Education, Environmental Crises and Sustainability
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Introduction

This chapter offers insights into the relationship between education, environmental crises and sustainability. Two decades into the 21st century, humankind is at the cusp of a seismic change that threatens the survival of upto 20-30% of species currently sharing our planet (IPCC, 2014). These changes will result in loss of habitat for humans and animals and lead to highly depleted stocks of natural resources for the future generations (IPCC, 2018). Scientists further predict air pollution to become the biggest cause of premature death, killing an estimated 3.6 million people per year by 2050. This demands reimagining the intricate connections between how we live, what we value in life and how we want to achieve our aspirations. Education is a key part of this process.

The implications for low and middle-income countries where most of the world's poor live are particularly severe in terms of loss of livelihood and habitat through flooding, water scarcity, food insecurity and human displacement. Regions in this category include Sub-Saharan Africa and South and South East Asia. Many developing nations are situated in low latitude countries and it is estimated that 80% of the damage from climate change may be concentrated in these areas (IPCC, 2014). According to the World Bank (2020), Sub-Saharan Africa will experience frequent droughts and shifts in rainfall, resulting in food insecurity. Densely populated cities such as Kolkata and Mumbai will become more vulnerable to flooding, warming temperatures and intense cyclones. Depleted water sources from the Himalayas will reduce the flow of water into the Indus, Ganges and Brahmaputra basins with far reaching adverse impact on the fertile agricultural belts that produce food for the sub continent. In South East Asia, Vietnam's Mekong Delta, which produces most of the rice consumed by the population, is vulnerable to rising sea levels.

There is considerable injustice with regard to where carbon emissions are highest and where the most severe effects on climate change are felt. The global population has increased from just 2.5 billion people in 1950, to over 7 billion in 2020, and is expected to rise to 9 billion by 2050 (UNPopulation, 2020)[1]. When we look at levels of per capita consumption in terms of fossil fuel-based electricity, oil, transportation and household goods, we see different patterns in different countries. The populous middle-income countries such as China, India, Indonesia and Pakistan account for over 40 percent of the contribution to global warming, but their per capita figures of carbon emissions are much lower than many high income

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[1] https://www.un.org/en/sections/issues-depth/population/index.html

countries[2]. Thus, while India's carbon footprint, or contribution to global warming is 3rd in world, with 2654 metric tonnes of CO_2 emissions, its per person emissions are 2 metric tonnes placing it 82nd in the global ranking. In comparison, the United States ranks 2nd in its overall contribution to carbon emission with 5416 metric tonnes, and is also ranked very high with regard to emission per person of 17 metric tonnes, just below a few small island states or oil producing nations such as Saudi Arabia and Kuwait. Climate justice calls for support and policy based on per capita carbon emission and potential impact of climate change using a people centred approach to improving human wellbeing. Education systems have a particular role in engaging all stakeholders in this process.

The following sections review climate change, environmental crisis and the role of education; they draw out how education has been linked with sustainability and how a sustainable development agenda charts how we can live respecting planetary boundaries. The discussion identifies some key areas where educational processes will enable the achievement of a sustainable development agenda, contributing to creating informed individuals who practice ecological responsibility.

Ecological shifts, Environmental crises and education

The environmental crises associated with severe ecological shifts pose many challenges to education systems. Kwauk (2020) draws attention to the dilemmas and ambiguities exhibited by the education leadership at both the micro and macro levels in response to the climate activism of school children in 2019. The 'School Strikes for Climate' campaign led to millions of children and adults out on streets around the world. Teachers were divided as to whether to join or penalise students for missing school. Kwauk (2020) notes how this indicates a deeper problem with regard to how climate change has been viewed within the education sector. Alongside an active conceptual engagement, there has been uneven support for action, sometimes out of fear of violating academic process and rules. The biggest challenge for education systems is the reconfiguration required for all stakeholders to confidently place ecological precarity above all other priorities.

Ecology is the study of changes in an ecosystem. An ecosystem is a group of living organisms that live in and interact with each other in a specific environment. The earth's ecosystem comprises the life bubble created through an interaction between biotic factors – plants, animals and other living organisms and the abiotic factors, such as weather, climate, and landscape. Greenhouse gases are critical to life on earth, creating an insulating layer to maintain the optimum temperature conducive for plant and animal survival and propagation. But excess greenhouse gases cause the planet to heat up. In 2018, a report by scientists of the Intergovernmental Panel on Climate Change (IPCC, 2018) warned of multiple crises resulting from rising global temperatures including food insecurity, water scarcity, mass displacement of people through loss of livelihood and habitat. This confirmed the finding of a large community of scientists, who had noted rising planetary temperatures were caused by human activity (IPCC, 2018). Evidence shows a steep increase in global warming since the Industrial Revolution, estimated to have resulted in a 1.0°C average rise above pre-industrial level temperatures. Human activities that produce greenhouse gases have caused global temperatures to rise, resulting in long-term changes to the climate. Scientific models predict global warming will reach 1.5°C average rise above this level between 2030-2052 if anthropogenic emissions continue to increase at the current rates. Changes in the earth's

