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# What Is Climate Change Education?

Robert B. Stevenson<sup>1</sup> · Jennifer Nicholls<sup>1</sup> · Hilary Whitehouse<sup>1</sup>

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**Abstract** This article addresses the questions of what and how educators should teach and how students might be engaged to learn in preparation for an uncertain future arising from the risks and the human and ecological impacts of climate change. Relevant literature is briefly reviewed on student and teacher understandings of climate change and conceptions of climate change education as education for preparing students for future climate change mitigation and adaptation measures and the potential for disaster. Opportunities in Australian schools for teaching climate change mitigation and adaptation are critically examined. Climate change should be understood as a complex social as well as scientific issue characterized by uncertain and context-specific knowledge. This demands educators engage in inquiry and co-learning with students. The lack of time and the reported curriculum opportunities to address climate change in the classroom suggest a need for using co-curricular and community initiatives for student investigations and learning. Teachers must encourage students to think critically and creatively about approaches to climate change mitigation and adaptation and develop their capacity to respond with meaningful actions.

**Keywords** Mitigation and adaptation · Disaster risk · Uncertain knowledge

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✉ Robert B. Stevenson  
bob.stevenson@jcu.edu.au

<sup>1</sup> Centre for Research and Innovation in Sustainability Education (cRISE) and College of Arts Society and Education, James Cook University, Queensland, Australia

## Introduction

In essence, climate change education is about learning in the face of risk, uncertainty and rapid change. Humans have never before been in the situation now confronting the planet (Intergovernmental Panel on Climate Change 2014). We can no longer promise young people a stable atmosphere in their lifetimes, so what and how are we to teach? And how are students to be engaged and to learn in preparation for this uncertain future? These are key questions for educators throughout Australia.

One piece of good news is that there appears over recent years to have been an increasingly greater public understanding in Australia of the need for action on climate change. A 2016 poll of 2000 respondents, conducted by The Climate Institute, found that 77% of respondents accepted that climate change was happening, compared to 64% in 2012, and that 65% of people want Australia to lead the world on findingsolutions, up from only 52% four years ago. While Australia still struggles with an “inverse relationship between public concern about climate change and government action” (Matt McDonald, quoted in Whitmore 2016), higher levels of public concern potentially mean greater support for action, including climate education in schools and communities.

Mainstreaming climate change education throughout formal education systems can be one of the most important and effective means of developing capacities for addressing the climate crisis. This is due to multiplier effects, where families and communities benefit when individuals share what they have learned (Mochizuki and Bryan 2015), especially in relation to adaptation and mitigation. Climate change education also sits easily with Australia’s Innovation Agenda (Commonwealth of Australia 2015). We have to respond through collaborative problem-solving and innovation across multiple dimensions of environmental, social, economic,

political—and educational—institutions and systems. Innovation depends on being able to learn collaboratively, adaptively, productively and quickly, as well as to act across different and often vast scales of both space and time.

Therefore, climate change education demands a focus on the kind of learning, critical and creative thinking and capacity building that will enable youth to engage with the information, inquire, understand, ask critical questions and take what they determine are appropriate actions to respond to climate change. We argue that climate change education involves creatively preparing children and young people for a rapidly changing, uncertain, risky and possibly dangerous future. Just how dangerous totally depends on the actions we take today.

### Student and Teacher Understandings of Climate Change

As a first step we need to understand what meaning students and teachers make of climate change. Research often focuses on what people know about climate change. In Australia, Dawson (2015) studied climate change understanding with 438 Year 10 Western Australian high school students to find out what students knew before developing curriculum resources and teacher professional development. Only one in three students was able to write correctly or partially correctly a definition of the greenhouse effect and climate change.

