must be made explicit. In contrast to those who retain faith in a purely technological response to the climate crisis, this paper is



underpinned by a notion that a more radical transformation of our societies is necessary, given the roots of climate change in a paradigm of development based on accumulation, exploitation of natural resources and human communities, and the separation of humans from the natural environment. As a consequence, education takes on a role not only of acquisition of scientific knowledge for technological development, but for the deep transformation of human beings and their societies, in accordance with principles of social justice and the quest for understanding.

2. The epistemic challenge of climate change

Before turning to the specificities of climate change in the classroom, it is important to consider some of its salient features as a phenomenon, particularly its epistemic dimensions. Concerns about the warming of the planet as a result of emissions of CO₂ and other greenhouse gases grew in the second half of the 20th century, but only received formal international recognition with the creation of the United Nations Framework Convention on Climate Change (UNFCCC) in 1992. Since then, the world has taken only small steps towards dealing with the problem, through a combination of fragile international treaties developed through the United Nations Conferences of Parties (COPs), national moves towards renewable energies, development of less carbon-intensive technologies, pressure from popular movements and changes in consumer choices.

Given that climate change could make human life on earth impossible in a relatively short timeframe, it is astounding how little action has been taken. Reasons for this inaction include: the difficulties of international cooperation on what is inevitably a global issue on account of economic and political competition between nations; deep embedding of carbon within the global economic system; the political influence of fossil fuel companies and the importance of fossil fuels to state power; the relative invisibility of climate change as a threat, particularly for those in cosseted higher-income communities; attachment to the luxuries of a carbon-heavy lifestyle, again particularly in higher income communities; difficulties of extending our moral imagination to future generations and to those geographically distant; and inertia caused by the overwhelming nature of the threat.

Most people do in fact believe in the reality of anthropogenic global warming and its potentially catastrophic impacts. According to a recent UNDP and University of Oxford (2021) study, 64% of people worldwide believe that there is a climate emergency (a stronger belief than that of the existence of climate change), and in most countries only 1% or 2% support no climate-related policies. The primary challenge then is how to convert this knowledge and understanding of the issue into concrete changes in individual behaviours, collective organisation and institutional structures of societies – and education is strongly implicated in this task. Nevertheless, there are those who disbelieve, either entirely or

partially, in either the existence of climate change or its dangers. According to climatologist Michael E. Mann (Mann & Toles 2016), there are 'six stages of denial', corresponding to the following positions:

1. "It's not happening!"
2. "Ok, it's happening . . . But it's natural!"
3. "The problem is self-correcting anyway"
4. "And it will be good for us!"
5. "It's too late or too expensive to act"
6. "We'll find some simple technofix anyway"

Proponents of climate change denial cluster around different stages on this progression, and sometimes combine them, leading to confusions and contradictions in their arguments. Booker (2009), for example, moves between critiques of the methodology of the 'hockey stick' study (Mann et al. 1998) and the inefficiencies of renewable energy (with a particular hostility towards wind turbines) along with attacks on the United Nations, European Union and big government. Yet despite these inconsistencies in argument, and the general lack of evidence to support their positions, climate deniers have been effective in sowing the seeds of doubt and in holding their own in public fora. As explored by Marshall (2014), spokespeople for the climate denial lobby such as Marc Morano have proved themselves to be more adept at the public communication game than climate scientists and have had some success in undermining the scientific consensus. While it may be a minority of people who fully deny climate change, even a small amount of doubt introduced can be harmful given the difficulties of achieving such a radical shift in our individual and collective lifestyles and worldviews. Furthermore, there are signs that the fossil fuel lobby has a new strategy now of accepting climate change, but buying time to carry on making profits during a slow transition – thereby moving from denial to 'delay'.

To a large extent, denial of climate change and rejection of the policies designed to address it have little to do with the facts of the matter, but are more of an emblem of allegiance. Marshall (2014) argues that, far from being swayed by the empirical evidence, the right-wing groups that deny climate change hold rejection of the science as a badge of honour, forging stronger affiliation with the in-group. Climate change denial is, therefore, strongly linked in certain contexts with a range of other banners such as individual freedoms, the free market, small government and rejection of metropolitan liberal elites. Yet denial is not limited to these right-wing groups. As Norgaard (2011) shows, even communities who have knowledge and experience of climate change engage in an unwitting 'socially organized denial', by failing to make connections to human actions.

These questions must be set in the broader epistemic contestations of the 20th and 21st centuries. Traditional theocratic and aristocratic notions of truth and justice, Enlightenment notions of rationality and progress, and post-modern unsettling of objectivity and universality are historically layered, but continue

to coexist in contemporary societies with varying configurations. The campaigns for the US presidential election in 2016 and Brexit in the UK counterposed the 'people' against the political elite – in these cases framed as the liberal, cosmopolitan, educated elite. Intertwined with this constructed tension was a distrust of specialists and academics, in the UK most famously encapsulated in Michael Gove's statement that "people in this country have had enough of experts"¹. These moves have led to a legitimisation of the questioning of official knowledge, science and experts, and an encouragement of counter-theories and conspiracy theories. While there has been some recovery of recognition for science and experts in the Covid era, the pandemic has also fuelled the spread of disinformation and conspiracies, along faultlines similar to those of climate change.

The rise of social media has intensified these trends, since they allow for rapid dissemination of 'alternative' truths, and the reinforcement of echo chambers, with users often confined to communities that reflect their own political views. Furthermore, social media have increasingly been utilised as tools for deliberate manipulation of the populace for commercial or electoral gain, making even more fragile the conduits to reliable knowledge.

Climate change is contested epistemically, but also axiologically, and touches deeply on questions of the good life. For some, the idea of a low-carbon existence is the ultimate sacrifice, the obliteration of all of the precious gains made by civilisation and technology over recent centuries. For others, it is a welcome opportunity for a less opulent, but ultimately more meaningful, healthier and more enjoyable life, freed from the noise and pollution of industrial society, and the mental enslavement and manipulations of consumerist society. It is inevitable that those in these two camps will advocate for different strategies for addressing the problem – the former, technological fixes that will allow high consumption lifestyles to continue; and the latter, emissions reductions that will require less wasteful forms of living.

Climate change also fosters political division over forms of societal organisation. Much of the resistance to and denial of climate scientists, campaigners and advocacy organisations is because they are associated with collectivist organisation and restrictions of individual freedom. In this way, many climate change deniers brand environmentalism as communism through the back door, and even a smuggling in of a global super-government (Booker 2009; Morano 2018). While the transition to a low carbon society does not necessarily entail a centrally planned economy, it is inevitable that such a significant societal shift will require some collective management and international cooperation.

Another aspect of significance to the teaching of climate change is its emotional dimension. The strong embedding in values of the different positions on climate change already make it an emotive and potentially conflictual issue. Yet there is another significant element in the existential threat posed by the phenomenon. A number of commentators (e.g. Lehtonen et al. 2019; Ojala 2016)

point to the fear and anxiety caused by climate change, particularly in young people. While fear can be galvanising in some instances, in others it can be debilitating, or lead to a 'what the hell' attitude and doubling down on destructive actions. These affective and psychological dimensions must be acknowledged and engaged with in responses to the climate emergency, as discussed in the section that follows.

