

About this briefing note

This is a short summary of some of the current debates and state of the research in relation to climate change and education. Its primary purpose is to support the research teams in our network seeking to develop new community-led research agendas. However, our hope is that it will also provide a useful provocation and starting point for others coming new to the field and seeking to develop research and action projects. It does not aim to be comprehensive and to reference all the existing research relating to climate change and education, but to draw out some of the main areas of knowledge and, in particular, to identify the things we know less about where research is urgently needed.

We recognise that there will be practices, resources and references that we do not know about and have not referenced here. It is our contention that we do research *in* community and *with* others, and so we invite you to let us know of anything you think is missing and we will update this document in future versions for collective use.

What is Climate Change?

Climate Change is narrowly understood as a scientific phenomenon in which the increasing amounts of greenhouse gases in the atmosphere, as a result of natural phenomena and of human behaviour increase the overall temperature of the planet, leading to significant disruptions in weather (on daily shorter term scales) and ultimately climate patterns (several years on longer scales). These disruptions are understood to pose a significant threat to life and livelihoods across the planet. From this perspective, the global agreed priority is to urgently reduce global greenhouse gas emissions to levels that are compatible with a 1.5° increase on pre-industrial levels. This priority to reduce emissions (**mitigation**) implies significant and far-reaching changes away from carbon-dependent economy and infrastructure for industrialised and industrialising nations, as well as significant changes to agriculture practices and consumption patterns in the global north (usually also coupled to adaptation). Current analyses of pathways to reduction suggests that globally emissions look on track for at least 3° global temperature rise by end of this century.

To understand climate change as simply a scientific phenomenon, however, is to ignore the fact that there is profound disagreement about how societies should respond to this challenge: in particular, there is disagreement about who should make changes, the scale and pace of change, the potentially negative impacts of such changes in other areas (energy poverty, impact on biodiversity and conventional development pathways), the costs of such change and whether it is, indeed, politically, economically or socially possible to achieve the proposed reductions in the timescale allowed. Such issues are usually addressed as 'adaptation' but more recently some are suggesting that it is not enough to make incremental changes and that 'deeper' adaptational approaches are urgently needed. The question of equity is particularly central to this debate – with 50% of global consumption emissions being produced by the richest 10% of the global population; and with significant differences in emissions produced by the global north and the global south. Added to this, different cultural, religious and indeed marginal

scientific beliefs offer competing emphases on climate change as a priority in relation to other issues. This makes clear that climate change is not simply a scientific and technical problem, but is a site of profound ethical debate (UNESCO, 2010) – whose livelihoods, beliefs, interests should be taken into account, whose ways of living subject to significant change or defended? What balance should be achieved between the present and the future? Between historical responsibility and contemporary needs?

While the mitigation debate rages, there is evidence that a changing climate is already having significant effects globally – from intensified flooding to drought to extreme weather events. In this context, the focus shifts toward the critical and urgent **adaptation** challenges and to the question of how individuals and communities can be supported to develop resilience towards significant and disruptive events. This forms the focus for much of the UN SDG Climate Action Goal (see below) as well as increasingly being the focus of more informal movements, such as the deep adaptation networks. This attention foregrounds, in particular, the expertise and knowledge of communities who have been living with a changing climate for many years and who are expert in strategies for adaptation (within limits).

Much less discussed, is the question of **restoration** of climate and **regeneration** of culture and also the generative urgent actions that will be needed not only in the 'classroom' and lecture halls but in society and all citizens. Namely, an attention and understanding of how climate might be restored to pre-industrial conditions, and to how a regenerative cultural and socio-political transformation might be achieved that orients societies and citizens towards new ways of living that not only operate within what has been called the safe operating limits of the planet but also contribute to greater personal and collective wellbeing (Raworth, 2017).

What does the Sustainable Development Goal for Climate Change mean for education?