[2] Global Carbon Atlas http://www.globalcarbonatlas.org/en/CO2-emissions

ecosystem, triggered by global warning, have produced highly concerning ecological shifts posing challenges to resource availability for future generations and survival of several species. The wide genre of activities shown to be responsible for causing global warming and damaging the planet include burning fossil fuels to secure energy requirements in construction, industry and transport; waste production and its disposal; urbanisation and deforestation and glacial melting. Box 17.1 gives a detailed explanation of these causes.

Box17. 1 Measurement and indictors: Causes of Global Warming

- Burning of fossil fuels (oil, coal and gas) to power factories, buildings and transportation. This releases gases that trap heat from the sun and warm up the earth leading to global warming. In 2018, global emissions from fossil fuels and cement production stood at 36.7 billion tonnes compared with 6.4 billion tonnes in 1950. Scientists believe that even to stay at the current levels of greenhouse gas concentrations in the atmosphere, the world needs to reach net-zero emissions by 2050 (Ritchie and Roser 2020).The net-zero emission or the climate neutrality concept is to reduce human activity caused greenhouse gas emissions close to zero and mop up the remaining by carbon removal from the atmosphere by forestation and/or by direct capture and storage technology.
- Waste production and its disposal often add to these harmful emissions and also threaten marine life. Decomposition of food waste creates large amounts of greenhouse gases. Estimates indicate around 88 million tonnes of food wasted annually in the EU (European Commission, 2016) result in over 3 billion tonnes of greenhouse gas emissions (Bravi et. al 2020). In the UK approximately £9.7 billion are lost per year by throwing away unused food (Read, 2019). Further, use of non-biodegradable materials in the world, such as plastic has risen steeply from just 2 million tonnes produced in 1950 to over 7.5 billion tonnes in 2015 (Geyer et. al 2017). Prior to 1980, almost all plastic was discarded without recycling or any incineration. In 2015, 20 percent was recycled and 25 percent was incinerated. It is estimated that each year up to 13 million metric tons of plastic is left in the oceans and at least 800 species worldwide are threatened by this waste (Reddy, 2020). the damage to marine ecosystems through non-biodegradable plastic waste is considered to be at the highest levels observed so far. There is growing evidence of fish, seabirds, sea turtles, and marine mammals becoming entangled in and ingesting plastic debris leading to drowning and suffocation. Some plastics that decompose into fine particles quicker find their way into the sea food consumed by humans (Reddy, 2020).

- Urbanization and deforestation – In 2018, more people lived in urban areas than in rural areas, with 55 per cent of the world's population residing in towns and cities. In 1950, 30 per cent of the world's population was urban, and by 2050, 68 per cent of the world's population is projected to be urban (UNDESA, 2019). Meeting the infrastructure and food needs of the expanding urban population requires additional land leading to deforestation. Thus, in addition to the greenhouse gasses generated through transportation, building, heating and other urban activities, loss of forests depletes the ecosystem of trees that absorb greenhouse gasses and release oxygen in the atmosphere. Tropical deforestation to meet expanding food and consumer needs is estimated to add 3 billion tons of greenhouse gasses each year (Gourmelon, 2016).
- Scientists note glacial melting and irreversible shrinking of the polar ice sheets that will cause sea level rises of over two metres around the world (Garbe et. al, 2020).

This in turn will submerge several low-lying coastal regions with up to 650 million people currently living there.

While many of these adverse impacts have been worsening since the start of the Industrial Revolution, the last twenty years have seen the steepest increase in greenhouse emissions (IPCC, 2018). This suggests rapid and some irreversible shifts in the planet's ecological system that have the potential to threaten the survival of several species and result in the loss of habitat for humans and animals. Advancement in technology since the Industrial Revolution has given people immense ability to use the environment and its resources for their own needs. This resource exploitation has been propelled by the emergence of free market economies, in which economic factors shape production, consumption, use of resources, and treatment of waste. There is a divergence in attitudes with regard to conceptions of environment evident in many Western societies, where the Industrial Revolution and free market economies emerged, and in several Latin American, African and Asian cultures. (Selin, 2003).The perspective associated with many economic and environmental ideas developed in much of Europe and the USA, views the environment as a free resource available for people, companies, and countries to use in whichever way they like to achieve short-term profit maximization with little or no regard for long-term sustainable use. In contrast a number of non-Western cultures view nature as a larger earth system, where human beings are one among many actors. They emphasise co-existence and respect for nature, environment and other living beings (ibid). Ideas of a free market are now being promoted in many regions where ideas about sustainability have had a long history. This has resulted in deforestation (Brazil, Indonesia, India) and expansion of extractive industries (eg. DRC, Angola, South Africa and India).