3. The response of education to the climate crisis

Not all responses to climate change require education. Some people hold out faith in technological developments, either in global responses on a massive scale such as geo-engineering in the form of atmospheric sprays or subterranean carbon capture, or more dispersed innovations such as electric cars and new forms of energy generation. These responses would require only specialist professional and scientific education for the few. Most, however, recognise that simply waiting for these developments is hazardous to say the least, given the urgency of the threat, and assert that broader awareness and practical action is needed across all populations of all societies. Furthermore, the development of new technology, and the orientation and usage of existing technology, are strongly bound up with economic, political and cultural currents, and therefore we cannot easily separate the two.

The various conventions and agreements relating to climate change and sustainable development invoke education as part of the means of rectifying the situation. Article 6 of the UNFCCC requires states to promote and facilitate "The development and implementation of educational and public awareness programmes on climate change and its effects", "Public access to information on climate change and its effects" and "Training of scientific, technical and managerial personnel". Education, training and public awareness have been built into subsequent climate agreements, including Goal 13 of the Sustainable Development Goals (Reid 2019). There has in fact been significant change at the official level, with only 5% of UNFCCC signatory countries not incorporating climate change into their curricula (UNESCO 2019). Mexico and Italy have made CCE compulsory throughout all levels of the education system (Kwauk & Casey 2021). Yet very often this official adoption has not translated into adequate learning, on account of insufficient teacher preparation and CCE's marginal position in the curriculum (Reid 2019).

The logic underpinning the role of education in addressing climate change is conventionally that of awareness leading to action: in other words that people do not know about climate change, or do not understand it sufficiently, and that is why they are not doing anything about it. This logic has two important characteristics: first, it is a deficit model in assuming lack of knowledge and understanding; and second, it takes as read that awareness leads to action. Both of these are problematic, as much in their factual basis as in terms of their educational implications.

¹ <https://www.ft.com/content/3be49734-29cb-11e6-83e4-abc22d5d108c>



Research in fact has shown the dubious efficacy of awareness-raising of a purely cognitive nature (Anderson, A. 2012; Bangay & Blum 2010; Facer 2020; Facer et al. 2020; Munroe et al. 2019; Rousell & Cutter-Mackenzie-Knowles 2020; Stevenson et al. 2017). Yet moving beyond the knowledge element is demanding on educators. Teaching climate science requires little departure from traditional formal education, but challenges arise when we move into the realm of responses to the climate emergency:

The distinction between ‘just the facts’ and ‘also the actions’ may separate some science educators from environmental educators, but also may highlight the point at which educators believe a fundamental science topic becomes political, and therefore too close to advocacy for classroom educators to address. (Monroe et al 2019: 792)

Aiming to address the gap between knowledge and action, many educational and public information approaches focus on behaviour change. Largely targeting the individual level, they point learners towards practical shifts in their patterns of consumption and usage, and contributions to regeneration at the local level. While these are all laudable actions, they are only part of the change that is needed in order to address the climate emergency, which also requires attention to corporations, governments and underpinning societal structures. In focusing only on the individual these educational approaches leave the political and economic roots of climate change unexamined. We can therefore see a series of balancing acts needed by educators, in moving from knowledge to action, from the individual to the collective and from the technical to the political. The shift to the latter of these binaries does not exclude the former, which still retains its importance (i.e. knowledge of climate change will always be essential, even though not sufficient).

As part of this balancing act, a number of alternative approaches have emerged in recent years. These have included engaging students more effectively, through incorporating experiential elements, either through simulated experiences, or real-life environmental challenges, and use of digital technologies and social media (Senbel et al. 2014). Other approaches have focused on the emotional or affective (Ojala 2016; Bryan 2020; Lehtonen et al. 2019), arguing for psychosocial or eco-social approaches, artistic or cultural activities, or learning through activism and campaigning (Nussey 2021). The idea here is that emotions can be turned from being a stifling force to a liberating one. The intertwining of human and natural environment realms leads to an approximation of climate change education with citizenship education, as argued in Jacobi (2003).

Kwauk & Casey (2021: 46-47), for example, aim to connect with students in this more holistic way through their frame of five ‘design elements’ of climate change education:

1. a cognitive point of entry, like a recent climate-related disaster or the introduction of a local environmental resource challenge, and the possible solutions to it;
2. An affective dimension that helps to cultivate one’s empathy toward the environment;
3. An existential component that challenges one’s sense of self, one’s way of living and being, and one’s values, beliefs, and worldview;
4. An ownership dimension, like the self-identification of a community-based environmental challenge, or developing a plan that builds one’s knowledge of, personal connection and commitment to, and sense of responsibility for a local climate change issue;
5. Opportunities for empowered action or dissent, like a community action project or political protest to not only feel a sense of direction, but to also increase sense of agency and confidence in making informed choices.

Cordero et al. (2020) , similarly, identify the three key attributes of empathy, ownership and empowerment to promote through their curricular programme, encompassing the elements of climate science, climate solutions and environmental communication.

Climate change education, therefore, while becoming more prevalent as a whole, has widely divergent approaches, clustering around fundamental differences of political, moral and epistemic values. In their discussion of the ‘new green learning agenda’, Kwauk & Casey (2021) distinguish between three approaches to CCE: 1) skills for green jobs (employment focus); 2) green life skills (personal and civic as well as professional, lifelong and life wide); and 3) skills for green transformation (addressing oppressive structures and political transformation). This frame shows the continuum from more technical to more political, and narrower to broader conceptualisations of the scope and impact of CCE. As seen above, government approaches tend to cluster around the transmission of information and more technical training (Nussey 2021). At the broader and more political end are the transformative approaches drawing on the ideas of Paulo Freire that aim for collective political action through conscientisation, as well as feminist and decolonial thought, the development of a critical understanding of injustices and action to forge a new form of society (Facer 2020, Lotz-Sisitka et al. 2015, Macintyre et al. 2018; Stirling 2010; Tannock 2022).

As stated above, climate change education builds on the older tradition of environmental education, and more recent education for sustainable development. While anthropogenic global warming on the basis of greenhouse gases involves a particular set of facts and body of scientific knowledge, many of the underpinning issues are similar to earlier environmental challenges – involving complex moral questions of how human beings can live with each other and within the carrying capacity of the ecosystem. This long tradition of environmental education provides a wealth of experience, inspiration and methodological tools for contemporary climate change educators, though many of the challenges and tensions

are still there. All instances of what is sometimes called ‘adjectival’ education (crosscutting curricular themes such as citizenship, diversity, human rights or peace) suffer from the lack of a defined disciplinary space, dedicated professionals and time allocation during the school day. Incorporating these crosscutting themes in higher education can be particularly challenging, as explored in the section follows.

4. The higher education backdrop

As seen above, global agreements on climate change have advocated for education at all levels of the formal system, in professional training and in public awareness campaigns. Few would disagree that all stages and forms of education need to be harnessed in such a critical challenge. Each of these levels, of course, involves different teaching and learning approaches – though there will be commonalities. Higher education presents some particularities on account of the following features: in contrast to school level in most countries it is voluntary and non-universal; it is highly specialised in nature, usually in a single disciplinary or professional area; teachers in higher education are usually researchers and scholars in a disciplinary area, and rarely have extensive pedagogical preparation; and there exist significant areas of institutional activity alongside teaching – most importantly research, but also community engagement and consultancy. In addition, while the composition of student bodies differs dramatically from institution to institution, in many cases universities show diversity in terms of the origin of students, providing a space for interaction across regional, national, cultural and linguistic groups.