Climate Action is the focus of SDG13. In the table below, we map the way it frames potential roles for action in climate action and then discuss the limits of this framing.

Prompts for reflection from the SDG

If we take the SDG at face value, there are two key implications for education:

First, that the relationship between education and climate change requires a broad conception of education that engages multiple sectors, disciplines and approaches. Climate Change Education, therefore, cannot be assumed to refer to schools only, nor to the provision of scientific information alone. Nor can climate change only be addressed from a 'western' view (e.g. model driven) and 'formal education perspective. We also need better understanding of other knowledge forms and ways of seeing the world and climate change (e.g. local, tacit and indigenous knowledge and world views). Rather, it is a much broader set of activities and demands that engage multiple disciplines, sets of knowledge and sites of learning.

Second, that adaptation and resilience are equally as important as mitigation strategies in education. This is particularly significant when we consider the focus on mitigation education in Western research and the recent global school strikes which have also overwhelmingly focused on mitigation issues.

Target	Educational focus Group	What sort of education?
Target 13.1: Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	All citizens	Disaster preparedness and adaptation education
Target 13.2: Integrate climate change measures into national policies, strategies and planning	National leaders, policy makers, planners	Assessment of different climate change measures at policy level, climate change policy and planning
Target 13.3: Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	Non-specific – all students, institutions, general public	Awareness of and capacity to mitigate, adapt to, reduce impact of and understand early signs of climate change
Target 13.b: Promote mechanisms for raising capacity for effective climate change-related planning and management in least developed countries and small island developing States, including focusing on women, youth and local and marginalized communities	Civic & community leadership. Women, youth and local and marginalised communities. In least developed states.	How to plan for climate change How to adapt to climate change

Weaknesses of this framing

There are, however, some significant weaknesses to the SDG as a frame for developing new forms of climate change education:

First, the SDG implies that there is a ‘settled’ and somehow agreed framing of what constitutes climate change mitigation, adaptation and resilience – and implies that the function of education is to ‘promote’ this settled understanding, assuming a ‘deficit knowledge’ approach that arguably seeks to fill in the so called climate knowledge voids in learners heads, rather than to negotiate mitigation, adaptation and resilience measures as appropriate in each setting.

Second, the educational priorities are associated primarily with ‘awareness raising’ and ‘implementation’ as a strategy for mitigation – despite longstanding evidence that simply ‘raising awareness’ has not been proven to be useful (Monroe et al, 2017; Reid & McKenzie, 2017) for either individual or collective behaviour change and that engaging with local and specific ‘frames’ of understanding is likely to be significantly more effective (Callison, 2014; Lee et al, 2015; Zaval & Cornwell, 2016; Kahan et al, 2012)

Third, the goal fails to grapple with the tensions that will necessarily arise around adequate mitigation and adaptation measures or the learning required to produce collective social responses to these. The power differentials between ‘northern’ and ‘southern’ approaches to the climate change discussions as well as equity and power differentials in the debates (e.g. gender dimensions; the missing voices at the negotiation tables at all scales – local to international) also need surfacing) are needed. In so doing, such current approaches offer little insights into either the history of climate change or the massive cultural and socio-political transformations required to move towards a more socially just, sustainable society where the flourishing of one is linked to the flourishing of all. The goal, in other words, ignores the contested nature of climate change, its entanglement with industrial modern societies and overlooks the broader challenges of creating regenerative cultures.

Fourth, the goal treats climate change action as primarily a cognitive matter, failing to engage with the wealth of data that recognises the role of emotion, anxiety, fear and hope in enabling individuals and groups to make sense of and act in response to climate change challenges. In so doing, it ignores the eco-psychological factors likely to be involved and the importance of working with existing psychological frames and cultural beliefs (Doherty & Clayton 2011; Norgaard, 2011; Randall, 2009)

Fifth, despite the rhetoric around indicators, there is a fundamental absence of robust cross-national data and high impact deliverables. What good climate education might look like in these conditions, is notably absent.