Climate change has thus transformed into an environment crisis with serious implications for the current and future generations making urgent demands on education systems. The OECD's *Environmental Outlook to 2050: The Consequences of Inaction* (OECD, 2001) alerted us in 2001 to global processes precipitating major damages to livelihoods:

- Pressures on the planet's ecosystem are now so great that future generations could face falling living standards.
- The population is expected to increase from roughly 7 billion people today to more than 9 billion in 2050. The global economy is expected to recover from the financial crisis and ultimately quadruple in size. However, the financial cost of failing to address climate change could result in an up to 14% loss in per capita consumption worldwide by 2050, according to some estimates.
- Pollution will become the biggest cause of premature death, killing an estimated 3.6 million people per year by 2050.
- Air pollution alone will be a major killer, overtaking both poor sanitation and a lack of clean drinking water as a global health threat.
- Due to dependence on fossil fuels, carbon dioxide emissions from energy use will grow by 70%. This will help drive up the global average temperature by 3° to 6 ° Celsius by 2100. This far exceeds the internationally agreed-upon global warming limit of two degrees, but three degrees may be the "tipping point" where climate change could run out of control.
- Because the population will grow so dramatically, there will be a 55% increase in demand for water, and 40% of the world's population will be living under severe

water stress. Groundwater depletion will be the biggest threat to agriculture and to urban water supplies, while pollution from sewage and waste water—including chemicals used in cleaning—will put further strain on global water supplies.

- Biodiversity will decline by 10% on land, with the worst impacts felt in Asia, Europe and southern Africa.

These warnings alerted us to the planetary boundaries which would be ruptured if no action was to be taken to mitigate climate change. Since the publication of this OECD report, almost 20 years back, things have not got any better, with indications of further decline noted by the IPCC (2014, 2018). The notion of planetary boundaries (Rockström et al. 2009), proposed by internationally renowned scientists, identifies nine processes that regulate the stability and resilience of the Earth system. These boundaries comprise limits to the levels of: ozone depletion, biodiversity loss and extinctions, chemical pollution, climate change, ocean acidification, fresh-water consumption, land system, nitrogen and phosphorus flows, and aerosol use. Raworth (2017) illustrates the relationship between planetary boundaries and social foundations of human well-being in the 21st century. (See Box 17.2). Failing to secure the social foundation of wellbeing within planetry boundaries will result in food insecurity, lack of educational opportunities and housing to name a few. Respecting or living within planetary boundaries will allow humanity to develop and thrive for generations to come. Crossing these boundaries increases the risk of generating large-scale abrupt or irreversible environmental changes with immediate and long-lasting damage to humanity's social foundation.

Box 17.2   Concepts: doughnut economics is a visual representation of planetary boundaries, social needs and the safe space to meet them
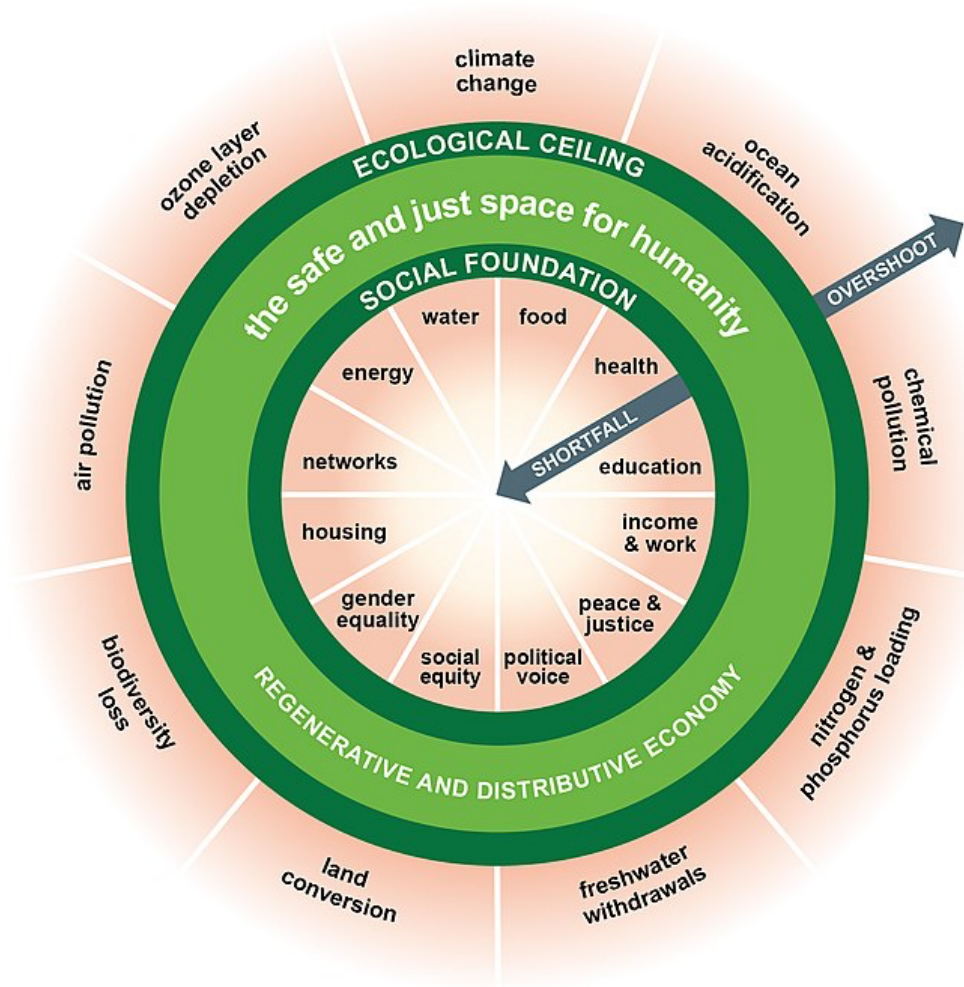
Source: Raworth 2017