Three areas of change in higher education are particularly relevant to the question of teaching of climate change. The first is the oft-mentioned phenomenon of massification, with rapid increases in enrolment across the globe – though still with significant differences between countries (with low-income countries averaging 9% gross enrolment ratio, lower middle-income countries 27%, upper middle-income countries 38% and high-income countries 79% [UIS 2022]). This process of expansion has brought new social groups into the university, in many cases ones that have not had high quality schooling and face particular challenges with the academic demands. Massification has also led to growth in number and diversification of type of courses on offer at universities, with an increase in vocational programmes. With the expanding proportion of the population in the university, the civic role of higher education has become more prominent, with increasing use of this level for promoting social goods – of which climate change education is a clear example – though there are many who question whether this is an appropriate role of the university (Martin 2022).

In parallel with the process of massification, universities through the 20th century and beyond have endured a period of epistemic tension and conflict, one that has thrown into question the institution’s worth, authority and legitimacy. Philosophical

currents of post-structuralism have questioned the moral and epistemic certainties of the Enlightenment, and unsettled the position of the academic community as the bastion of truth and knowledge. These influences, combined with the encroachment of neoliberalism – which has co-opted the post-modern decentring for its own ends – have led many commentators to point to the ‘university in ruins’ (Reading 1994), or the crisis of the university (Santos 2004). Technology has also exacerbated this perceived crisis, in undermining the university’s role as a literal store and archive of knowledge by making information broadly available through the internet, in challenging the role of the professor through processes of unbundling and standardisation of content (McCowan 2017), through the emergence of massive open online courses (MOOCs) breaking universities’ monopoly on taught provision, the emergence of learning analytics and surveillance mechanisms, and many other developments (Laurillard & Kennedy 2017; Williamson 2018). The epistemic turmoil has had a political dimension, in being mobilised in the quest for recognition of marginalised groups, and challenges to patriarchy, social class elitism, white supremacy and heteronormativity. Universities have been strongly bound up in the ‘culture wars’, and the unsettling and reinstatement of the Canon (Bloom 2014), and battles between defenders of the Western Enlightenment (e.g. Pinker 2018; Peterson 2018) and the ‘woke’ generation. As mentioned above, the populist movements of 2016 represented a further challenge to universities’ epistemic legitimacy (Ignatieff 2018). The Rhodes Must Fall movement in South Africa set in motion calls for decolonisation of the curriculum and institution that spread around the world, even to the former colonial centres, and have brought new awareness to the ‘monoculture of the mind’ in universities and the need for epistemic pluralism (Del Monte & Posholi 2021; Santos 2015; Shahjahan 2015; Shiva 1993).

Another quite different influence on universities relevant to this debate is increasing attention to teaching and learning quality. With inevitable exceptions – both institutionally and individually – universities historically have neglected teaching quality in favour of research quality, and in contrast to schools have not required their staff to have any form of teaching qualification. In recent decades marked changes in this area have been evident, spurred on by the processes of massification outlined above, and the arrival of non-traditional students with different learning needs, the increase in the number of teaching-only institutions, the need for universities to demonstrate their teaching and learning quality in the context of marketisation and consumer choice and value for money demands on universities to account for public funding. Universities around the world have set up teaching and learning units, introduced mandatory courses for staff – sometimes accredited, and provided other forms of learning support for students.

Research and scholarship on teaching and learning in higher education also grew markedly in this period, in some cases showing the disappointing learning gains through traditional higher education (Arum & Roksa 2011, Schendel 2015), as well as pointing to the efficacy of particular methods (Kember & Gow 1994). While there is contestation within the field of scholarship of teaching and learning as in any field, some common emphases



have emerged: reduction in use of the traditional lecture; the use of the 'flipped classroom'² as a way of ensuring content delivery does not crowd out the space for discussion in precious class time; introduction of collaborative group work; movement in lecturers from a knowledge transmission to a learning facilitation role; replacement of final exams with coursework and portfolios; and introduction of problem-based and case-based learning (Ashwin et al. 2020; Biggs 1999; Kember & Gow 1994; McCowan et al. 2022). Developments in digital technologies have also brought significant changes to the teaching and learning experience in universities – with an acceleration in this process due to the Covid pandemic.

Furthermore, universities have paid increasing attention to their broader educational responsibilities, beyond specific disciplinary areas. This trend has been underpinned by drives for employability, in part through market mechanisms of choice, but also the pressures of government in their designs for a highly skilled workforce. Commonly now, higher education institutions advertise their list of graduate attributes, variously including qualities such as global citizenship, intercultural competence, leadership, teamwork, critical thinking, problem solving and digital literacy – many of these of relevance to climate change. These shifts, however, are often a target of resistance by academics, associated as they are either with a challenge to traditional disciplinary practices or a Trojan horse neo-liberalisation of the curriculum.

While the above trends have made possible the incorporation of climate change into the higher education curriculum, at first sight its inclusion seems to represent a significant problem. First, there are issues internal to the university that militate against its effective inclusion. Climate change is not located within a single discipline, and encounters significant obstacles both in embedding across all courses, and in establishing itself as a discrete unit – in light of the autonomy of lecturers to design their courses, curriculum overload and professional accreditation. As outlined in McCowan (2021) there can also be resistance to value-based initiatives and cross-curricular provision from both staff and students.

Second, teaching climate change is complex because of the nature of the issue. It is a contested question, with a range of possible positions cohering with scientific evidence, not to mention vocal challenging of the science from some quarters. As a controversial issue that implicates deep moral and political values about the way our lives and societies are organised, it is challenging to navigate in the context of a diverse classroom. Arts, humanities and social sciences should be more comfortable with these kinds of moral debate and value complexity than natural sciences and STEM subjects with a more numerical basis, but face distinct challenges of integrating issues of climate change, which may appear at first sight confined to environmental science. Climate change also involves a range of skills and practical experiences which are difficult to develop in the classroom context.

Third, climate change is embedded in a set of deeper epistemic challenges in contemporary societies. Universities have long been centres of struggles for meaning and legitimacy, in the context of post-modern challenges to Enlightenment notions of objective truth and progress. The traditional theocratic views that the Enlightenment had displaced in Europe have also had a resurgence in different parts of the world, providing an unexpected ally with those challenging the Enlightenment project. Populist leaders have taken advantage of the stand-off to turn the epistemic vacuum to their advantage, utilising new social media to spread fear, prejudice and disinformation. Climate change has been positioned by these populist movements as a smokescreen for socialism, big government and threats to individual liberties, bolstered by the deliberate campaigns of misinformation of fossil fuel lobbies.

Nevertheless, despite this unpromising backdrop, this paper will attempt to show that climate change is in fact a spur for much-needed change in higher education. While highly challenging, if we do succeed in addressing it in university teaching and learning, then we will have achieved the transformation that was needed in any event. These ideas have been expressed extensively in relation to the broader societal shifts. So Helm (2020) refers to 'no regrets' policies, ones which help reduce carbon emissions or increase carbon absorption, but will achieve other desirable social and environmental ends at the same time. Naomi Klein's (2014; 2019) work in this way emphasises the inseparability of the social movements for workers' rights and indigenous rights, and the environmental movement, given climate injustice and the inseparability of social and natural exploitation.

In the field of education, the inclusion of climate change can signify an opportunity to engage more deeply with the fundamental questions of human existence that cut across all disciplinary areas and university courses, and to enable transformation of students in higher education across personal, civic and professional domains – in short, the aims of university education. The section that follows will explore further these various generative dimensions.