Sixth, the SDG offers no direction for addressing what O’Brien (2018; O’Brien & Sygna, 2013) calls the ‘three spheres of transformation’ or Ostrom describes as ‘polycentric approaches for dealing with climate change, or Donalla Meadows identifies as systemic levers for change. In other words, the necessity to support action and reflection at the multiple personal, practical, political; local, national and international; cultural and conceptual levels.

The SDG on Climate Action, therefore, is better understood as a specific and limited framing of some elements of climate education than as comprehensive basis for developing successful approaches to climate change education, public learning and training. In the rest of this briefing, we highlight some of the key lessons from the research literature that adopt a broader conception of the relationship between education and climate change.

Current Developments in Education & Climate Change

The relationship between climate change and education (including schools, universities, adult education and public learning) is a long one and comprises many different activities, philosophies and institutional and non-institutional practices (Monroe et al, 2017; Stevenson et al, 2017). Since 1992, the United Nations Framework Convention on Climate Change has recognised the role of education. Long before this, however, environmental, outdoors and nature education as well as education for sustainable development, have all had an established, if often marginal, role in the wider educational

landscape. Moreover, democratic education movements, citizenship education, as well as ethical education, also all offer resources for addressing the combined social, political and ethical challenges of climate change, and also all have a long and contested history. It is beyond the scope of this briefing, however, to cover these in depth, and we encourage those with an interest in this area to review the list of resources and bibliography at the end of this paper if they wish to explore these further.

Our aim instead is first, to indicate where the main bodies of research and current thinking can be found in the areas of education for mitigation, adaptation and regeneration; and second, to identify where the significant unanswered questions remain in this field. These questions might form the basis for new projects and research.

Education & Mitigation – how can education contribute to mitigation efforts?

- References to global warming and climate change have been included in school curricula since the 1980s. Over this time, however, there has been little evidence that such education has impacted on student behaviours or societal change. Indeed, higher levels of education are commonly associated with higher levels of consumption and emissions. Moreover, there is some emerging evidence that the more ‘information’ and ‘awareness’ that individuals have, the less they are likely to act. This paper does not, therefore, focus on questions of how to teach children about climate change – there is sufficient literature and work on this elsewhere (see resources below).
- In relation to mitigation education efforts at the present time, given the Paris consensus that proposes the need to reduce emissions rapidly, educational efforts are likely to shift away from school students as recipients of ‘climate awareness’ education and towards those who are currently responsible for consumption decisions – i.e. adults. Here we are seeing a shift towards public education that takes a number of forms:
 - Promoting Carbon Literacy – developing individuals’ understanding of their own contribution to carbon emissions. Mitigation here is focused on individual behaviour change. This is subject to critique in that many of the large gains in carbon reduction are to be achieved not by individuals but by strategic, infrastructural and governmental interventions.



Visual Minutes from event ‘The Role of Higher Education Teaching and Public Engagement in Addressing the Climate Emergency’, January 2020, University of Bristol, UK. Image by Creative Connection, Copyright TESF

- Nudging and behavioural approaches – there is increasing interest (see UNEP) in creating conditions in which individuals can, easily and without reflection, make particular choices that are deemed to be climate positive. One critique here is that such approaches tend to individualise responsibility for climate change and undermine the potential for groups to knowingly and collectively reflect upon the choices that are being presented and to develop potentially new and different responses to these.
- Building agency, collective action and capacity – here, in counter to the individualised approaches, we are seeing forms of collective learning in communities becoming increasingly active. Examples include Transition Towns, the Art of Organising Hope network (Dinerstein, 2015), the Ecovillages movement etc. These practices build often on popular education traditions as well as, in some cases, participatory action research traditions and focus on creating the conditions in which groups can begin to live, collectively, in ways that produce less impact on the environment. (See also our related TESF Briefing Paper on Transformative Public Education)
- A critical element of education in relation to climate mitigation, is attention to the role that emotions and existing cultural and social frames play in responses to information about climate change processes. There is significant evidence that treating climate change simply as a scientific phenomenon leaves students and learners (wider societal actors) poorly prepared to engage with and actively and positively respond to climate change challenges. There are growing bodies of work in education (Ojala 2016, 2017, Ojala & Bengtsson, 2019), in ecopsychology and in climate psychology that are beginning to provide guidance for educators and others and supporting them in dealing with

the emotional challenges of taking a changing climate seriously.

