

The Need for Climate Change in Education

By David Selby

*Dr. David Selby is Professor of Education for Sustainability and Director of the Centre for Sustainable Futures, University of Plymouth, United Kingdom.
Contact: david.selby@plymouth.ac.uk.*

In the Doldrums: Becalmed Schools in a Sea of Complexity

Climate change offers a profoundly instructive example of the gulf between the worldview informing most educational institutions and the worldview needed to engage with the complexities of the contemporary world.

Schools remain bastions of a mechanistic mindset. The curriculum, for the most part, continues to be divided into tidy compartments and discrete subject disciplines while most teachers make, at best, tokenistic efforts to explore the interrelationships between what the learner encounters within each classroom or subject setting. The science/humanities divide underpinning the curriculum enshrines and reinforces the human/nature divide inherited from mechanism (Selby, 2001, 7).

Grade apartheid is the norm. Individualized and competitive rather than collaborative learning continue to dominate the learning process. There is a drum beat insistence within the agenda of most subjects that certain knowledge and real understanding are achievable through reducing any topic or theme to its discrete component parts. Explanation is addressed in terms of contiguous cause-and-effect events or relationships (Griffin, 1988, 16). Most schools keep the community at arm's length, more often than not disregarding the locality and environment as learning contexts of rich potential (Goldstein & Selby, 2000, 17). Separation, in short, remains the name of the game.

In contradistinction, climate change confronts education with interconnectedness, chaos, complexity, uncertainty and the controversial. Climate change presents, par excellence, a system in which changes in one or more elements or sub-systems can reverberate through the whole, inducing transformation across a hugely complex web of relationships. Bifurcation points are reached within the system's unfolding: critical points of instability at

which the system undergoes abrupt, unexpected and radical transformation (Capra, 1996, 137). The trigger can be a cluster of localized relations (including our own actions and inactions) that are capable of dramatic non-local, non-contiguous effects. The system, thus, defies manipulation and control and the future remains "intrinsically unknowable" (Dahlberg, 2001, 13).

An adequate responsiveness on the part of schools to climate change would in most cases require a cultural shift of significant, even seismic, proportions. A culture more often than not characterized by right answers, the comfortable certainties of *ex cathedra* teacher pronouncements, a linear understanding of causality, a predominantly single textbook-driven learning process (and attendant failure to complexity issues), and student passivity would need to give way to a culture of uncertainty, systems consciousness, a dynamic sharing of subjectivities and multiple voices, and action-oriented learning.

An indication of how hard the cultural shift required would be becomes clear when we find environmental advocates themselves calling for new wine in old bottles. "Complexity is not in many textbooks yet, but it should be," writes Steven Dahlberg (2001, 10), overlooking that the textbook is typically a standardized and stand-alone unitary resource offering, incongruently, but one voice on complexity!

Given the mechanistic mindset pervading education, it comes as little surprise that most advocacy of, and research into, climate change education has emanated from science educators. Climate change is, for the most part, conceived of as a topic to be located within the science curriculum, although commentators concede that even this presents difficulties, given the standard senior school curriculum division into biology, chemistry and physics. Hence, the physics teacher would not address the biology of climate change and the biologist would not address the physics of climate change (Fortner, 2001, 25).

Cross-cutting science courses remain the exception rather than the rule especially at the senior grade levels where students can best handle the complexity of the topic. Compounding the problem is an acculturation of science teachers that renders them reluctant to address the aesthetic, economic, emotional, political, social, and spiritual dimensions of climate change, its impacts and implications. The ubiquitous espousal of

objectivity within the scientific world, itself another manifestation of mechanism (through the assumption that subject and object can be separated), also fosters discomfiture in handling the controversial in the classroom. The outcome is that the social and personal implications of controversy-inducing topics such as climate change are at best only superficially and sketchily addressed. Clearly a way forward would be to infuse and reinforce the issue across all subjects. Hence, the historian could explore climate change through the impacts on human societies of mini ice ages and periods of warming through time, the art educator could discuss the reddening of skies in artistic landscape depictions globally following the eruption of Krakatoa (Fortner, 2001, 25), while the geographer could have students prepare future national and continental outline maps, and their economic and geo-political implications, in the light of best and worst case scenarios for sea level rises (Pike & Selby, 1995, 83).

A significant problem is that teacher education programs also remain by and large framed according to subject specialisms so that prospective science teachers tend to learn about climate change within the long-established content and methodological confines of science, while trainee teachers of other subjects learn a curriculum and pedagogy largely devoid of the scientific. The "two cultures" straitjacket, and its constricting effects, thus passes down the teaching generations.