5. Climate change as a driver for pedagogical transformation

The pressing questions of human existence can be divided into three types: ontological – those relating to being, the nature of the self and the other entities that make up the world we live in; epistemological – those relating to knowledge, how we acquire it and what makes it valid; and axiological – the values that underpin what we do in our lives, the good and the just. These three philosophical categories may not encompass all areas of human

² An approach in which, instead of class time being used to transmit knowledge content (e.g. in the form of a lecture) which students then apply afterwards, students acquire the knowledge in advance through reading, videos etc., leaving the class for questions, discussion and application of the material.

enquiry, but they do represent the most weighty questions facing us. However, we do not need to see these categories as ones purely pertaining to the subject of philosophy. Instead, they are the bedrock of any educational endeavour. Whatever we set out to learn, and at whatever age or level of education, the process should engage us in reflection on questions of being, knowledge and value, as applied to the specific subject or content.

Climate change in this way has ontological, epistemological and axiological elements. It alerts us to questions of being (who we are and how we relate to the natural world), of knowledge (whose version of events should we trust) and value (what is a fair distribution of the burdens of change). What this paper will argue is that climate change is a particularly conducive issue for fostering deep reflection and for transforming learners. It serves not only its own agenda of equipping learners to act in the climate crisis, but is a driver for a more powerful and transformative educational experience overall.

The sections that follow will address these three spheres of human enquiry in turn, drawing out the aspects of relevance to climate change, and the ways these can be explored in the classroom. In the space available, the discussion will highlight just a few ways in which climate change can be viewed through these three perspectives – undoubtedly there are many others.

5.1 Ontological

The most immediate ontological concern is with the nature of the climate system, and by extension the nature of the world we live in. The temperature and weather patterns on earth are the result of an intricate interplay of factors involving the sun, the atmosphere, land, oceans and ice sheets, as well as living organisms. The knock-on impacts of changes in temperature are also multiple (e.g. melting of permafrost, changes to ocean currents), and many of them in turn influence the temperatures themselves, leading to positive and negative feedback loops within the cycle. These loops create the possibility of tipping points, and the risk of stages of no return in temperature rises. The key ontological idea that emerges here is interdependence, and through a study of these processes, learners can reflect not only on the concrete and practical considerations of the causes of climate change and possible interventions, but also the deeper interconnectedness of the natural environment. In order to operate in the world we designate categories and attach terms to them (e.g. cloud, carbon, plants) yet when we reflect on their existence, it is clear that they are not entirely separate from other phenomena.

There is a long tradition of writing about interdependence in ecology, for example James Lovelock's Gaia hypothesis, Lynn Margulis's symbiosis, Fritjof Capra's web of life and Anna Tsing's assemblages. These accounts provide different perspectives, are challenged and reframed, and should not be presented as doctrine. The important thing for educators to do is to disturb

our conventional notion of the separateness and independence of phenomena, and allow new understandings to emerge. Many argue that this interconnectedness requires of us new forms of thinking: Lehtonen et al. (2019), for example, propose 'phenomena-based' learning, through which wicked problems can be approached with systemic and holistic thinking.

The second main area of ontological reflection is the human being. Climate change also challenges our conceptions of who we are individually and collectively. Part of these reflections are similar to those above around interdependence. We have a physical body that occupies its own space, but on reflection we soon see that even our bodies are not really 'ours', made up as we are of millions of bacteria, and of water that is constantly recycled. Our mental world also is constituted by interactions with others and collectively constructed languages and concepts. The distancing of the human being from the natural environment in early modern Europe and Francis Bacon's exhortation to human dominion over nature can thus be seen not only as damaging but also based on a misconception³.

As part of the pedagogical process of reflecting on ontology, it is useful to present alternative ontologies to those many students will be accustomed to (Komatsu et al. 2021). In a Western context, ideas of *sumak kawsay* (or *buen vivir*, good living) from the Andean region of South America and *Ubuntu* from Southern Africa, which present a worldview of interconnected existence, are helpful in opening up the imagination (Assié-Lumumba 2017; Brown and McCowan 2018; Olivera Rodríguez 2017).

A final series of reflections concern the notion of change itself. What is the nature of change, and what implications does its inevitability have for our understandings of space and time? Mortality, the fragility of human existence, the possibility of the end of the human species and continuation of planetary life without human beings, are all brought into the foreground. Naturally, some of these are disturbing topics and have to be dealt with in delicate ways, particularly in the context of widespread anxiety amongst young people. Nevertheless, a careful treatment can be an important part of the deepening understanding of self and the future of humanity.

5.2 Epistemological

Should climate denial be prohibited in the classroom, given its unscientific basis and the danger it poses to humanity? Or should it be brought out in the open and addressed? One of the arguments for not excluding climate denial from classrooms is that it provides an opportunity for epistemic exploration. Climate change in this way has a broader role in providing a space for exploring with learners what knowledge is, how it is acquired and validated, and how it relates to values and action. What is the basis of our knowledge and belief, and how do we navigate the diverging perspectives provided by personal experience, systematic research, intuition, friends, family, authorities and experts?

3 This is not a comment on the moral and political desirability of individualism versus collectivism, but an ontological point about the extent of separateness of human beings.



Epistemic concerns are as old as conscious human beings, but have taken on particular complexity in the contemporary age on account of the coexistence of strongly contrasting epistemologies and ontologies within and between societies; development of information and communications technology that brings individuals into closer contact with that diversity; the ready availability of huge stores of information through the internet, but without a clear criterion of sorting and selection; and the deliberate use of social media to spread misinformation and manipulate audiences.

Climate change provides a focal point through which all of these contemporary trends can be brought out into the open and reflected on in the classroom. It is an issue that is subject to significant contestation, in its most extreme form involving outright denial of its existence, but also a range of reasoned positions in terms of how best to address the challenge. Understanding and navigating this contestation is essential, not only in maintaining some degree of social cohesion and cooperation, but also in finding valid solutions – given the highly complex nature of the climate emergency.

'Fake news' has been one of the unfortunate motifs of the 21st-century, and being able to identify patently false or manipulative information is a primary role of the education system at all levels. (Acknowledging this role of higher education does not necessarily involve a reductive true/false binary based on universal, objective fact, and is consistent with more nuanced views). This capacity is commonly associated with critical thinking, a quality that has had a good deal of discussion in debates on higher education. As argued by Arum & Roksa (2011) and Schendel (2015), critical thinking is not guaranteed in the university experience, and depends on the pedagogical environment. The available literature shows that certain features of taught courses are more conducive to the development of criticality: the use of 'ill-structured' problems (those without a clear and straightforward answer), collaborative group work, an open environment for discussion and enriching educational experiences beyond the classroom (Schendel et al 2021).

The discussions of the higher education backdrop above alluded to significant epistemic tensions and contestations over climate change. One added challenge is that the climate deniers have successfully been able to exploit the general value of scepticism in science, claiming that the climate change lobby is shutting down debate and stifling dissenting views, utilising the peer review system and other outlets of communication for their ends (Morano 2018). The academic community is then forced into either an unenviable position of asserting uniformity of view – an anathema to science generally, and not entirely true, since even amongst those in agreement with anthropogenic climate change there are some differences of position – or one of climate science as an open question, which lays open cracks into which the denial lobby can hammer their wedges.