- An equally important site for mitigation through education, is the attention to educational institutions as material and economic practices. The land, buildings, purchasing decisions, food supply, transport and employment decisions of schools, colleges and universities are collectively very significant at local, national and international scales. There are some important examples emerging of institutions taking climate friendly and climate justice decisions – such as the Community Wealth processes (<https://community-wealth.org/about>) in which universities are understood to be anchor institutions in local communities, where their purchasing decisions are reviewed to ensure that they are working with and supporting local communities. More specifically related to emissions reductions, we see emerging international examples of changing use of land, changing energy supplies and changing buildings. In many cases, such changes are integrated with student learning and (in universities) with research.

Education & Adaptation – how can education contribute to adaptation efforts?

- Formal education as a site for learning about how to adapt to a changing climate is relatively under-developed. Much of the educational practice involved in adaptation is outside the school setting, in communities, and as such, is relatively poorly documented. In some cases however (e.g. Fundisa for Change) efforts amongst others have been made to begin to engage adaptation themes in cross-curricula ways in schools in South Africa).
- Adaptation can take the form of material preparedness for weather-related risks and disruptions. Here, the field of disaster education is growing with intentional efforts to build individual and community resilience in the face of significant disruptive change.
- It can also, in the case of the deep adaptation movement (<https://jembendell.com/>), take the form of rethinking institutions and practices for radical and disruptive social and economic change. For example the extensive changes that may be required in urban planning, infrastructure and rethinking how we 'live' in city contexts.
- Again, the material and physical practices of education can and should play important roles in adaptation to climate change. The design of buildings, use of land, purchasing decisions, economic practices all play an important role in facilitating communities' capacity to respond to changing conditions. In many communities, schools and universities may also be important public buildings, where communities can come together for shelter, support, collective action. Understanding the public role of these institutions in conditions of adaptation to significant climate disruption is essential and under-researched (Facer, 2019).

Education and Regeneration

The TEF project is focused on the potential for education to act as a site of social transformation and action. A core interest, then, is in

how education might play a role in nurturing a regenerative culture in which new ways of living in balance with the ecosystem and respectful of social justice, might be achieved. In relation to climate change, this means exploring those educational practices that are moving beyond attempts to mitigate climate harms or adapt to them, but which are supporting their participants to begin to imagine and critically re-imagine new ways of living that address the entangled economic, social, epistemological, historical and ecological conditions that have created the conditions for climate change. These educational agendas include:

- Attention to education as a site of symbiosis, of enabling students (and teachers) to explore and open up what might not yet exist. Of bringing together knowledge and experience in ways that do not seek to remedy current situations, but which work explicitly to let go of current forms of social and economic organisation, as well as current attachments to particularly lifestyles and forms of consciousness, to explore what might come next. This transformative learning draws on very diverse traditions, from western european philosophy of education (Osberg, 2018; Facer, 2013), to decolonisation of education movements (Lotz-Sisitka, 2017, see also <https://decolonialfutures.net/>), to black feminism, to futures studies (Facer, 2016) as well as to traditions of critical pedagogy. Here, the attention is to creating educational practices in which students can collectively interrogate the present, and open up possibilities for imagining and beginning to make different futures.
- Attention to education systems as emerging from and deeply implicated in fossil capitalism and its antecedents, cultures and structures. Here, researchers and practitioners are asking what it means to work in institutions that emerge from colonial and imperial histories, that are deeply entangled with fossil capital, and that work with epistemological starting points that are often antithetical to opening up the possibilities of new forms of social, epistemological and economic organisation.
- Attention to the nature of the person at the heart of the educational enterprise. Radically questioning whether the concept of the autonomous rational individual continues as a useful framework for education in a changing climate. Here, we see the growth of more-than human theories, the earth rights movement, an attention to different traditions of understanding the self that decentre the human and engage with non-western knowledge traditions that support attention to concepts of interdependence, emergence, complexity and process becoming.