Foggy Understandings – and the Fog is, if Anything, Thickening

What is research into student and teacher understanding of climate change saying? On the positive side, it is saying that misconceptions about climate change are diminishing in number and frequency although a significant level of confusion remains. On the negative side, it is saying that the level of basic understanding of climate change has sunk (Boyes & Stanistreet, 2001). A 2001 cohort of U.K. grade nine and eleven students had fewer scientific ideas about the causes, consequences and "cures" for the so-called "greenhouse effect" than their 1993 counterparts. For instance, fewer understood that carbon dioxide plays a significant role in climate change, that the Earth would get hotter, that there would be more flooding, that there would be dramatic weather changes, and that desertification would increase. At the same time, the 2001 students were less likely to harbor misconceptions and misconnections, such as linking global warming and skin cancer (Boyes & Stanistreet, 2001). Canadian and US researchers report that school students, trainee

teachers and pre-service teachers, as well as the adult population generally, tend to confuse global warming and the depletion of the ozone layer, believing that ozone holes facilitate the sun's rays in entering the atmosphere and, so, cause global warming or that the "greenhouse effect" is leading to the erosion of the ozone layer (Khalid, 2001; Pruneau et al., 2001; cf. Aron et al., 1984). Another frequent confusion, reported among older UK school students, is the blaming of global warming upon nuclear radiation (Boyes & Stanistreet, 2001, 87).

Misinformation and low levels of understanding amongst student teachers as well as practicing teachers suggest that misconceptions are being perpetuated within their classrooms (Hooper, 1988). This not only affects students' understandings but also reduces their likelihood of informed and personal citizenship engagement (Boyes et al., 1995). A problem is that teachers of earlier grades receive only limited and often elective grounding in environmental and scientific concepts during their initial training, leaving them ill-prepared to facilitate learning around science-linked topics (Khalid, 2001). This weakness in training provision has led to occasional path-finding initiatives making environmental education a core and required course for trainee teachers (Maurice, 1996). Television and Internet, while also a significant source of climate change learning, can not sufficiently challenge and dismantle people's misconceptions (Boyes & Stanistreet, 2001, 99).

A serious obstacle for learning and teaching about climate change in schools is that, across the disciplines, teachers tend to hold back from presenting it as a contested issue, awash with conflicting positions and controversy. The dominant approach is a teacher-centered one involving lectures from the front of the class in which a body of orthodox knowledge (i.e. facts around which there is a reasonable level of consensus) is presented. Such an approach stifles dialogue, offering no useful process through which students can jointly work through their own misconceptions (and, hence, internalize their re-learning). It also denies students the opportunity to develop enquiry skills and hone their critical thinking around the issue by being confronted by conflicting and often controversial arguments (McBean & Hengeveld, 2000, 22-3). Collaborative learning around material likely to generate controversy and conflict is viewed as an optimal strategy for developing higher-order thinking skills and conceptual understanding in students (Johnson & Johnson, 1983). It appears that some of the most effective awareness-raising initiatives on climate change

have revolved around interdisciplinary and collaborative learning approaches where students are active participants, researchers and decision-makers confronted by data offering multiple interpretations and value positions (Samaras et al., 2000; Fortner, 2001). Given the complexity of the issues, such approaches have been for the most part restricted to senior students. An urgent and by no means impossible task for educators is to replicate the approach in age-appropriate ways with students of earlier grade levels. Real as against passive engagement with the issues is vital for an effective climate change educational strategy.

Up Close and Personal: Making Climate Change Tangible

A further important reason for the ineffectiveness of many school-based climate change programs arises from an inability to overcome the abstraction of the topic, though the warm North American winters of 2005/'06 and 2006/'07, the hot summers of 2003 and 2006 in Europe, and the 1000-year drought in Australia now mitigate this issue somewhat. Climate change stretches out across space and time. As such, it can easily be perceived as either not relevant to the learner's day-to-day existence or, if relevant, too big for the individual to be able to do anything to make a difference. Douglas Adams (1982) called this the SEP (Someone Else's Problem) effect. To overcome this, a number of strategies are proposed.

First, learning programs have to address already evident impacts as well as the likely lifetime effects of climate change, thus dislodging any 'business as usual' mindset. Researching climate life histories of older members of the community, maintaining an annual date log of first sightings of flowers, insects and birds each springtime, global weather event billboards and discussion sessions, and extrapolation work on temperature, sea level, desertification spread and other available data, are some of many learning approaches available.