Many of these debates have involved the scientific consensus on climate change. Deniers have paraded the small number of scientists who contest anthropogenic global warming, and

challenged the existence of a consensus. A bibliographic analysis (Cook et al. 2013) showed, however, that 97% of published articles with a position on climate change endorsed human-caused global warming. Scientific literacy in relation to climate change, therefore, is also essential for all students of higher education and the general public. Naturally, it is impossible for all people to have a comprehensive knowledge of climate science, or the technical expertise of climate scientists, but a basic understanding is essential for underpinning one's own actions and in navigating the epistemic conflict. Importantly, however, this kind of awareness is not only one of separating the true from the false, but in developing a more nuanced awareness of different epistemologies that might provide multiple valid readings.

The role of higher education teachers then in relation to climate change is both to provide a space for learners to explore their own epistemological positions, individually and in relation to one another, and to present the contested epistemic terrain on which battles around climate change are being fought. These contestations involve an intertwining of questions of fact and value, of the contrasting logics of different disciplinary areas, of contrasting epistemological and ontological foundations, and of complex systems (societal and environmental) without predictable linear outcomes.

Climate change also raises awareness of academic disciplines, the relationships between them, their contributions and limitations. In no sense can the phenomenon of climate change be limited to a single discipline: while certain areas may have a key role in identifying changes in climate and their immediate impacts (geology, geography, meteorology etc), the wide-ranging disruption to plant and animal life, human societies and all aspects of the natural and physical world mean necessarily that all disciplines are involved. The complexity of the topic makes essential not only contributions from different disciplines, but also that disciplines will work together in new ways, in transdisciplinary as well as multidisciplinary modes.

Another important dimension of epistemological awareness relates to the diversity of knowledge traditions. Human cultures have generated a variety of worldviews which involve distinctive ontologies, epistemologies and axiologies. To acknowledge the value of understanding and engaging with these diverse knowledge traditions is not to slip into a limp relativism: different traditions may have their strengths and weaknesses, their areas of contribution and their applicability to different contexts and situations, or simply reveal different dimensions of human experience. While a problematic term in its own right, what we think of as 'Western' knowledge dominates higher education in today's world – through its formation of the inductive scientific method that dominates our epistemic space, and through the institution of the university which has spread through the world. Western academic knowledge has many positive qualities and has brought undeniable achievements, but does not have an exclusive claim to truth or value; furthermore, Western traditions are themselves plural, and even practice in the natural sciences involves a variety of epistemic approaches, including intuition and imagination (UNESCO 2022).

In order to safeguard this epistemic pluralism, and as a question of justice for colonised and subjugated peoples worldwide, there have been worldwide calls for decolonisation of higher education, spurred on by the prominent Rhodes Must Fall movement in South Africa. Indigenous movements have called for the inclusion of their knowledge traditions, not instead of but alongside mainstream ones, corresponding to what Santos (2015) calls an 'ecology of knowledges'.

Given the complexity of the challenge, and the forms of thought which led us into trouble in the first place, it is not unreasonable to believe that an ecology of knowledges will be necessary to address climate change. The practical challenges of mitigation, adaptation and regeneration require dialogue between universities and external communities, between mainstream academic knowledge and local knowledge systems, and between different cultures and positionalities. Co-construction of knowledge becomes therefore a question of justice, but also the most effective form of building lasting responses to the climate crisis. More fundamentally, many have argued that a whole new paradigm for humanity is needed (Silova 2021), to haul ourselves out of the pit created for us by millennia of exploitative relations with the non-human environment, made catastrophic by the increase in technological power since the Industrial Revolution, and through the increase of incentives for accumulation from the growth of capitalism. Different visions for this relationship can be found in philosophies such as *sumak kawsay* or *ubuntu* discussed above, but also within marginalised Western traditions, such as eco-feminism and deep ecology (King 1995; Sessions 1987).

5.3 Axiological

Climate change is contested not only in terms of its sources of evidence and paradigms of understanding, but also in the value sets that accompany them. Many, in fact (e.g. Marshall 2014; Norgaard 2011), have argued that climate denial is better understood as a conflict of values and emotions than a dispute over facts. The value contestations relate to various areas: the good life and forms of living that are seen to be worthwhile, questions of justice, what a fair distribution of the burden of change and disruption should be, as well as questions of authority and freedom, of the legitimacy of coercion and forms of organisation necessary for achieving global sustainability.

As stated above, there is at the present moment an indisputable situation of climate injustice in which the wealthiest communities and countries as a general rule bear disproportionate responsibility for causing climate change, while the poorest communities and countries bear the brunt of the negative impacts and lack the financial resources to protect themselves. While mitigation, adaptation and regeneration are needed globally, the burdens of adaptation and regeneration on some are caused by the lack of attention to mitigation on the part of others. This is a geographical, political and economic divide (designated imperfectly by the Global North/Global South labels) but also highlights inequalities within countries – leading to a focus on most affected peoples and areas (MAPA) cutting across different locations.

While the facts of the case are clear, the implications are hotly contested. Do wealthy regions have responsibility for atoning for historical actions (e.g. the Industrial Revolution in Britain) or only their current emissions? Should the largest emitters of greenhouse gases make financial payments to compensate other regions affected by the impacts? Should low-income countries be inhibited from developing fossil fuel-based industry when other regions of the world have historically generated their wealth from them? Addressing these questions head-on in pedagogical spaces is important both for ensuring all are aware of the injustices, but also in refining learners' abilities to reflect, deliberate and position themselves on these complex issues.

Important value questions are also raised concerning the forms of social organisation necessary and permissible. Much of the opposition to environmentalism has been provoked by the constraints that it is seen to impose on individual freedom: that the movement is 'green on the outside, red on the inside' (Delingpole 2012), communism by the back door, big government or even global rule by the United Nations. While these concerns are wildly inflated (and many environmentalists are equally concerned about constraints on individual freedoms and the dangers of excessive state power), resolving the climate crisis may indeed require limitations on individuals and corporations, and the establishment of new forms of global coordination. If people do not make the necessary changes of their own volition, should they be forced to do so, and at what proximity to the precipice of species destruction would authoritarian measures be justified?

Finally, there are questions about the good life. Is our task as humanity to maximise (through technology and economic management) the possibilities of continuing the high consumption lifestyle that those in privilege parts of the world have become used to? Or is a more frugal and less wasteful lifestyle, closer to nature and valuing the spiritual over the material, in fact a richer life in any event? Major religions have had ambiguous relationships with climate action, with Christianity on the one hand being held responsible for the root cause of the crisis in positioning the human being as 'master' of nature, but on the other hand, as seen in Pope Francis's *Laudato Si'*, advocating for major pro-environment shifts. Climate change challenges and causes us to question all aspects of the values with which we live.

How exactly to engage with these values is a complex matter that will be addressed more fully in the section that follows. Transmitting a predefined set of values to learners is challenging with young children, and almost impossible with adults of university age, and of dubious legitimacy even if it were feasible. What universities can do is to allow space for learners to grapple with these complex questions head-on, to appreciate their underpinning principles, to understand diverse positions and expand their moral reasoning to those in different positions, places and points in time.

This section has argued that climate change can act as a positive driver for change in teaching and learning, in opening up the profound ontological, epistemological and axiological questions



that all education should address. It is true that any issue that one could choose to address in education (whether studying the ancient Greeks, US-China trade relations, genetically modified crops or quantum computing) could potentially be addressed from these three different angles. But climate change is particularly conducive to opening up crucial questions and dilemmas in these areas through its complexity, its moral urgency, its comprehensiveness (in touching on all aspects of human existence) and its global reach (in involving all humanity).