Whilst the problems of the climate crisis are largely physical (environmental), the causes and solutions lie more in people's attitudes, values, and expectations, which are shaped by social and educational relationships. This leads one to reflect whether there have been missed opportunities in the domain of education policy and practice to engage with all people - young and old beyond the realms of universities and scientists. We have been alerted to a looming environmental crisis since 1972 by the Club of Rome (Meadows et. al, 1972), the Brundtland Report of 1987, the Earth Summit in 1992 and the focus of MDG 7 and its targets in 2000 to ensure environmental sustainability. The 4 targets included integrating the principles of sustainable development into national policies to reverse the depletion of environmental resources, reduce biodiversity loss, support sustainable access to clean and safe drinking water and basic sanitation, and secure substantial improvement in the lives of slum dwellers. In 2015, the targets had only partially been met, with much work remaining to reduce depletion of environmental resources and loss of biodiversity . Education systems had not been used sufficiently to expand knowledge of these issues. Kwauk (2020) notes

much of the macro level activity at global and national levels has been confined to glossy logo-filled websites with call for lofty actions, high-level working groups, agenda-setting declarations and commitments. UNESCO's leadership has been critiqued (Jickling, 2017) for lack of meaningful transformation at the grassroots, and little clarity on the role of key actors.

Against the backdrop of limited work within education systems in the last few years, grassroots actors have shown encouraging and inspirational leadership. School children have highlighted the environmental crisis in real time using the tactic of the school strike and building an environmental movement, in a way that has communicated to all generations. The leadership shown by an inspiring seventeen year old environmental activist, Greta Thunberg, and many others like her, gained international recognition promoting the view that humanity is facing an existential crisis arising from climate change.

This activism builds on many decades of courageous leadership and social action in developing countries using many forms of educational engagement. Environmentalists such Wangari Maathai who led the Green Belt Movement in Kenya and Rene Ngongo, a Congolese biologist, who dedicated his life to saving the Congo rainforest from deforestation and environmental degradation, both used education as key elements in their campaigns. Some activists have been killed for their work. Ken Saro-Wiwa, a Nigerian human rights activist and environmentalist , who pioneered The Movement for the Survival of the Ogoni People (MOSOP) was hanged. The Brazilian conservationist, Chico Mendes, was assassinated in 1988 and U.S. born environmentalist Sister Dorothy Stang was killed in Anapu, in the Amazon basin, Brazil in 2005. Both had promoted the cause of protecting the Amazon Rainforest. India has a multitude of environmentalists whose work continues to inspire grassroots action and engagement of youth . These include Sundarlal Bahuguna's 'Chipko Movement' in the 1970s which mobilised the locals to protect trees, Vandana Shiva's work which has publicised food sovereignty, rights of the Earth and women; and Chandi Prasad Bhatt, an Indian Gandhian environmentalist and social activist. The dedication of these activists has wide appeal for youth and community organisations in their home country and globally. In the Global North, the work of Sir David Attenborough has documented the environmental crisis for TV audiences of all ages, different educational levels and varied socio-economic backgrounds. The work of these activistists indicates how education can help shape values, exchange information and guide action.