Second, programs need to be informed by a philosophy of connectedness directed towards promoting a lived awareness of the nested nature of the individual, local, regional and global levels (Selby, 2001). The global is shown as informing the local and so becomes immediately manifest.

Third, programs have to demonstrate what individuals and communities can do to contribute to the amelioration of the problem, while providing space for learners to develop their own action proposals. The UK research described earlier reports a reduced understanding amongst young people between the 1993 and 2001 cohorts that restricting vehicle use, recycling paper, planting more trees, and transferring to renewable energy forms are helpful initiatives in which they could participate (Boyes & Stanistreet, 2001, 91).

Fourth, programs need to help develop in students the self-confidence, proactive mindset, and democratic skills set enabling them to participate in social and environmental change advocacy and change agency (Selby, 1995, 317-21). Student involvement in fomenting change remains, however, a problem for schools, fearing accusations of indoctrination and politicization. As suggested later, this speaks for local school and community partnerships for change, an approach that in and of itself would help overcome the de-contextualized nature of much climate change education.

Fifth, climate change programs need to offer students the opportunity to reflect upon and come to concrete terms with fundamental re-conceptualizations of the "good life", i.e. what constitutes life satisfaction, social status and a sense of personal worth, in that, as the Kyoto debates have shown, the issue demands fundamental and painful transformations away from rampant consumerism in a way other high profile environmental issues have perhaps not so clearly demanded (Kempton, 1993, 236; Lenzen & Murray, 2001, 38). A new vision framed by quality of life rather than standard of living criteria, and also proposing new tools for conviviality, needs to inform our approach to the future.

The lack of a future-oriented culture within schools is a fundamental obstacle standing in the way of effective educational countermeasures to climate change. Schools are ostensibly there to help the young generation prepare for a future life of fulfilling engagement in society, yet there is a pervasive futures-myopia across the curriculum. Students are rarely asked to envision and critically reflect upon *probable futures*, i.e. futures that are likely to happen given current trends and developments; *possible futures*, i.e. futures that might conceivably come about that are not hidebound by prevailing paradigms and trends and which are often envisioned and articulated by countercultural groups; and *preferred futures*, i.e. futures that, given our individual values and priorities, we would like to have come about

(Selby, 2003, 156). Futures education offers rich potential for student empowerment. Having explored probable, possible and preferred futures, learners can address questions such as:

- What negative future scenarios have we discovered?
- How might we help avert or preempt such scenarios?
- What positive future scenarios have we discerned?
- What can we do individually and collectively to help realize them?

Alvin Toffler (1971, 425-40; 1984, 185-6) refers to this approach as *anticipatory democracy*. It would be exciting to see whole communities, including their schools, engage in "anticipatory democracy" enquiry and action processes concerning climate change.

Futures education also brings what seems distant in time closer by helping students understand that past, present and future are co-evolving and co-creating concepts. What we do now affects the future. How we see the future informs our lives in the present. How we see the future affects how we view the past. What we trawl from the sum total of the past to make our history affects our now and future. Any seeming temporal remoteness of climate change can, thus, be mediated (Hicks, 1994, 1996; Selby, 2003, 156). Clearly, the infusion of a sustainability ethic into education demands we give due prominence to the future. Elise Boulding's concept of a *200-year present* is helpful here. She suggests that we conceive of "now" as a "continuously moving moment, always reaching out 100 years in either direction from the day we are in, " with people in our "now" who were born a hundred years ago, and people being born into our "now" who will live one hundred years. So the 200-year present "is our space, one that we can move around in directly in our own lives and indirectly by touching the lives of the young and old around us" (Boulding, 1988, 4). Climate change thus comes centre stage in everybody's now. Its seeming irrelevance bred of timescale is circumvented.

Climate change learning strategies also need to take into account the school locality. Eastern Canadian research suggests that a mindset that climate change is "out there" – irrelevant and untouchable in our daily lives – presents a bigger problem in urban areas than it does in rural or semi-rural areas. The signs of climate change are more immediately visible

within rural contexts where there is a greater likelihood of attunement to nature and the rural pace of life is slower, allowing people to notice things (Pruneau et al., 2001). The city can also offer a delusory protection for its inhabitants from climate change. One promising strategy suggested by the Canadian researchers is that of encouraging students to develop an intimate awareness of regional flora and fauna and various seasonal weather patterns. "The idea of going outside and perceiving ambient elements creates a link with those elements. A reflection exercise could follow the direct contact: Do we really want to lose the piping plover, the boreal clintonia, snow, the return of spring, and so on?" (Pruneau et al., 2001, 135).

