



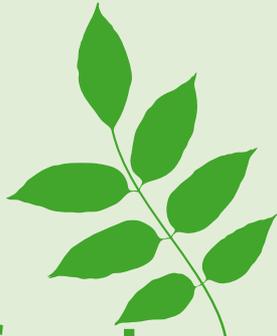
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for Education



Education Sector Responses to Climate Change

Background Paper with International Examples



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List of acronyms

| | |
|----------------------------------------------------------------|--------|
| Climate Change | CC |
| Climate Change Education | CCE |
| Disaster Risk Reduction | DRR |
| Education for All | EFA |
| Education for Sustainable Development | ESD |
| Environmental Education | EE |
| Hyogo Framework for Action | HFA |
| Intergovernmental Panel on Climate Change | IPCC |
| Millennium Development Goals | MDGs |
| Non-governmental Organisations | NGOs |
| Organisation for Economic Co-operation and Development | OECD |
| Small Island Developing States | SIDS |
| Sustainable Development | SD |
| United Kingdom's Department for International Development | DFID |
| United Nations Children's Fund | UNICEF |
| United Nations Decade of Education for Sustainable Development | DESD |
| United Nations Environment Programme | UNEP |
| United Nations Framework Convention on Climate Change | UNFCCC |
| Voluntary Service Overseas | VSO |

Foreword



Asia-Pacific has the largest population and fastest growing economy of any region in the world. With its diverse geography and topography, it is also a region facing negative impacts of the effects of climate change. The significant foreign investment and impressive development gains the region has achieved over the past several years are at high risk of leveling off or even reversing as countries must divert scarce resources to cope with climate change phenomena, such as sea level rise, severe storms, and weather variability, all of which exert inconceivable pressure on food and water supplies, and livelihoods. Moreover, the region is not only likely to be negatively affected by climate change, but it is also on track to contribute to its exacerbation. Studies suggest that by 2030, Asia will generate close to half of the world's total carbon emissions.

It is thus critical that Asia-Pacific increases its knowledge and understanding of climate change phenomena and that governments establish working mitigation and adaptation strategies. Due to the drastic changes before us, the education sector has a fundamental role to play in developing the knowledge, skills and capacities of individuals and communities to adapt to climate change and to support mitigation efforts.

Viet Nam has recognized its own vulnerabilities to climate change effects, namely increased severe rainfall, drought, and slow onset hazards such as sea level and temperature rise; and the Government has identified climate change adaptation as one of its top priorities. In 2010, the Viet Nam Ministry of Education and Training (MOET) took an important step in this area by developing the "MOET Action Plan on Education Sector Response to Climate Change." As part of the action plan development process, UNESCO Viet Nam commissioned this study, *Education Sector Responses to Climate Change*, to better inform MOET and partners working in the sector.

Recognizing the important role education has to play in addressing climate change and the valuable work undertaken in Viet Nam, the MOET and UNESCO have agreed to share this study as an e- publication for wider dissemination in the region and beyond. Through its review of academic research and project documents, the study explores the relationship between the education sector and climate change, and its core messages are relevant to all countries.

We trust that this publication will prove beneficial to all those working on combining theory and practice in the education sector, and all those concerned with addressing climate change.

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1 Introduction

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1.1 Impacts of Climate Change

According to the most recent report from the Intergovernmental Panel on Climate Change (IPCC, 2007), eleven out of the last twelve years have been the hottest on record since 1850. The IPCC also estimated that the average global surface temperature from 1850/1899 to 2001/2005 has increased by 0.760C. The global sea level increased at an average rate of 1.8 mm per year over the period 1961 to 2003 and, over the 20th century, sea levels rose by 0.17m. Since the middle of 20th century human activities have contributed to global warming, a phenomenon which is expected to continue to increase at a faster rate in the 21st century if there is no effort to address it.

Climate change (CC) is a key priority for international development as its impact is likely to be disproportionately felt in developing countries. This is because developing countries are generally warmer, more prone to rainfall variability, more dependent on agriculture – the most climate-sensitive of economic sectors – and as a result of low income have limited risk mitigation infrastructure, both physical and financial (e.g. insurance) (Stern, 2007). Increased instances of drought, flooding and severe weather events as well as incremental environmental change through processes such as inundation, desertification and salination are likely to exacerbate existing problems related to agricultural production, communicable diseases, migration streams, poverty and conflict (Bangay and Blum, 2010; Smith and Vivekananda, 2007; UNICEF UK, 2008; WHO, 2008). Consequences for the majority of people in Asia and Africa as well as those living in Small Island Developing States (SIDS) are likely to be particularly significant, although the specific nature of climate threats will vary between countries.