There is an emerging body of literature that draws attention to the educational implications of climate change. Reimers (2021) highlights the human competency and knowledge enhancing attribute of education as being critical for humankind to adapt and mitigate the impacts of climate change. The knowledge expansion domain is vast, including individual and collective responsibility to the planet and sustainable lifestyle practices. Additionally, expansion of human competencies underpins innovation and inventions of technologoies that can mitigate green house gas emissions as evidenced in the electric car technology. However, translating the wider awareness of climate change into behaviour and societal change has been disappointing as noted by Facer et al. (2020). This study suggests a targeted approach to address the challenge of transforming climate literacy into behaviour change at the individual and collective levels. Thus, further adding a critical role that education needs to play in adaptation and mitigation of climate change by active engagement of the citizens in complementarity with technological solutions.

Sustainability and education

The significance of education to address the environmental crisis has been somewhat underplayed , because the focus of the works that formulated ideas about sustainability did not consider the significance of this field of work. The origins of the discourse on sustainable development can be traced to the concerns regarding the exploitation of the global commons. Two pioneering bodies of research emerged in the 1970s and 1980s - *Limits to Growth* (Medows et al, 1972), and The Brundtland Report of 1987.

Medows et al, in 1972 alerted the world to three possibilities. First, they noted if present growth trends in world population, industrialization, pollution, food production, and resource depletion were to continue unchanged, the limits to growth on this planet would be reached within one hundred years, probably resulting in a rather sudden and uncontrollable decline in population and industrial capacity. A second trajectory, they argued, would make it possible to alter these growth trends and establish a condition of ecological and economic stability, which would be sustainable far into the future. The state of global equilibrium could be designed so that the basic material needs of each person on earth would be satisfied and each person would have an equal opportunity to realize individual human potential. Third, they concluded if the world's people decide to strive for the second outcome rather than the first, the sooner they were to begin working to attain it, the greater   chances of success would be (Medows et al, 1972, pp 23-24). The study did not examine how education could be harnessed to enable the wider population to engage with these issues.

The Brundtland Report in 1987 articulated a critical relationship between current and the future human needs, thus defining sustainable development. The report - 'Our Common Future' emphasised 'the possibility for a new era of economic growth, one that must be based on policies that sustain and expand the environmental resources base' (Brundtland , 1987, p 18). It highlighted interlocking crises between the needs of a global economy and a global ecology emphasising the environmental damage being caused by rapid economic growth and the dangerous levels of consumption of finite resources. Unfortunately, there was only scattered awareness in the society at that time of the adverse impacts of ecological degradation on economic growth. The report pointed to the pitfalls that lay ahead for human development in ignoring this relationship. It highlighted that the environmental crisis, the energy crisis and the development crisis were all entwined and parts of a single bigger crisis. The Report warned of depleting local resources for the developing world, home to the majority of the world's poor. Around 90 percent of the projected growth and population increase was expected to take place in already burgeoning cities in developing countries. At the time of writing the report (1987) the majority of the developing countries had lower per capita income than at the beginning of the decade. The report drew attention to the increasing demand on the environmental resources, as a result of rising poverty and unemployment. Grounded within these concerns, the Brundtland Commission introduced the concept of sustainable development as one where the needs of the present generation are met without compromising the ability of future generations to meet their own needs. Sustainable development requires 'meeting the basic needs of all and extending to all the opportunity to fulfil their aspirations for a better life..' (Brundtland, 1987, p 25).

The Report's comprehensive call for actions, comprising several hundreds of action points in each domain, largely focused on policy and institutional infrastructure change and rebuilding policy processes to tackle sustainable development at national levels setting benchmarks to maintain human progress within guidelines linked tohuman needs and natural laws

(Brundtland, 1987, p. 281). But there was little detailed delineation of work to be done in education.

The idea of sustainable development has gained much impetus and attracted both intense attention and critique from a wide range of stakeholders (Sachs, 2008; Stern, 2006; Shiva, 1992, 2005; Bigg, 2003;). The work of Elinor Ostrom (1990, 1993, 2006) has been particularly notable. Commentators acknowledge and endorse citizens and communities as key stakeholders in engaging with sustainable development, but a clear articulation of what kind of educational opportunities can enhance this engagement was not well developed.