Another important suggestion is that learning programs give voice to perspectives and viewpoints little heeded in the Rich North of the planet. Climate change is still primarily a problem emanating from the rich industrialized countries of the metaphorical North (i.e. including Australia and New Zealand). Population growth in the South has considerably less impact on climate change than the consumer societies of the North (Parikh, 1996). Additionally, climate change research is preponderantly a phenomenon of the North, meaning global discourse is primarily set within the terms of reference of the rich world (Kandlikar & Sagar, 1999; Lenzen & Murray 2001, 37). The undiluted, unappropriated and unmediated voice of the South is urgently needed in learning programs, especially so if the social justice aspects of climate change are to be addressed.

Out of the Doldrums: Towards En-chanted and Engaged Learning

Experience suggests that few of the proposals advanced above will have any significant impact upon the efficacy of climate change education unless educators and the institutions within which they teach are prepared to rethink, and rethink radically and expansively, both the needs of the learner, the nature of "knowing," and the relationship between ways of knowing and the motivation to take action.

In her lyrical and oft-reprinted essay, **The Sense of Wonder**, written in 1956, Rachel Carson reminds us that the child intuitively apprehends, and holds, a truth that adults easily seem to forget – that we are all part of the natural world. Carson writes about how to nurture in the emergent adult a lifelong sense of wonder, and how to maintain the freshness of vision and sense of connectedness with which we first saw the world. "If a child is to keep alive his [or

her] inborn sense of wonder, ” she counsels parents, ”he [she] needs the companionship of at least one adult who can share it, rediscovering with him [her] the joy, excitement and mystery of the world we live in” (Carson, 1998, 55). Were she to be writing some fifty years later, she might not only exhort parents to confront their sense of inadequacy in this regard but also bewail the manifest failure of mainstream education to cultivate wonder and earth-connectedness in students. School is rather the place where, after the early years, a sense of wonder, of enchantment, is all but suppressed.

The mechanistic worldview that dominates schools, reinforced through the ‘back to basics’ and ”measurability and accountability are everything” market-driven educational policies of the past twenty or so years, is marked by an endemic failure to embrace a multi-dimensional understanding of what ”knowing” entails. The epistemological culture of most classrooms is that we know through engagement with abstract concepts, through accumulation and memorization of data, through the application of skills, and through the cerebral application of objective reason and analysis. In this we have forgotten Carson’s exhortation that ”for the child...it is not so important to *know* as to *feel*” (1998, 56). Indeed for both child and adult, learning through lived experience, through an embodied and felt sense of what is experienced, through the sharing of subjectivities, through the cultivation of emotion and empathy, through relational and spiritual sensibility, through love and compassion, are equal and complementary means of knowing (Selby, 2001, 13).

An acceptance of diverse ways of knowing, with a consequent full reclaiming of the socio-affective dimension, is crucial if young people and adults are to commit to the deep individual and social transformations that climate change calls for. We have accumulated a veritable mountain of evidence on climate change and a range of environmental issues but the stockpiling of data, and of conclusions drawn from those data, have proven inadequate catalysts for change in and of themselves. “Facts and figures, reason and logic,” writes Theodore Roszak (1992, 47), “can show us the errors of our present ways; they can delineate the risks we run. But they cannot motivate, they cannot teach a better way to live, a better way to want to live. That must be born from inside our own convictions. And that birth may have to be a painful one.” Al Gore’s movie, *An Inconvenient Truth*, is built on a similar pedagogical approach of motivating for change via (overwhelming) factual evidence.

Effective climate change education calls for a synergistic interplay between learning about oneself and learning about the world, between the personal and the planetary. The problem, as implicitly present in the data presented throughout this essay, is that climate change learning materials and programs (as well as environmental and sustainability education materials and programs more generally) indicate an overarching passivity and outer-directedness (the learner being asked to look out on the world in a disconnected way) with insufficient exploration of the learner's "inner ecology" in its dynamic relationship with the world (Grieg, Pike & Selby, 1987, 43). There is too much outspace and not enough inscape, and far too little engagement with how, through their interplay, they co-create the kaleidoscopic world we know.