6. Pedagogical foundations

The above sections have set out three broad areas of enquiry in relation to climate change, ones which provoke deep questions about ourselves and the world, and are conducive to the transformation of self and society. Yet there are a range of possible ways in which these questions can be addressed in the classroom. Some attention, therefore, is needed to the process elements, of orientations of teaching and learning in the classroom. This section highlights two fundamental principles for orienting pedagogy – critical questioning and deliberation.

Given the urgency of the issue, and the high degree of scientific agreement, it might be tempting to present climate change as a settled set of facts, commitments and actions to be instilled in students. Yet, as argued by Jickling and Wals (2008) in relation to education for sustainable development, a campaigning or advocacy approach is never justifiable in the classroom. In an educational setting, particularly one involving adults, learners must exercise their own agency to engage with the material and acquire new understandings through processes of critical reflection. Furthermore, in the case of climate change, the complexity of the issue means that creativity and imagination must constantly be employed to adapt to the emergent properties of the system and form new responses to the crisis. Conditioning, non-reflexive training or even subliminal messages might be successful in bringing about pro-environmental behaviours in the short-term. But it is not a solution to the climate emergency – and it is certainly not ‘education’.

Processes are needed, therefore, through which learners can become aware of their own understandings and positions, engage with other perspectives and worldviews, challenge their assumptions and construct new possibilities. The dual processes of critical questioning and deliberation are central here. These two principles are fundamental to the educational process as they encourage reflection, perspective and possible revision of our views and understandings. As principles they are applicable to any educational setting and any subject matter, though they are far from straightforward to implement and can be challenging, as they disturb the comfort of our familiar and entrenched ideas.

Questioning and deliberation are approaches that we bring to the teaching of climate change with a normative orientation. They emerge from commitments to human agency, of respect for persons and the value of human understanding, rather than unreflective survival or subordination of the human being

to external goals and technologies. Nevertheless, while prior commitments, they are also enabled by engagement with climate change. The complexity, profundity and contestation around climate lend themselves both to processes of critical questioning and to vibrant group discussions, leading to a virtuous cycle through which the principles can be reinforced and deepened.

6.1 Critical questioning

An important part of transformative learning is the development of critical questioning. Educational spaces can be structured in this way so as to encourage learners to question their existing beliefs, perspectives and assumptions. This process operates on a continuum from relatively mild revising of factual knowledge, to a fundamental about turn in one’s identity and worldview. It is opposed to learning approaches that are transmissive, involving an unquestioning flow of knowledge from teacher to student, and also to learner-led processes that involve accommodation of new knowledge entirely within existing assumptions.

While promotion of critical questioning is largely a matter of underlying orientation of the teacher, and can manifest itself in multiple ways, there are some recognised formal approaches. The Socratic method is the root of many of these approaches in the Western tradition. Socrates aimed to spark insights in his interlocutors by taking them through a series of searching questions that would force them to reassess their unexamined assumptions. This generation of new knowledge through questioning has been an ever present current in the Western higher education tradition, alongside traditions of transmission of knowledge and memorisation. Socrates described himself as a ‘gadfly’, niggling at and disturbing the complacency of Athens. The idea of this form of questioning as being uncomfortable is a common theme across critical approaches (e.g. Sterling 2010): while challenges and reframing of our fundamental assumptions are ultimately beneficial, they are unsettling and at times painful.

A more recent structured approach is problem-based learning. It approaches learning not from the starting point of a body of knowledge to be acquired or mastered, but with the solving of problems relevant to the professional area – either theoretically contrived or ones encountered in actual practice. The problem in question is one that is designed to promote critical reflection amongst learners, and collaboration in a group setting. Problem-based learning is commonly used in universities, being particularly prominent in health sciences, through which trainee doctors and nurses develop not through acquiring a formal body of knowledge, but through being faced by real-life medical situations. Critical questioning can therefore occur in a more abstract, intellectual context, or in a more applied, professional one.

Climate change is embedded in human civilisation, practices and belief systems and so addressing it involves critical questioning of this sort. The transmission of a body of knowledge around climate science is not entirely worthless – certainly there is some factual knowledge that all people should have – but it is unlikely to be sufficient to for finding solutions to the ‘wicked’ problem,

or bring about the kinds of individual and collective changes that are necessary. These various forms such as Socratic questioning and problem-based learning are essential for, in the first place, sparking realisations about the complex web of causes of our current unsustainable lives and societies, and then, to think creatively about how to move forward. These approaches can be adopted in the various one-on-one teaching situations in the university (for example in postgraduate research supervision, or in tutoring for an essay or dissertation at undergraduate level) in which Socratic dialogue is readily applicable. Group situations are conducive to problem-based learning, but forms of Socratic questioning through discussion are also possible, along with other methods such as simulations, role plays and thought experiments.

However, there is a tradition of more political questioning, focusing not so much on challenging assumptions of our identity and existence, or solving problems, but of challenging and overcoming the injustices that exist in our societies. Most prominent of the thinkers associated with this current is Paulo Freire, who developed a comprehensive theory of social and political transformation through education – initially adult literacy programmes, but extending through all levels of formal education. Freire's (e.g. 1970) primary insight is that education is inevitably serving a political purpose – in his terms, either liberating or domesticating. This influence is not so much because of the explicit content – although in some cases there will be direct treatment of political issues in the classroom – but because of a deeper process of formation of the 'subject' or person. A correspondence was observed between the disempowerment of the learner in the classroom – and the adult in the community literacy class – considered to be an empty vessel, with their existing learning and knowledge disregarded – and the disempowerment of the citizen in the political sphere.

Questioning in Freire's pedagogy occurred initially through the presentation of visual cues (stylised representations of the present reality) intended to provoke reflection on their conditions of living and inequalities in society. More broadly, Freire advocated for problematisation or problem-posing education, through which the naturalisation of disparities of power and wealth could be challenged. Problematisation is practised hand-in-hand with *dialogue* (respectful, horizontal pedagogical relations) in the educational space, and together they lay the foundations for individuals to take the reins of their own destinies in the broader world: a complementarity similar to that between questioning and deliberation, discussed below. While the account above has presented an apparently individual view, the process is essentially collective: the raising of awareness in marginalised populations that they can change the way that societies are organised in accordance with justice, and the formation of the collective organisation to make it happen. Writers building on Freire's ideas (e.g. Giroux & McLaren 1986; hooks 1994; Shor 1992 etc.) – challenging, adapting and revitalising them – are commonly grouped under the label 'critical pedagogy'.

In his own writing, Freire's main concern was poverty and oppression, and not the natural environment, although he was said to be writing a book about it at the time of his death (Misiaszek 2020b). However, it has since become clear that environmental concerns are no longer those of the privileged middle class with leisure time to enjoy nature, but intimately bound up with global social justice and the well-being and survival of the poorest communities (Klein 2014; 2019). Freirean conscientisation in the 21st century inevitably involves a critical understanding of climate change and its causes, and coordinated collective action to address it. The kind of action that will emerge from transformative pedagogy is not that of the isolated, top-down, technical solution of geo-engineering or carbon capture, but a transformation of our local, national and global economic, political and cultural systems to put in place a more caring, egalitarian and sustainable world.