Links are evident between people living in poverty and lack of education to support sustainable development. Using the Brundtland definition of sustainable development where the 'needs of the present generation are met without compromising the ability of the future generations to meet their own needs', people who are unable to satisfy even the most basic of their needs, remain marginalised. Poverty reduces people's capacity to use resources in a sustainable manner and it intensifies pressure on the environment. Lack of information, and lack of access to education limits people's ability to acquire the knowledge and skills required to change behaviour. Such communities face the immediate and urgent task of making their day to day ends meet and may not think about the future or the environment. This is illustrated by the common practice of using plastic and cardboard mix as cooking fuel in the densely populated urban slums in Mumbai[3]. Despite the harmful toxic fumes, communities continue to use this cooking fuel because of their inability to purchase more expensive cleaner fuels. Fieldwork carried out in 2016 showed users were only partially aware of the damaging impact of the fumes , although they spoke of smoke triggering a cough while cooking,. The wider impact of toxic fumes on the environment and on the health of all of the 600,000 slum dwellers was not mentioned. Absence of any educational input to raise awareness of the harms associated with the fuel used and the lack of any offer of alternative cooking fuel further excluded these slum dwelling communities from engaging with knowledge and action to change practice and behaviour.

Environmental Education, Decade of Education for Sustainable Development and SDG 4

There have been a range of initiatives to engage educationally with issues of the environmental crisis and sustainabilaity.

Environmental education (EE) emerged in the1960s with a focus on education about environmental issues, such as air and water pollution, depletion and degradation of natural resources and concerns with rapid growth in worldwide population. The approach, as practised mostly in the United States thus had a limited engagement with 'greening' the environment and producing knowledgeable citizens motivated to work towards solving wider environmental problems. Some viewed EE as limited to a curriculum intervention, which in turn made it difficult to be adopted in schools because of its mismatch with the regular disciplines delivered by an education system (Gough and Gough, 2010). Global attention to this issue focussed on policy change. Two key UNESCO-UNEP[4] international conferences held in Belgrade (1975) and Tiblisi (1977) resulted in insights that critiqued EE but also laid the foundations for education to play a key role in facing the challenges of environmental change. The critiques drew attention to the difficulties in the construction of the appropriate curriculum

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[3] Author's fieldwork in Deonar Slum, Mumbai, 2016
[4] United Nations Environmental Programme, established in 1961

for environmental education, tensions in the conceptualisation of environment in relation to social understandings of the needs of humankind , and problems in the implementation of EE in a mainstream curriculum. There were also concerns raised regarding the under representation of views from developing countries (ibid).

The Tiblisi conference was forthright in emphasising the role of the education sector to engage students in teaching and learning about environmental problems. Acritical approach was advocated that would encourage awareness of the complex factors associated with environmental problems. This was to be grounded in a broad range of teaching methods and set in many locales so that students could participate in planning their learning experiences. Opportunities were to be promoted to actively involve the education sector in working towards resolving environmental problems[5]. These insights continued to be part of the policy framework promoted during UNESCO's decade of education for sustainable development 40 years later. However, while the Tiblisi outcomes and the UNESCO publications that followed recognised the leadership role of the education sector in shaping and driving an environmental education agenda and also acknowledged the importance of student engagement at the planning stage, there were several shortcomings. Weak implementation pathways to translate these ideas into practice and embed them in the national curricula have been noted (Gough and Gough, 2010). Environmental education was located within the realm of specific communities associated with sections of the education system, with little or no attention given to raising wider societal awarenesss and promoting actions for lifestyle change.

Several workshops and conferences organised by UNESCO and other UN bodies between 1980 and 2000 were instrumental in the launch of the Millenium Development Goals (MDGs) in September 2000. Despite dedicated goals on education (MDG 2, MDG 3,Target 3A) and environmental sustainability (MDG 7), there was little connection between them suggested in this policy framework. It was the launch of the UN Decade of Education for Sustainable Development (DESD) for the period 2005-2014 that offered a more focused agenda for education for sustainable development. Under UNESCO's leadership, a resolution was passed in 2002 to implement the DESD framework and define Education for Sustainable Development (ESD). This identified a sustainability-education partnership required to adopt principles of sustainable development in national educational curricula worldwide (Michelsen and Wells, 2017). ESD identified drivers of knowledge, skills, perspectives, values that shaped 4 areas of emphasis: improving access and retention in quality education; reorienting existing educational programmes to address sustainability; increasing public understanding and awareness of sustainability, and providing training to workforce in all sectors (ibid).

ESD drew on both the critiques of EE and also on some concerns regarding the leadership position the education sector could take in driving the agenda to resolve environmental challenges. ESD engaged with both formal and non-formal education expanding the remit of policy and practice to include knowledge, learning and teaching in problematising environmental challenges and formulation of solutions beyond the boundaries of higher education and scientific institutions. Further, ESD engaged with charting out in detail a multitude of specific actions to raise public awareness and provide training propgrammes in different contexts (ibid). ESD was intended to create a central space for sustainability knowledge exchange. It focussed on the content change required to promote education for sustainable development. Thus calling for improved public awareness, and new training in

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[5] https://unesdoc.unesco.org/ark:/48223/pf0000032763

sustainability practices that would enable the embedding of the principles of sustainability to reshape education in creating a more sustainable future.