Climate change presents an international challenge of a magnitude not previously encountered. Its impacts have the potential to exacerbate existing tensions and create new ones, which, in turn, have implications for stability and security at a local and international level. An effective response to climate change and its associated biophysical and socio-economic impacts will therefore need to be multifaceted and inherently political.

1.1.1 The negative impact of climate change on education

To date the majority of research on education and climate change has focused on the impact of climate and associated environmental changes on schooling. According to two recent publications, Save the Children's (2008) 'Legacy of Disasters' and UNICEF UK's (2008) 'Our Climate, Our Children, Our Responsibility', it is children who will be hardest hit by the effects of climate change. These impacts will be seen, for instance, in the direct effects on educational provision associated with increasing incidence of severe weather events (e.g. drought, flooding, cyclones, heat waves). Over the longer term, incremental environmental changes (e.g. sea level change, salination, changes in season patterns, desertification, soil erosion, species loss, etc.) are also likely to result in deteriorating livelihoods, which impact upon both household expenditure on schooling and the nutritional status of children (Bangay and Blum, 2010).

Evidence of the supply side consequences of extreme weather events is already emerging. The aftermath of Cyclone Sidr, which struck Bangladesh in November 2007, left 74 government primary schools destroyed and another 8,817 damaged. An estimated 103,664 children were affected as a result. The estimated cost of reconstruction and refurbishment was more than US\$82 million (Das, 2008). Similarly, the 2000 flood in Cambodia destroyed approximately 18 per cent of the country's schools, impacting the education of 500,000 children and costing US\$1.6 million in rehabilitation costs. Subsequent research in Cambodia has also demonstrated that school absenteeism and drop out are higher in flood-prone areas. Moreover, there is evidence that flooding inhibits completion of school programs, with schools located in flood-prone areas subject to at least one and a half months of closure due to flooding (ADPC, 2008).

The cumulative effects of extreme weather events on both initial enrolment and longer-term educational performance are not well known. Research in India, however, concludes that women born during flood years in the 1970s were 19 per cent less likely to have attended primary school (UNDP, 2007). It would also seem safe to conclude that interrupted and/or impeded access to education has a detrimental impact on learning outcomes, reducing the likelihood that children and young people – especially girls – will be able to break the cycle of poverty (Elimu Yetu Coalition, 2005). A further and important implication that the Cambodia and Bangladesh examples demonstrate is the significant financial burden that rehabilitation costs exert on constrained education budgets. Emergency responses to extreme weather events and their aftermath thus have the potential to undermine investment in improving the quality of education.

1.1.2 Climate change: A challenge for response

In recent years, climate change has received significant global attention. Climate change presents a unique challenge. The spatial resolutions of many climate change projections are too coarse to enable effective adaptation at the local or regional level. The gap between climate forecasts and projections and the needs of resource managers pose challenges to effective responses. Climate change also requires risk assessment on the basis of uncertain knowledge and the acknowledgement that solutions will require political and ethical choices as well as technical innovation.

The world is changing rapidly – economically, ecologically, technologically, culturally; in terms of population, international relations, social structures, etc. These changes result in increased tension between development and sustainability. In recent years, accelerating climate change has drawn increased attention to this tension. Warnings from scientists have increased and a mood of urgency marks the present situation. Should the educational system neglect this and continue as usual – or should it respond to these challenges, and how?

Communities are facing with new risks and have to address these. Communities must be able to assess a number of interdependent aspects and decide upon a suitable course of action. What would be enough – and what would not be enough? Should we do it in this way or that way? Their ability to qualify these kinds of considerations and decisions is fundamentally an educational issue.

Traditionally, educational institutions were established and structured on the basis of a strong belief in objective knowledge and forming the 'right' answers to every question. In this light, the task of education was to provide students with the truth and correct techniques. This role is still valid as factual knowledge and efficient techniques are crucial prerequisites for rational action. Yet it should not be the singular approach. Climate risks contain a degree of uncertainty and addressing them requires being able to

assess the interplay between a number of aspects, including ethical considerations of what is good and bad, rather than of solely aiming to uncover the truth.