Our colleague, Helen Boon, in investigating pre-service teachers' understandings of climate change, found that even in a university with a specialist focus on sustainability education, pre-service teachers struggled with the scientific complexity of climate change. Boon (2016) points to the conceptual difficulty of climate change science being of an interdisciplinary nature as a cause of the general low knowledge levels. Climate change science (as a whole earth system science) draws from many disciplines—those taught in schools, such as chemistry, physics, biology and earth sciences, as well as a constellation of tertiary disciplines.

These findings, however, reveal only part of the educational challenge of developing students' understanding of climate change. Other research indicates that people have diverse understandings and beliefs that vary depending on their location (i.e. where they live), cultural influences, wealth, gender and world views (Kahan et al. 2011). These influences contribute to the challenges in developing an understanding of anthropogenic climate change, which include invisible causes that generally do not directly impact human health or wellbeing; distant impacts, both geographically and temporally; delayed or absent gratification for taking action; powerful self-interests (Moser 2010). In sum, climate change is challenging to conceptualise and difficult to recognise from personal experience (Nicholls 2016).

Teachers should not be expected and do not need to have extensive knowledge of climate change before engaging and co-learning with their students in thinking about the transition to a more sustainable future. In McBain's (2016) words, "We have to face the challenge of incomplete knowledge. Robust decisions can be made despite inevitable unknowns. [We] can use uncertainties constructively to strengthen [our] confidence in achieving the outcomes we desire and envision together".

### More than Teaching Content

Climate change is not just a scientific phenomenon. It is a complex socio-scientific issue that demands more than the teaching of content. Nicholls (this issue of *Curriculum Perspectives*) found that a majority of Queensland teachers who participated in her study viewed climate change in narrow ways. Learning the (simplified) basics of the complex climate system is only one part of climate education. McKeown and Hopkins (2010), for example, describe climate change education as comprising two parts: climate and change. 'Climate' they explain involves the natural sciences, while 'change', or educating for change, involves engaging the social sciences and humanities.

Persisting with a traditional content delivery or "business-as-usual" approach is increasingly seen as inadequate (Fahey et al. 2014). Preparing students in Australia for futures that are unknown or only partially understood is one of the challenges for curriculum (Fahey 2012). The very complexity of the problem and the uncertainty of ways of responding means it is best addressed through curricular and pedagogies that fully allow students to explore the nature of the problem, discuss and debate appropriate pathways forward and take positive actions.

Kagawa and Selby (2010) argue climate change education requires a "social holistic learning process" that is flexible and embeds learning with action within local community contexts (p. 242). Classrooms should be oriented towards taking up the challenge of rethinking the world and the taken for granted (Kagawa and Selby 2010) and encouraging 'out-of-the-box' thinking (Glasser 2007). Stated in another way, climate change education demands learning that is inquiry-based, reflexive, creative and participatory in supporting learners to develop competencies that are transferable to new, uncertain and as yet unknown, or poorly defined, situations (Wals 2011).

The benefit of action is that it is a pedagogic means for not only facilitating learning about democratic political processes but also overcoming feelings of distress, hopelessness and fear (Ojala 2012a). Emphasising positive thinking, optimism for the future and trust in others may offer a defence from overly negative emotions that confronting climate change can create (Ojala 2012b). Consequently, climate change education should focus attention on futures and possible pathways to a sustainable future to promote hope in students (Ojala 2015).

## Education for Mitigation and Adaptation

Climate change education explores mitigation and adaptation at both the local and global level (Kagawa and Selby 2010) and the interrelationships between these levels. The pre-service teachers that Boon studied “repeatedly stressed they wanted to know more about mitigation actions, solutions and human impacts of climate change, areas less abstract and more clearly connected to their everyday life” (Boon 2016, p. 55). Making connections to students’ everyday life is, of course, critically important to effective learning.