 ESD did progress efforts to advance the sustainable development agenda in many societies, but there were many short falls between what was hoped for and what was achieved. DESD has been critiqued for offering a top down framework that was unidirectional with hierarchical relationships with children in particular, ignoring collective input and co-production of knowledge (Kwauk, 2020; Cutter-Mackenzie and Rousell, 2018). This approach, commentators argue, deters grassroots engagement and activism of children and youth in spreading awareness and questioning our current lifestyles. ESD gave limited attention to embracing gender driven actions to address the underlying problems of climate change, and gender inequality (Kwauk, 2020). The ESD framework widened the stakeholder base involved with learning and teaching about sustainable developement, yet, pathways to enhance action to implement these ideas remained sparse at the end of the decade. For example, a survey of 78 countries, found that nearly three quarters of national curriculum frameworks mentioned sustainable development (73%), while just over a third referenced climate change (36%)(Kwauk, 2020).

 Much more concerted effort in relation to education and sustainability was needed at global, national and local levels. The Sustainable Development Goals (SDGs), adopted by the heads of states of 193 nations on the seventieth anniversary of the United Nations on 25-27 September 2015, represent an urgent call for action by all countries, developed and developing linked in a global partnership. There is a clear acknowledgement that ending poverty and other deprivations must go together with strategies that improve health and education, reduce inequality, and spur economic growth – all while tackling climate change and working to preserve our oceans and forests[6]. The word 'sustainable' occurs in the headline description of eleven of the seventeen SDGs (SDGs 2, 6, 7, 8, 9, 11, 12, 14, 15, 17 and 17) with SDG 13 being the climate action goal: take urgent action to combat climate change and its impacts. This reflects a concern to place the sustainability discourse as the centrality of the post 2015 development agenda.

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[6] https://sdgs.un.org/goals

The SDG education goal includes target SDG 4.7:

> *ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development.*

This is a positive step, but the indicators to assess progress on these initiatives offer a broad framework with little clarity on how to monitor and evaluate this The only indicator of SDG Target 4.7 so far agreed does not guide particularly compelling actions:

> *'Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment'* [7]

In a comprehensive and insightful critique of SDG 4, contributions in the edited volume by Wulff (2020) draw attention to several pitfalls in the framing of the over all SDG 4 but also specifically with reference to Target 4.7. For example, despite the call for a new discourse to move away from our unsustainable ecological, social, economical, ethical, and cultural models towards a sustainable paradigm (Wals, 2007), the policy terrain remains largely unchanged. This has led to the continuation of the economic growth and social equity led priorities over ecology and climate change (Wulff, 2020)[8]. McCowan (2020) focuses on how universitites as home to knowledge creation and research can further influence the society and the environment, but a wide range of actions need to be planned and enacted. In a conceptual model that includes public engagement, the clearly articulated impact pathways to address current climate crisis, he suggests way that offer potential to contribute to both framing of measurable indicators and also shape a new discourse identifying a sustainable paradigm. Another body of literarure on environment and sustainability education (ESE) engages with connecting the discourse with government policy evidentin the work of Lotz-Sisitka et al. (2020) in the context of South Africa. This study adds to the knowledge needed to develop an ESE research-policy interface, which can also contribute to more effective translation of the SDG Target 4.7 into practice.

SDG Target 4.7 points to the need for education on sustainability, but more needs to be done to signpost how this can be achieved at multiple levels. Building on the idea of ecoschools, put forward by Arjen Wals (Peters and Wals 2016), one way is to support education projects that enable understanding from a young age of the ecological shifts that lead to climate change and environmental crisis and sustainable living. These shifts are captured by informed individuals (scientists) and draw on insights informed by the principles of sustainable development. This knowledge shapes ideas and pedagogy to create new knowledge, inform individuals and communities, and thus support innovations to meet sustainability challenges. This interactivity allows for educational content to be relevant to the concerns of of ecology, climate change and sustainable living to generate methods created by informed communities to support specific actions.

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[7] https://sdgs.un.org/goals/goal4
[8] Komatu et al. in Wulff (2020).

This three way partnership between education, ecology and sustainability to educate and create sustainbility informed youth can be seen in two schools The Kopila Valley School (KVS) in west Nepal and Students' Educational & Cultural Movement of Ladakh (SECMOL) in India.