Furthermore, the balancing act between tackling long-term sustainable development issues and more immediate economic imperatives is another challenge for the education sector. Globalization has drawn attention to the relationship between the competitiveness of country workforces and student performance, particularly within science. The effect on the educational system has been a greater focus on empirical tests and performance indicators, and less willingness among teachers and schools to experiment with new approaches to teaching and learning. Both these factors impact negatively on the innovative, interdisciplinary and competence-centered aspects of climate change education.

1.1.2 Barriers of incorporating climate change into the education sector

Clearly there will be significant challenges to integrating in education the knowledge and skills required to respond to the impacts of climate change. The level of incorporation of climate change issues will vary greatly depending on the level of education, and the local and national contexts being addressed. In primary education, for instance, a core concern is when to introduce the issue of climate change. This decision is important in order not to frighten children and young people, but to empower them to understand and critically engage with environmental change.

In secondary education, tensions exist between a centralized curriculum and the need to promote locally based and locally appropriate knowledge. Overloaded curricula frequently present additional challenges. Identification of the most appropriate issues and areas of knowledge will require cooperation between local, national and international actors. Educators at all levels will also need support and training to deliver quality education about complex, climate related topics in ways which are both relevant to local environmental, social and political contexts, and which meet wider educational targets (e.g. literacy, numeracy, employability).

The chronic shortage of scientific knowledge and expertise around climate change and its impacts in many developing countries are also a key concern for educators and policy makers at both secondary and tertiary levels. As an OECD study reported in the 2009 EFA Global Monitoring Report stated:

The PISA 2006 assessment of scientific literacy among 15-year old students offers some important lessons. Strong performance in science and awareness of global environmental problems tend to go hand in hand, and both are associated with a sense of responsibility supporting sustainable environmental management. Conversely, weak performance in science is associated with lower awareness of environmental problems. Failure in scientific education will mean less widespread—and less informed—public debate on issues such as climate change and wider environmental problems (UNESCO, 2008).

There are, however, some opportunities for exchange between institutions across the globe, which could assist with skills and technology transfer, and capacity development. Examples include initiatives such as DFID's DELPHE program for higher education (British Council, 2008) and UNEP's Mainstreaming Environment and Sustainability in African Universities project (Gough and Scott, 2007), as well as the long-term efforts in international professional exchange and skill share by NGOs such as Voluntary Service Overseas (VSO).



2 Climate Change Education

While there is emerging awareness of the current and potential impacts of climate change on education provision and learning, it is also clear that education – formal and non-formal, from primary through to tertiary and adult education – has an important role to play in addressing this change. Education is recognized as an important first step in increasing resilience (Bonifacio, A., Takeuchi, Y. and Shaw, R., 2010). The United Nations Framework Convention on Climate Change (UNFCCC) Article 6: Education, Training and Public Awareness (also known as the New Delhi work program) recognizes that education must play a key role in a holistic response to climate change at local, national and global levels. The Hyogo Framework for Action's (HFA; 2005-2015) priority 3 focuses on increasing resilience and building a culture of safety and resilience at all levels through the use of knowledge, innovation and education, and Goal 2 of the Millennium Development Goals (MDG) discusses the importance of primary education in reducing poverty.

2.1 Education for Sustainable Development (ESD)

Since the 1960s, a large body of research has sought to understand the links between increasing knowledge of environmental and development concerns, and social and environmental change. This work has used various terms and definitions, including 'development education', 'environmental education', 'education for sustainable development', among others (Bourn, 2008; Palmer, 1998; Scott and Vare, 2008; Sterling, 2001). Education for Sustainable Development (ESD) has been a widely promoted philosophy in the last two decades.

The concept of ESD emerged in the late 1980s alongside international discussions of environmental protection and sustainable development. It was given much of its shape at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992, and in the resulting *Agenda 21*:

Education, including formal education, public awareness and training should be recognized as a process by which human beings and societies can reach their fullest potential. Education is critical for promoting sustainable development and improving the capacity of the people to address environment and development issues. While basic education provides the underpinning for any environmental and development education, the latter needs to be incorporated as an essential part of learning. (UNCED, 1992)

ESD continues to receive international attention through the current UNESCO-led UN Decade of Education for Sustainable Development (DESD; 2005–2014). The aims of the Decade are to integrate the principles, values and practices of sustainable development into all aspects of education and learning, and to encourage changes in behaviors that allow for a more sustainable and just society for all (UNESCO, 2006). Key features of ESD include:

- A concern for high quality education, which is interdisciplinary and holistic, fosters critical thinking and problem solving, and is participatory and locally relevant;
- An attention to values, including respect for others, for difference and diversity, and for the environment;
- An acknowledgement that ESD will be shaped by diverse perspectives and will take place across a range of learning spaces, from formal and informal, and early childhood through adult life (UNESCO, 2006).