What needs to be understood and developed?

While there is an important and existing body of work that relates to education and climate change, there is much that is very poorly understood and very little consensus on what constitutes high quality climate education and more critically regenerative 'education' in any of these three domains. There is much that needs to be done.

- There is an over-emphasis on climate change *mitigation* directed at young people in the research literature, with education for mitigation amongst adults and elite populations, under-examined.

- There is little in relation to education and climate *adaptation* research in any field other than disaster preparedness. The links to professional bodies is emerging and forms of 'learning' that can be shared are emerging for example in the business sector. Wider civic outreach, usually described as 'activism' is, however, not often captured in debates linked to such 'formal educational' centres of action this despite the seminal work of Paulo Freire and others calling for more critical interrogations of dominant discourses.
 - The questions underpinning *regenerative cultures*, are also under-researched in the education domain, namely: education in the politics of climate change, decoloniality and climate justice, strategies to support the emergence of alternative cultures and ethics to drive climate justice and ethical responses to mitigation.
 - The implications of climate and ecopsychology have yet to make their way into most educational discussions and arguably into the wider climate change adaptation arena – in particular in relation to developing a better understanding of how individuals, groups and organisations deal with complex *emotions* in relation to the future
 - The role of *teachers and mentors or leaders and 'change agents'* in relation to climate in education, is under-theorised, researched and developed. Given that teachers are the front line of all educational practice, that their professionalism and training determine all outcomes, this is a significant omission.
 - There is very little research on climate change education in the *vocational and technical* arenas – how is climate visible in the development of craftspeople, professionals and others, how is it taking its place alongside professional, guild and national standards?
 - Best practice in the *material and economic practices* of schools and university estates and institutions in relation to climate change mitigation and adaptation is absent. There is significant activity, but little collective understanding. There is a need for institutional, architectural, economic, landscape and organisational studies in this field.
- <https://education.abc.net.au/home#!/topic/494588/climate-change>
 - <https://nzcurriculum.tki.org.nz/Curriculum-resources/Education-for-sustainability/Tools-and-resources#collapsible1>
 - UN accredited course on climate change <https://www.educateglobal.org/>
 - <https://educatorsdeclare.org/resources/>
 - teaching difficult global issues resources <https://www2.mmu.ac.uk/esri/teacher-resource/>
 - <https://www.eitfood.eu/crosskic/projects/eu-skills-for-future>
 - <http://nzcurriculum.tki.org.nz/News/Climate-Change-Learning-Programme-Wellbeing-Guide>
 - <https://www.lifegate.com/people/news/italy-school-climate-change>

Values activities

- [Values and frames](#) – Common Cause handbook
- [Climate Psychology Alliance](#)
- [Radical Hope Syllabus](#)

Seeing people as facilitators of change

- [Participatory futures methods](#) - aid in facilitating active co-evolutionary adaptation
- [Teach the Future](#) - prepare students for tomorrow
- Convening publics around matters of concern (Masschelein and Simons)
- [Art of Hosting](#) - conversational processes, for example [Climate Change "We can fix it world cafe"](#)
- [Educators as change agents, students as change agents](#) - How can education inspire change? What is possible, probable and preferred?
- [Different theories of change](#) (how can we become change agents)
- [Building Agency in the Face of Uncertainty](#)
- <https://yip.se/program/>