Freirean approaches of problematisation and conscientisation are, therefore, highly relevant to climate. Collective processes of analysis and reflection can reveal the ways in which climate change is bound up with socio-economic inequalities and asymmetries of power at all levels, and how the solutions need to be grounded in the fostering of more egalitarian and just societies. Climate change represents a teaching opportunity in this sense, as through sustained analysis and reflection, what initially appears as a neutral technical issue reveals its roots in distribution of resources, modes of political decision-making, power differentials and our entire civilisational model.

While there are those (e.g. Bowers & Apffel-Marglin 2005) who argue that the Western anthropocentric currents underpinning Freire's thought are inimical to ecological sustainability, his thought has been integrated with environmental ideas through the eco-pedagogy movement (Gadotti 2000; Khan 2010; Misiaszek 2020a, 2020b). Misiaszek (2020a), for example, draws directly on Freire in his five dimensions of: problem posing methods, democratically authentic dialogue, practice-based teaching, conflict-based teaching and teaching spaces as research spaces. Eco-pedagogy then is the educational manifestation of the uniting of the social justice and ecological agendas. As Jacobi (2003: 189) states, environmental education must be "above all a political act oriented towards social transformation⁴".

One important aspect of this question (and one which could have warranted its own separate treatment) is futures thinking. Critical pedagogy inevitably involves a utopian orientation, and a faith in the possibility of humanity to create a better world. In relation to climate change, a number of commentators (e.g. Cook 2019; Facer 2020; Bussey 2010) have pointed to the importance of imagination and thinking creatively about the future in this way. Reid (2019), for example, refers to 'cathedral thinking', when the foundations need to be built now even if we may not know exactly what the ceiling will look like later. Amsler & Facer (2019) distinguish between three types of future thinking: first, the creative

4 Translation from the original Portuguese by the author.



democratic type, drawing on Dewey and Freire amongst others, through which people as unfinished beings are able to shape the world; second, the neoliberal futurity, through which the present is disciplined so as to minimise the risk in the future; and third, utopian disobedience and ecological thinking – the first and third of these providing counterpoints to the contemporary neoliberal regimes of anticipation. Addressing climate change in the higher education classroom, in this way, involves creating spaces for thinking about and planning the future: but importantly, in a way that allows students to open their imagination beyond the contemporary (unjust) world order, and consider possibilities of a fairer and more sustainable world (Facer 2021).

6.2 Deliberation

A fundamental part of living in a collectivity is deliberation – at least if we are to avoid authoritarian or absolute rule. Listening to the views of others, communicating our own views, and through the interaction of the two, revising those views is essential both for making the right decisions, but also ensuring justice and inclusion in society. As argued by many commentators over the ages (e.g. Gutmann 1987; Mill 1991; Pateman 1970) deliberation is not only a guard against authoritarian rule, but also against forms of majoritarian democracy that reduce the democratic principle to a competition of rigid positions.

Higher education is a highly conducive space for the development of deliberation – a practice that must be learned, and learned through experience. The possibilities of deliberation depend in the first instance on policies of access, and ensuring that university spaces do not become segregated on the basis of socio-economic level or other factors. But they also depend on the pedagogical environment created in the classroom. Many developments in teaching and learning in higher education over recent decades have in fact focused on creating a space for deliberation in the classroom, through fostering an environment in which students feel able to raise questions, and protecting the time available for these discussions – particularly through flipped or inverted classroom approaches where the content input takes place largely before the real-time class (Lage et al. 2000). Deliberation can take place in online fora as well as face-to-face ones, though careful consideration is needed to ensure that the design of the virtual space allows for these forms of interaction.

Deliberation in all spheres involves dealing with disagreements, some of which are sensitive and heated and relate to value-based questions without clear answers. In higher education these controversial issues are a challenge, but also an opportunity: a challenge because they are hard to present and frame on the part of the teacher, and because they can fuel tensions and conflict amongst students in the classroom; but an opportunity because their charged and ambiguous nature means that they can provide an intense engagement in the educational space, foster critical dialogue across diversity and expand students' nuanced moral reasoning and action. While levels of concern about climate change are generally high amongst youth populations, and (depending on the context) the proportion of those denying climate change

outright is likely to be low, there will still be significant differences on views on how best to address the challenge – in line with the axiological divergences outlined above.

There has been substantial work on controversial issues in education at the school level. Debates include the question of what should count as a controversial issue, the role of classroom discussion, how teachers should respond to conspiracy theories and the limits of free speech (Callan 2016; Hand 2008; Hand and Levenson 2012; Hayward and Gronland 2021). Most of these debates are relevant to higher education classrooms, though with allowance made for the greater age and maturity of students and the voluntary nature of their studies.

Educators can navigate these issues in different ways. A useful frame can be found in the distinction between neutral chairman, balanced and stated commitment approaches (QCA 1998). The teacher can act as a dispassionate facilitator, allowing the students to put forward their views on the topic, and react to those of others. Or if the teacher perceives that there is a strong clustering of students around one side of the question, they might emphasise an alternative view – either simply to have all relevant perspectives represented, or as a deliberate attempt to unsettle entrenched views and to spark new insights. Neither of the above positions has involved teachers putting forward their own perspectives. A 'stated commitment' approach might be risky in some circumstances, if students are liable to align their views uncritically with those of the teacher; on the other hand, it might be artificial and even disingenuous for teachers not to share their own views when they are expecting students to do so. Ultimately, decisions on expressing teachers' views, as well as the use of neutral chairman and balanced approaches, will depend on the age, maturity and learner autonomy of the students, the dynamic of the classroom and other contextual factors, and the aims of the learning activity.

One crucial question in relation to controversial issues is what counts as no-go areas, the boundaries of acceptability in free speech. The criteria commonly adopted relate to racist, sexist or homophobic views, other expressions of hatred against particular social groups, or incitement to violence, along with offensive language and personal insults: expression of views along these lines would therefore not be permitted in the classroom. Where do we draw this line in relation to climate change? Should denial of climate change be banned from the classroom?

There are certainly arguments in favour of excluding climate denial from educational institutions. Firstly, the evidence and scientific research available to us at the present moment suggests that anthropogenic global warming is real (Masson-Delmotte et al. 2021), so any fundamental challenge to that view could be prohibited on the basis of spreading false information. Second, given the Herculean task of transforming an unsustainable society into a sustainable one, and the catastrophic costs of not doing so, allowing voices to undermine that task might be considered too great a risk to take.

On the other hand, allowing climate denial in the classroom enables exploration of the contested epistemic dimensions of climate, as discussed above: these could be explored theoretically, but may be more vivid if embodied in the views of participants. Another reason is that the exclusion of climate denial puts it underground, which paradoxically allows it to survive and even flourish, as a consciously countercultural view. This discussion touches on the larger issue of 'no platforming', and is highly complex, and there may be versions of climate denial which would in any circumstances be inappropriate in the classroom – particularly if linked with racist, sexist, homophobic or other exclusionary and prejudiced views and incitements.