The KVS uses 'rammed earth technology', which is a climate sensitive technology to address the food requirements of school children, strengthening resilience to natural disasters, and insulation from extreme temperatures. The children in turn are key stakeholders in all aspects of the school activities by engaging directly thus living understanding and practicing the principles of sustainability from a young age (Adams, 2020). SECMOL on the other hand, was founded on the principles of 'Bright Head, Skilled Hands and Kind Heart'(Ranjan, 2019). Students become key stakeholders in running the school and are involved in building work using eco-friendly mud techonologies, cooking food and managing expenses.

Box 17.3 Pathways to Practice: Two school communities

KVS located in Nepal's Western district of Surkhet is run by the charity BlinkNow. This region is highly vulnerable to natural disasters, has erratic power supplies, with very high prevalence of extreme poverty, and health inequalities. The adoption of 'rammed earth technology' has allowed the buildings to withstand extreme weather conditions. The school uses local knowledge to decide what and where to plant focusing on self-sufficiency. This includes growing nutritious food to be served as the school lunch, which may be the only meal for that day for many of the students. The school campus is carefully planted with edible and medicinal plants such as ginger, turmeric, fruit trees, sugar cane, sweet potato and asparagus. The seasonal vegetables and grains mimic local farming rotations. At KVS, the focus is not just on what the children are taught, but about what they learn from the teaching environment. One learning environment is the on-site farm, where students learn about agriculture, animal welfare and husbandry (cows, turkeys, ducks, chickens and rabbits), beekeeping, mushroom propagation and more. Teachers of every subject have committed to teach classes on the farm or in the forest at least once a month. Each class has their own allotment to plant and nurture and the children enjoy the satisfaction of contributing their harvest to the school kitchen. As well as providing a valuable teaching tool, the farm plays an integrated role in the BlinkNow ecosystem. The cows, for example, provide milk for the the charity's children's home, compost for the beds and biogas, and they consume the agricultural and food waste. In Nepal, cows represent prosperity, so their ownership also gives the school children semblance of Nepali traditions.
Source: Adams, 2020

B

SECMOL is located in Leh, the capital of Ladakh in India. The region is a cold desert at high altitudes in the North East border with China. The founder of SECMOL, Sonam Wangchuk is a trained mechanical engineer who observed in the 1980s that the education system for the Ladakhi children was broken and irrelevant. Around 95 percent of Ladakhi students used to fail in all important board exams. The few who managed to pass found no jobs in the region. This triggered Mr Wanchuk and a few friends to launch SECMOL in 1988. SECMOL's campus completely utilizes solar energy for all its power, food and water needs. The SECMOL building is made up of rammed earth walls filled in with small wood pieces for insulation. The maximum usage of the solar power has greatly reduced the costs of running SECMOL, meaning, the school does not require any funding. The SECMOL students

manage the campus on their own i tending the garden, milking the cows, maintaining solar panels, helping with construction work and kitchen duties. Students who failed their board exams multiple times and who joined SECMOL are now successful human beings. Mr Wangchuk helped build Ice Stupas, a discovery that has the potential to reduce the problem of water shortage significantly in regions like Ladakh. His work has brought in many awards including the *INR 100 million* from the Rolex Award for Enterprise, which he has used to set up the Himalyan Institute of Alternatives grounded in the philosophy of learning by doing, collaborating, and reflecting on the past. The tenets are:

1. *Learn by doing: Move away from classroom learning as students imbibe the local culture and traditional knowledge while they work and learn alongside the local people in Ladakh. We believe in education that enriches both the body and mind.*
2. *Collaborative Teaching: Students learn not only from academicians and industry experts but also from the local practitioners who are actually facing the challenges we want to tackle for the himalayan region*
3. *Integrating traditional wisdom with technology: We develop sustainable models such as natural earth building passive solar houses and other such unique models that are efficient eco-friendly have low carbon footprint and draw from traditional practices*

Source: https://www.hial.edu.in/about-us-ladakh/hial/

Conclusion

The environmental crisis largely propelled by human activity means humankind faces one of its biggest challenges that threatens the survival of our planet. Regions where most of the world's poor live are likely to have severe impacts in terms of loss of livelihood and habitat, water scarcity, food insecurity and human displacement. The role of education is ever more important now in reshaping our values and how we live in ways that conserve and respect environmental resources. Challenges in embedding this into curricula pedogogy in formal and informal contexts are significant. One way to meet and overcome these difficutiess is to educate children using environmental pedagogy from an early age as illustrated in the examples of the KVS and SECMOL schools.

Questions for discussion
1. What are the key challenges confronting education systems s in changing curriculum, pedagogy and assessment and helping to mitigate the environmental crisis?
2. Identify the main gaps in SDG Target 4.7 and critically discuss the proposed indicators with regard to achieving sustainable development.
3. This chapter has provided two examples of 'eco-schools'. Find similar schools in other parts of the world and critically examine how they are creating sustainability informed citizens

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