Facilitating Dialogue and Negotiation

- [Council of All Beings](#) - raises questions about democracy and representation; how should non-human animals be represented in human institutions and contexts?
- [Without Modernity Cards](#) offers questions and invitations related to affective and relational work "within" and "gesturing out of" (with/out) modernity.
- [Connected Communities](#) - connect academic and community expertise.
 - Internationalisation at home - understood as engagement with difference, might be combined with robust research-based educational agendas

Building agency and empowerment

- [Active Student Participation Companion](#)
- [Engaging Students as Partners in Teaching and Learning: A Guide for Faculty](#) (Book and webpage resource)

Resources

The following is a set of materials, links, initiatives and activities that relate to climate change education. The list is not exhaustive and we present it here as intentionally unfinished, inviting readers to let us know of other resources of which we should be aware.

Teacher Resources – climate change general

- wwf.org.uk/get-involved/s...
- campaigncc.org/schoolresources
- sustainabilityinschools.edu.au/resources
- science.org.au/education/immu...
- climatecouncil.org.au
- <https://www.oce.global/en/resources/class-activities>
- <https://www.coolaustralia.org/>

Building knowledge collectively

- <https://connected-communities.org/index.php/connected-communities-foundation-series/>
- <https://www.participatorymethods.org/glossary/participatory-action-research>

Reflecting on history, structural issues

- <http://commonworlds.net/how-might-mapping-and-walking-with-places-where-we-spend-the-most-time-make-visible-the-historical-political-and-ethical-stories-of-a-place/>
- Gesturing towards decolonial futures

Dealing with emotions, anxiety

- <https://www.climatepsychologyalliance.org/about>

Raising Awareness tools and activities

- Carbon Literacy Toolkit and Courses <https://carbonliteracy.com/>
- Signal2Noise_arctic – studentproject facebook.com/Signal2Noise20...

Capacity building for teachers, activists, educators, youth

- www.vvob.org/en/news/keep-it-cool-vvob-embarks-climate-change-education-south-africa
- Legacy 17 network – providing courses on the SDGs <https://legacy17.org/>
- One week global programme <https://www.youth.ie/documents/climate-revolution-one-world-week-development-education-and-global-citizenship-education-resource-pack/>
- Youth leadership capacity building <https://www.ungtklima.no/>
- https://www.carsoncenter.uni-muenchen.de/events_conf_seminars/event_history/2019-events-history/conferences2019/index.html

Twitter links and people blogging on education and climate

- @InezHS
- @earthspople
- @kerileef
- @ccluppsala
- @coolaustralia
- @SustainableCBR
- @transitiontowns
- @campaigncc
- @KHayhoe

Campaigns, Networks

- Campaign for education on climate change: teachthefuture.uk by @UKSCN1
- Activism resource, beautifulrising.org
- Climate Friendly Schools Network: https://en.wikipedia.org/wiki/Climate-friendly_school
- <https://www.facebook.com/Fundisaforchange/>
- https://www.sustainabilityexchange.ac.uk/adaptation_guide_1

- <https://www.voiceamerica.com/episode/109664/the-ecocentrists-a-history-of-radical-environmentalism>
- <https://www.indigenousclimateaction.com>
- <http://afteroil.ca/resources-2/1-triggering-transition/>
- <https://www.justpowers.ca/projects/speculative-energy-futures/>
- <https://www.climatepsychologyalliance.org/handbook>

University level courses

- University of Helsinki – Climate Change Course : <https://courses.helsinki.fi/en/atm302> -
- <https://mooc.helsinki.fi/course/view.php?id=36#section-1>
- https://book.unibo.it/courses/course-v1:Unibo+HE4SDGs+2019_E1/about

Reports

- <https://www.thecommonwealth-educationhub.net/the-role-of-education-in-propelling-climate-action/>