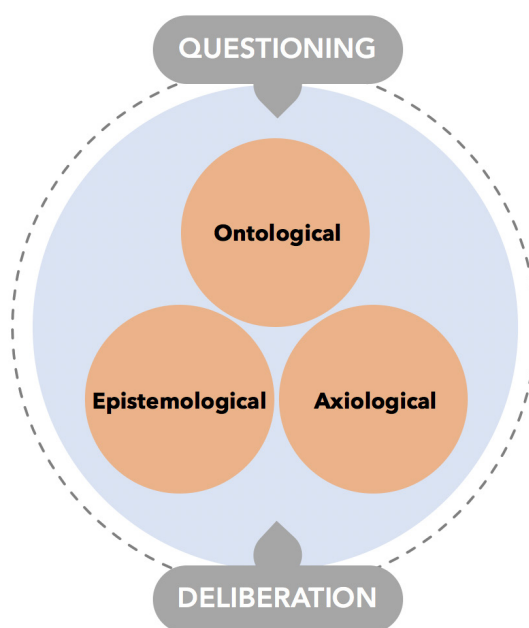
Monroe et al's (2019) systematic review showed the value of "deliberative discussion to help learners better understand their own and others' viewpoints and knowledge about climate change" (original emphasis). As discussed in the earlier sections, emotions and climate anxiety must also be engaged with in educational settings. Yet creating this kind of environment is not straightforward, and providing a real space for deliberation in classrooms can at times be threatening for higher education teachers: it involves letting go and allowing the learners to dictate the movement of the discussion, and risks disagreement and even conflict. For learners too, it may be an uncomfortable experience. But as argued by Kwauk & Casey (2021), there is value in disruption of ideas, and even of making learners uncomfortable intellectually as a way of unsettling entrenched and unquestioned views, and controversial issues can be useful for this end.

Critical questioning and deliberation are not new ideas, and have been seen in educational traditions around the world from the monasteries of classical India to the Scandinavian folk high schools. Yet while ever present, they are always vulnerable to

the convenience of the standardised, transmission approach, ones which we associate with either marketised or authoritarian education systems, but which can equally be a temptation when faced with an urgent moral issue such as climate change.

As seen on Figure 1, they underpin the treatment of the ontological, epistemological and axiological subject matter in the classroom, providing a foundational orientation from which the specific methods and approaches to teaching and learning can emerge. (As discussed above, these can involve not only group discussion in the classroom, but also arts-based approaches, role plays and simulations, storytelling and many others). The two qualities are not separate but interact and are complimentary. Questioning is in the first instance an internal process, in subjecting to critical scrutiny the assumptions held by the individual, though will often occur between teacher and student or in a group situation. Deliberation occurs primarily through engagement with others, though can also occur internally, through the process of self-reflection. But deliberation with others is a key means of fostering questioning, and critical questioning is an ever present part of deliberation. Critical questioning and deliberation, therefore, have their own intrinsic value, but in practice occur in conjunction, with each enabling and strengthening the other. The ways in which they manifest themselves in real-life education depends naturally on the context and circumstances, and can appear in a multiplicity of forms while adhering to the foundational principles.

Figure 1. Principles orienting the teaching of climate change



7. Conclusion

A well-known cartoon depicts a climate summit at which one of the delegates turns to another and asks, “But what if it’s a big hoax and we create a better world for nothing?”. There are so many reasons for becoming more energy efficient, reducing fossil fuel usage, moving towards a plant-based diet etc. that in some ways it is immaterial the extent to which they will mitigate a damaging increase in global temperatures. The idea that solving the climate conundrum may actually create a world that we would have wanted anyway – and solve some of the other thorny issues facing humanity – is pivotal, given the psychological and material obstacles presented by a discourse of sacrifice, austerity and trade-offs.

This paper has presented a similar argument in relation to teaching and learning in the university. At first sight, climate change may appear an inconvenient topic for those teaching in higher education: it is hard to know where to locate it in an overcrowded curriculum with multiple pressures from different angles; it cuts across a variety of current courses provided in the university; it may take lecturers out of their comfort zones in terms of their expertise; and given the rapidly changing body of knowledge and contestation on the fundamentals, potentially creates uncertainty and conflict in the classroom. Yet we can see in fact that, despite these challenges, climate change provides a precious opportunity for transformation and renewal in higher education. A number of the changes that we should be making anyway in teaching and learning in higher education – providing a space for deliberation across diversity, developing awareness of the sources and validation of our knowledge and so forth – are in fact facilitated by including climate change.

There may even be stronger arguments than the potential for synergies outlined above. One of Freire’s most powerful contributions was his insight into the inevitably political nature of pedagogical interactions: not only because they often directly deal with political content, but because they involve the formation of agents, leading either to disempowerment or empowerment of the learner and citizen. The implication here is that teachers cannot ‘sit on the fence’ and remain neutral in their teaching: they are either liberating or domesticating. In the same way, teachers can (no longer) avoid including climate change in their teaching. Its centrality to the fate of humanity means that it is inevitably part of any meaningful discussion of society and the natural environment, and part of each disciplinary and professional area. Not addressing it means supporting the current slide into self-destruction for humanity. Given the questions of environmental justice alluded to above, not addressing climate change also means perpetuating inequalities at all levels.

This paper has explored these ideas in relation to the transformative learning that is essential for responding to the climate emergency. Three spheres of human enquiry have been highlighted – the ontological, the epistemological and the axiological – underpinned by critical questioning and deliberation. In each case, climate change can be seen to represent a stimulus

to change, a challenging and unsettling one, but one that can bring a much-needed shift. While effective teaching of climate change depends on a pedagogical approach oriented around various factors (an open classroom environment for discussion, building on students’ existing knowledge, experiential learning, acknowledging emotions, use of arts etc.), it also in turn stimulates these active pedagogies in a virtuous cycle. While this paper has addressed those parts of the learning experience of students that are controlled by lecturers – the teaching part – it must be recalled that there are many other aspects, including peer learning and self-directed learning outside the classroom (McCowan 2021).

The UNDP and University of Oxford (2021) study on attitudes to climate change shows education to be the strongest predictor of believing in a climate emergency. Yet education systems and institutions should not rest on their laurels. While the increased literacy and access to information that comes with formal education will enhance acceptance of scientific evidence, addressing the climate crisis will require much more than this. The dimensions assessed in this paper form part of this task of transforming learners for action in the spheres of mitigation, adaptation and regeneration. For this end, we need to think not only of the desired outcomes (climate competencies, climate literacy etc.) but also the educational processes through which these can be achieved, with deep reflection on pedagogy and teaching and learning practices in higher education.

As argued elsewhere (Jickling and Wals 2008; McCowan 2019; 2021), education for sustainable development and climate change education must be education, not campaigning or conditioning. While there may be a temptation to instil unquestioning commitment and predefined behaviours and actions in the context of a global crisis, ultimately a sustainable and just planet will only be possible with autonomous, critical individuals who have arrived at their own ethical commitments. So a truly educational approach to climate change education will help us address the challenge. Yet, perhaps unexpectedly, climate change also helps us enhance education. It is an opportunity to address many of the failings of conventional formal education, and to build a more demanding, grounded and liberating vision.



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Climate-U

Transforming Universities
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About Transforming Universities for a Changing Climate

Climate change is the most significant global challenge of our time, and many of its effects are felt most strongly in the poorest communities of the world. Higher education has a crucial role to play in responding to the climate crisis, not only in conducting research, but also through teaching, community engagement and public awareness. This study contributes to our understanding of how universities in low and middle-income countries can enhance their capacity for responding to climate change, through a focus on the cases of Brazil, Fiji, Kenya and Mozambique. In doing so, it contributes to the broader task of understanding the role of education in achieving the full set of Sustainable Development Goals.

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