For students to know and feel the deep connection between self and nature, and so build a potential to develop a commitment to living with a minimum ecological footprint (Wackernagel & Rees, 1996), calls for a transformative disposition in both themselves and their learning community. The interests of both human society and the planet are now served primarily by Earth-mindful restraint, by what is sometimes called "voluntary simplicity" (Elgin, 1981), an insight suggesting that a "sea change" is called for in social, educational and personal priorities. "Everything we thought was good turns out to be bad" writes Monbiot (2005, 23). "It is an act of kindness to travel to your cousin's wedding. Now it is also an act of cruelty. It is a good thing to light the streets at night. Climate change tells us it kills more people than it saves. ... Climate change demands a reversal of our moral compass, for which we are plainly unprepared."

A re-oriented moral compass calls for changes in both head and heart that, in its turn, suggests learning challenges and experiences that draw upon the complementary physical, mental, emotional and spiritual dimensions of the learner; that en-chant the learner so she sings the song of the Earth. [We have prioritized the importance of *spelling* in the literacy sense but not in the magical sense.] Even though the suggestion here is not to replace commonly employed forms of learning but to juxtapose new forms alongside the old, these ideas would almost certainly be laughed out of court as outrageous in most school contexts. This speaks to how far schools have strayed from providing, if they ever have, an appropriate milieu for cultivating the quality of Earth-mindfulness necessary for sustainable living.

If learning programs, embracing multiple ways of knowing and enabling students to know themselves in their connectedness to nature, do foment a readiness to act on climate change, what hope is there that this matters, given the acknowledged complexity of the issue? A source of optimism can be found in the very nature of chaos and complexity. Within a hugely complex system such as that represented by the interaction of human agency, the natural environment and climate change, there is a high degree of sensitivity to change, even of a localized nature, so that a seemingly minor change can reverberate through the system with magnified impact leading to bifurcation. "Small changes can have large consequences. These consequences are inherently unpredictable. ... An understanding of the sensitivity of complex systems and the importance of feedback teaches that nothing is insignificant, that everything we do and do not do has the potential for global consequences" (Dahlberg, 2001, 11). The chaotic nature of the system currently manifesting itself in climate change thus speaks to the precautionary principle; that we should err on the side of caution in the decisions we make and the actions we take. But it also carries a message of empowerment in that if individuals and groups of individuals determine to act in Earth-friendly ways, their seemingly insignificant act might have the potential to bifurcate the system towards a more desirable state. "The explosive growth of potential of small disturbances in chaotic systems" (Dahlberg, 2001, 15) might explain the many instances where small groups of visionary, committed, yet seemingly powerless individuals have had impact way beyond their numbers.

Climate change education calls for new heroines and heroes; the recounting of inspirational stories of individuals and communities that have acted decisively for environmental protection, sustainability and social justice. Yet those emerging from our present-day educational institutions are less than likely to be imbued with a sense of empowerment in the face of complexity. Mechanistic responses to complexity are passivity and disengagement. For our schools to develop graduates who can confidently engage with the complexity of climate change, we need to move away from education that is constrained within tidy boxes, where learning outcomes are set and predictable, and where the outcome is more important than the process of learning. Classrooms need to embrace complexity and give space for bifurcations to happen! Teachers need to demonstrate that their own knowledge is limited and likely built on precarious foundations, that for most things there is

no one clear answer, that life is awash with uncertainty, that reality is not a machine of separate parts driven by contiguous connections, but that the reverberations of a butterfly flapping its wings one month can feed through the system in a ubiquitous way potentially affecting the weather thousands of miles away the next month (Capra, 1996, 134-5).

Confronting the impact and severity of climate change through education also calls for partnerships between schools, students, parents and community. Some climate change researchers suggest that while adults may be more reluctant to confront fundamental lifestyle changes and take pro-environmental action, young people are more ready to accept radical change. They also indicate that while adults are confident that change on a massive scale can happen, they expect their children to actually effect the change (Lenzen & Murray, 2001, 32; Pruneau et al., 2001, 132). And, as has been proposed, climate change programs need to be concretely situated in the community as one means of overcoming the abstraction of the learning. All of this suggests that climate change might best be approached through educational initiatives that bring together young people, their parents, community members and those with an expert contribution to make in ongoing community learning contexts that build awareness, foment interest and engagement, identify areas of consensus, and develop and implement actions plans. We return here to Toffler's call for "anticipatory democracy" and his attendant concrete suggestion for a "continued plebiscite on the future" through community-based "social future assemblies" (1971, 431-2). "School" could thus become a metaphor for locations of community learning, decision-making and action rather than bringing to mind a bricks and mortar institution, marked by compulsion, and ring-fenced from the community. This, too, would be a climate change for education as most of us have come to know it.

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