University climate change responses

- <https://www.timeshighereducation.com/features/how-green-my-university>
- <https://www.timeshighereducation.com/news/universities-urged-radically-cut-flights-help-climate>
- <https://www.timeshighereducation.com/news/climate-commission-targets-coordinated-sector-action-uk>
- https://www.eauc.org.uk/climate_commission
- <https://esac.ca/climate-change-academia/>

Key further reading

Andreotti, V., Stein, S., Susa, R., Jimmy, E., Amsler, S., Calhoun, B., Cajcova, T., Emilia, D., Siwek, D., Andre, B (2019) Gesturing Towards Decolonial Futures: Global Citizenship Otherwise Study Program https://www.academia.edu/39170601/Gesturing_Towards_Decolonial_Futures_Global_Citizenship_Otherwise_Study_Program

Facer, K (2019) Learning to Live on a Lively Planet: Renewing the Mission of the Research University in a changing climate, <http://www.cemus.uu.se/oct-1-open-lecture-learning-to-live-with-a-lively-planet-with-keri-facer/>

Lotz-Sisitka, Wals, A., Kronlid, D., McGarry, D (2015) Transformative, transgressive social learning: rethinking higher education pedagogy in times of systemic global dysfunction, *Current Opinion in Environmental Sustainability* 2015, 16:73–80

Macintyre, T., Lotz-Sisitka, H., Wals, A., Vogel, C., Tassone, V (2017) Towards Transformative Social Learning on the Path to 1.5 degrees, in *Current Opinion in Environmental Sustainability* 31:8 (80-87)

Monroe, M.C., Plate, R.R., Oxarart, A., Bowers, A., & Chaves, W.A. (2017) Identifying effective climate change education strategies: A systematic review of the research, *Environmental Education Research*, 1-22.

O'Brien, K and Leichenko, R (2019) *Climate and Society: Transforming the Future*, Cambridge: Polity Press

Stevenson, Nichols, Whitehouse (2017) What is climate change education? *Curriculum Perspectives* 37(3) DOI: 10.1007/s41297-017-0015-9

Vogel, C., Schwaibold, U. and Misser, S., 2015: "Teaching and learning for Climate Change' – the role of teacher materials and curriculum design, *Southern African Journal of Environmental Education*, 31, 78-97.

References

Amsler, S and Facer, K (2017) Learning the Future Otherwise: Emerging approaches to critical anticipation in education, *Futures*, 94, 1-84

Callison, C. (2014). *How climate change comes to matter: The communal life of facts*. Durham, N.C.: Duke University Press.

Dinerstein, A (2015) The politics of autonomy in latin america: the art of organising hope, New York: Palgrave Macmillan

Doherty, T. J. & Clayton, S. (2011). The psychological impacts of global climate change. *American Psychologist*, 66(4), 265-276.

Education. Pg. 45-62. Wageningen: Wageningen Academic Publishers.

Facer, K (2016), Using the Future in Education: Creating Space for Openness, Hope and Novelty, in H.Lees & N. Noddings (eds) *Palgrave Handbook for Alternative Education*, free pdf available here https://www.researchgate.net/publication/307557421_Using_the_Future_in_Education_Creating_Space_for_Openness_Hope_and_Novelty

Facer, K., 2013. The problem of the future and the possibilities of the present in education research. *Int. J. Educ. Res.* 61, 135-143. <https://doi.org/10.1016/j.ijer.2013.03.001>

Facer, K (2019) Climate Change: How Should Public Education Respond?, *Forum*, 61 (2), <http://doi.org/10.15730/forum.2019.61.2.207> - freely available at : https://www.researchgate.net/publication/340547681_Climate_Change_How_should_public_education_respond_Climate_Change_How_should_public_education_respond

Kahan, D. M., Peters, E., Wittlin, M., Slovic, P., Ouellette, L. L., Braman, D., & Mandel, G. (2012). The polarizing impact of science literacy and numeracy on perceived climate change risks. *Nature: Climate Change*, 2, 732-735.