Encouraging and inspiring individuals to take personal actions to mitigate climate change is encouraged by many (Lorenzoni et al. 2007; O’Neill and Nicholson-Cole 2009; Wolf and Moser 2011). While individual actions are an important part of a holistic response to climate change, some warn against educational responses that end with simplistic or one-off individual actions (Robottom and Hart 1995). This focus on individual behaviour change approaches is contested by those who argue climate change is a systemic problem and therefore requires education that challenges normative values that shape our worlds (Gonzalez-Guardiano and Meira-Carrea 2010). Transitioning from unsustainable values and, practices such as carbon-dependent forms of transportation, requires students to assume responsibility and develop the capacity to become civically engaged in collective actions that can contribute to reducing greenhouse emissions and transforming communities and societies to enact more sustainable policies and structures.

Mitigation efforts, however, will not be enough to respond to climate change, so individuals and communities will also need to adapt to future impacts that are unlikely to be avoided. Preparedness for current and potential consequences of climate change is progressively being recognised as essential. As we do not fully understand the implications of a future shaped by climate change, adaptation education is considered necessary to lower risk and vulnerability and build adaptive capacity and resilience (Krasny and DuBois 2016; United Nations Educational Scientific and Cultural Organisation & United Nations Environment Programme 2011). The unpredictable nature of climate change requires an approach to learning that is flexible and that builds capacity for responding to specific hazards as well as for reducing general vulnerabilities (Anderson 2012).

The complex nature of climate change will mean adaptation is by necessity a “continuous stream of activities, actions, decisions, and attitudes that inform decisions about all aspects of life and that reflect existing social norms and processes” (Nelson et al. 2007, p. 397). Adaptation is a dynamic social process that is place specific (Adger et al. 2003) and responds to modified circumstances. Adaptation education is an iterative process, where students develop the capacity for anticipatory and participatory learning and learn by doing.

## Education for Disaster Risk and Social Justice

Climate adaptation education includes disaster education. In Australia, this means learning about and how to respond safely to bushfires, floods, droughts, prolonged heatwaves, cyclones, tsunamis and storms. Many organisations, including local governments, provide education on natural hazards and disasters. As climate change increases the frequency, duration and severity of extreme weather events, such forms of community and school education are, in effect, climate change education.

Education on disaster risk reduction builds community resilience through a systematic approach to identifying, assessing and reducing risk. Students, teachers and the wider school community can be prepared and empowered to minimise risk associated with disasters and cope with risk during and after a disaster (United Nations International Children’s Emergency Fund 2011). At a school-wide level, administrative and teaching staff should work to ensure a “climate safe” school environment (United Nations Educational Scientific and Cultural Organisation & United Nations Environment Programme 2011, p. 61) through ‘climate change proofing’ educational infrastructure (Bangay and Blum 2010). Schools should be familiar with local hazards, undertake risk assessments and improve/maintain buildings where appropriate (Bangay and Blum 2010).

Given that children are particularly vulnerable to the effects of natural disasters, school curricula that incorporate learning about local disaster risks and how to be prepared and cope when disaster strikes can enhance young people’s resilience. Community-based and child-centred disaster risk reduction will increasingly become part of teacher’s work (see Cameron and Norrington-Davies 2010). Supporters of education on disaster risk reduction argue that students themselves should also be involved with risk reduction processes and be familiar with what to do in the event of an emergency (United Nations Educational Scientific and Cultural Organisation & United Nations Environment Programme 2011). In a review of the role of education in disaster risk reduction, Wisner (2006), for example, argues for learning that moves beyond a knowledge of natural hazards to learning that involves students themselves in exploring their local surroundings, assessing risks and speaking with community members about historical extreme weather events.

Globally tensions may also arise due to the inverse relationship between responsibility and vulnerability to impacts (Bangay and Blum 2010) as historically the greatest contributors to the enhanced greenhouse problem are industrialised countries, while those countries who are yet or only recently benefiting from development and economic growth fuelled by high carbon energies are most vulnerable. Further, those individuals and communities who are socially, financially or politically marginalised are particularly vulnerable to the impacts of climate change. Within Australia, for example, people who are unemployed, homeless, living in poor accommodation or frail through age or chronic illness are more vulnerable to the consequences, such as

increased food prices, reduced food and water availability and adverse health effects, associated with heat and increased disease risk (Climate Change Authority 2012). Change education can allow for the exploration of social justice issues locally, regionally and globally. The inequitable distribution of resources, rights and power can be explored, allowing students to make connections between their own experiences and those of others.