Lee, T. M., Markowitz, E. M., Howe, P. D., Ko, C.-Y., & Leiserowitz, A. A. (2015). Predictors of public climate change awareness and risk perception around the world. *Nature Climate Change*, 5, 1014-1020.

Lotz-Sisitka, H.B. 2017. "Decolonising as Future Frame for Environment and Sustainability Education. In Corcoran, P. & Weakland, J. (Eds). *Envisioning Futures for Environment and Sustainability*

Monroe, M.C., Plate, R.R., Oxarart, A., Bowers, A., & Chaves, W.A. (2017) Identifying effective climate change education strategies: A systematic review of the research, *Environmental Education Research*, 1-22

Monroe, M.C., Plate, R.R., Oxarart, A., Bowers, A., & Chaves, W.A. (2017) Identifying effective climate change education strategies: A

systematic review of the research, *Environmental Education Research*, 1-22.

Norgaard, K. M. (2011). *Living in denial: Climate change, emotions, and everyday life*. Cambridge, MA: The MIT press.

O'Brien, K. (2018). Is the 1.5°C target possible? Exploring the three spheres of transformation. *Current Opinion in Environmental Sustainability*, 31, 153-160.

O'Brien, K. & Sygna, L. (2013). Responding to climate change: The three spheres of transformation. In *Proceedings of Transformation in a Changing Climate* (pp.16-23), Norway: University of Oslo.

Ojala, M. (2016). Facing anxiety in climate change education: from therapeutic practice to hopeful transgressive learning. *Canadian Journal of Environmental Education*, 21, 41-56.

Ojala, M. (2017). Hope and anticipation in education for a sustainable future. *Futures: The journal of policy, planning and futures studies*, 94, 76-84.

Ojala, M. & Bengtsson, H. (2019). Young people's coping strategies concerning climate change: Relations to perceived communication with parents and friends and pro-environmental behavior. *Environment and Behavior*, 51 (8), 907-935.

Osberg, D., 2018. Education and the Future, in: Poli, R. (Ed.), *Handbook of Anticipation*. Springer International Publishing, Cham, pp. 1-20. https://doi.org/10.1007/978-3-319-31737-3_88-1

Preston, J (2012) *Disaster Education: 'Race' Equity and Pedagogy*, Rotterdam: Sense Publishers

Randall, R. (2009). Loss and climate change: The cost of parallel narratives. *Ecopsychology*, 1(3), 118-129.

Raworth, K (2017) *7 Ways to Think Like a 21st Century Economist* by Kate Raworth. 2017. White River Junction, VT: Chelsea Green Publishing

Reid, A. & McKenzie, M. (Eds.). (2017). Climate change and education virtual special issue. *Environmental Education Research*.

Stevenson, R, Nichols, J., Whitehouse, H (2017) What is Climate Change Education? *Curriculum Perspectives* volume 37, pages67-71(2017)

Torani et al (2019) The importance of education on disasters and emergencies: A review article, *J Educ Health Promot.* 2019; 8: 85.

UNESCO (2010) *The Ethical implications of global climate change: report by the World Commission on the Ethics of Scientific Knowledge and Technology (COMEST)*, Paris: Unesco

Vogel, C., Schwaibold, U. and Misser, S., 2015: "Teaching and learning for Climate Change' – the role of teacher materials and curriculum design, *Southern African Journal of Environmental Education*, 31, 78-97.

Zaval, L. & Cornwell, F. J. (2016). Paper commissioned for the Global Education Monitoring Report 2016, *Education for people and planet: Creating sustainable futures for all*.

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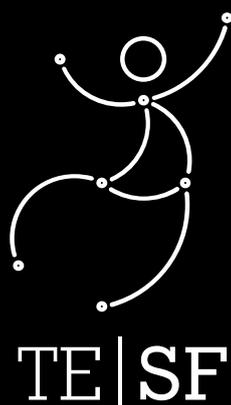


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