### Spaces for Engaging Students in Climate Change Education

Many teachers are concerned about the lack of time and curriculum opportunities to address climate change in their classrooms, especially with the current (over?) emphasis on NAPLAN scores and literacy and numeracy (often through explicit teaching) in primary schools (Nicholls 2016) and science, technology and mathematics (STEM) in secondary schools. Sustainability is a cross-curriculum priority in the Australian Curriculum, which theoretically offers space for teachers to include climate change (see Colliver, this issue of *Curriculum Perspectives*) despite there now being few direct references to climate change in the latest version. Unfortunately, the cross-curriculum priorities recently have become a “precarious space in the emerging Australian curriculum” following the politically charged conservative two-person review of the Australian Curriculum (Donnelly and Wiltshire 2014) and the statement by the Chair of the Australian Curriculum, Assessment and Reporting Authority (ACARA) that “there is no requirement in the Australian curriculum that subjects be taught through the cross-curriculum priorities” (Salter and Maxwell 2016, p. 2).

This further suggests that climate change education cannot be confined to traditional structures and formal curriculum spaces of education but needs to draw on new informal and hybrid (e.g. school/community) spaces offering alternative possibilities for learning and action. Such spaces that provide opportunities for students to engage in inquiry/project-based and action-oriented learning include community and school gardens that allow for learning about alternative paths of food production and security, as well as creating community; student clubs and competitions which can engage students in investigations and actions related to local climate impacts; new and expanded forms of citizen science that engage students in all phases of community-based research (Dillon et al. 2016); social media networks that enable youth to discuss climate issues and initiate climate change actions (Field, this issue of *Curriculum Perspectives*). These new and emerging approaches to learning and ways of organising learning can contribute to the transformation of unsustainable systems, values and routines.

### Conclusion

If the goal is to prepare learners for an uncertain future by helping them to gain the capacities (i.e. knowledge, skills, dispositions and values) to deal with future challenges, educators must rethink climate change mitigation and adaptation in ways that are not merely technical but socially transformative, using teaching and learning approaches that harness creativity and empower students to be able to act (Lotz-Sisitka 2010). A clear, coherent educational agenda for climate change education is as yet tentative with several related agendas engaging various aspects of the issue (Anderson 2010).

Educational responses to climate change best take the form of active social learning that develops the capacity for personal and societal transformative practice. However, current climate change education tends to “mirror the response of society” (Kagawa and Selby 2010), with curriculum responses focussed on scientific knowledge or the ‘*climate*’ in climate change education and ignoring ‘*change*’, thereby paying little attention to the consequences of climate change or the need for adaptation to the impact on human settlement and activities (e.g., see Stevenson 2011).

Orr (2004, p. 27) argued over a decade ago that, “we are still educating the young as if there were no planetary emergency”. Unfortunately, despite the increased urgency, little has changed since. Hopefully, Australian teachers at all levels will rise to the challenge expressed by the Australian Education for Sustainability Alliance (2014) to “advocate and lobby for best practice education for sustainability policy to fulfill our vision of a sustainable Australia ... [including] coherent and sustained professional development and resources to embed sustainability and climate change education, adaptation and mitigation responses across the economy”.

Preparedness for climate disruption will, by necessity, overcome any current stasis in state and national curriculum. In the future, we will not have the luxury of choice. This may be a confronting message to absorb. What we *can* rely on is human creativity and ingenuity, and it is within those curriculum spaces, and within hybrids of formal and informal learning, that educators will find the opportunity for change.

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