Both Agenda 21 and DESD, international policy frameworks, suggest ESD does not simply represent a single, new curriculum area for schools (e.g. environmental studies), but rather a more integrated approach to providing appropriate education and training in a diverse and rapidly changing world. Furthermore, both frameworks strongly connect ESD efforts to international interest in both increasing access to education and providing high quality through Education for All (EFA) and MDG efforts. These assertions are supported by a significant body of academic research and policy (Bangay and Blum, 2010).

2.2 Climate Change Education (CCE)

Climate change, and the individual and societal actions needed to address its challenges, are not new topics for education. Both can be found in environmental teaching materials from recent decades. Indeed, Climate Change Education (CCE) has not emerged as an independent field, but rather as an integral part of Environmental Education (EE) and ESD. In fact, CCE has only gradually developed its own identity during the last three years, and is therefore still in its infancy (Læssøe et al., 2009).

In some countries, this recent development is driven by government initiatives concerning climate change. The Chinese government, for example, has adopted climate change action plans which include specific education initiatives. Thus, knowledge about CC will be included in basic, higher and adult education with a focus on awareness and participation in relevant activities (Yi and Wu, 2009). Similarly, in the Canadian province of Newfoundland and Labrador, there has been a Climate Change Action Plan since 2005, which emphasizes CCE. In this province, the origin of the action plan may be attributed to the clearly visible local effects of climate change (Nazir et al., 2009). The Danish government's 2009 ESD strategy also launched a number of specific initiatives concerning CCE. New CCE initiatives under the rubric of EE and ESD can likewise be found in other countries (Breiting et al., 2009). In Australia, where ESD is well established, the new and ambitious National Solar School Initiative has been launched under the auspices of ESD but with specific reference to climate change. This initiative has set a goal "for all Australian schools to be 'solar schools' by 2016" (Chambers, 2009). In addition to these government-led initiatives, there are also examples of other concrete initiatives organized by NGOs and other institutions. Furthermore, in Brazil, various other stakeholders like the corporate sector, academic community and media are also involved in debating the role and place of CCE. This is true of many other countries as well (Jacobi et al. 2009; Læssøe et al., 2009).

2.2.1 The future of CCE

At present, CCE is still a peripheral topic in both educational research and practice. In research literature, CCE has been addressed almost exclusively as a domain of science education. Within the realm of practice, climate change is situated within EE and ESD, a minor theme within a peripheral area of the curriculum. Given the intense and growing interest in CCE, however, it is important to anticipate the possible scenarios under which it could develop into a central focus of education, and become an independent concept and focus area, whether labeled as 'climate education' or 'climate change education'. According to Læssøe et al. (2009), there are three different possibilities:

- One scenario is that CCE will develop independently of ESD, becoming a major theme within science education. This tendency is found in the USA, where CCE has so far been interpreted as "education about the scientific understanding of global climate change" (Feinstein, 2009). A similar picture can be seen in China, where CCE is comprised of science popularization activities aimed at raising awareness and motivating students to follow behavioral advice. This seems to be a restricted approach compared to the general ESD policy in China, which is guided by four basic principles: values education, a holistic and interdisciplinary approach, increase of diversity and competence, and creative inquiry (Yi & Wu, 2009).
- Another possibility is that CCE will develop as an integral element of ESD, emerging as a truly interdisciplinary pursuit. This tendency is mentioned in the case of Australia, UK, South Korea and Singapore (Chambers, 2009; Blum & Husbands, 2009; Goh et al., 2009; Kim and Kim, 2009). This interdisciplinary scenario may have different variations due to the fact that ESD is not an exact category. For example CC may be integrated with ESD as part of a Green Growth strategy, or alternatively as an issue which includes global ethics, transformation of lifestyles, social equity, limits to growth and other key topics of sustainable development.
- A third scenario is a hybrid of the first two, in which CCE is treated as an independent element under the umbrella of ESD, with ESD serving as a collective term for a variety of independent focus areas thematically related to sustainable development (SD). This scenario is embodied in the Danish national ESD strategy, which contains a number of CCE initiatives that conspicuously do not place climate change within the context of ESD, seeking instead to promote a general science education (Breiting et al., 2009).

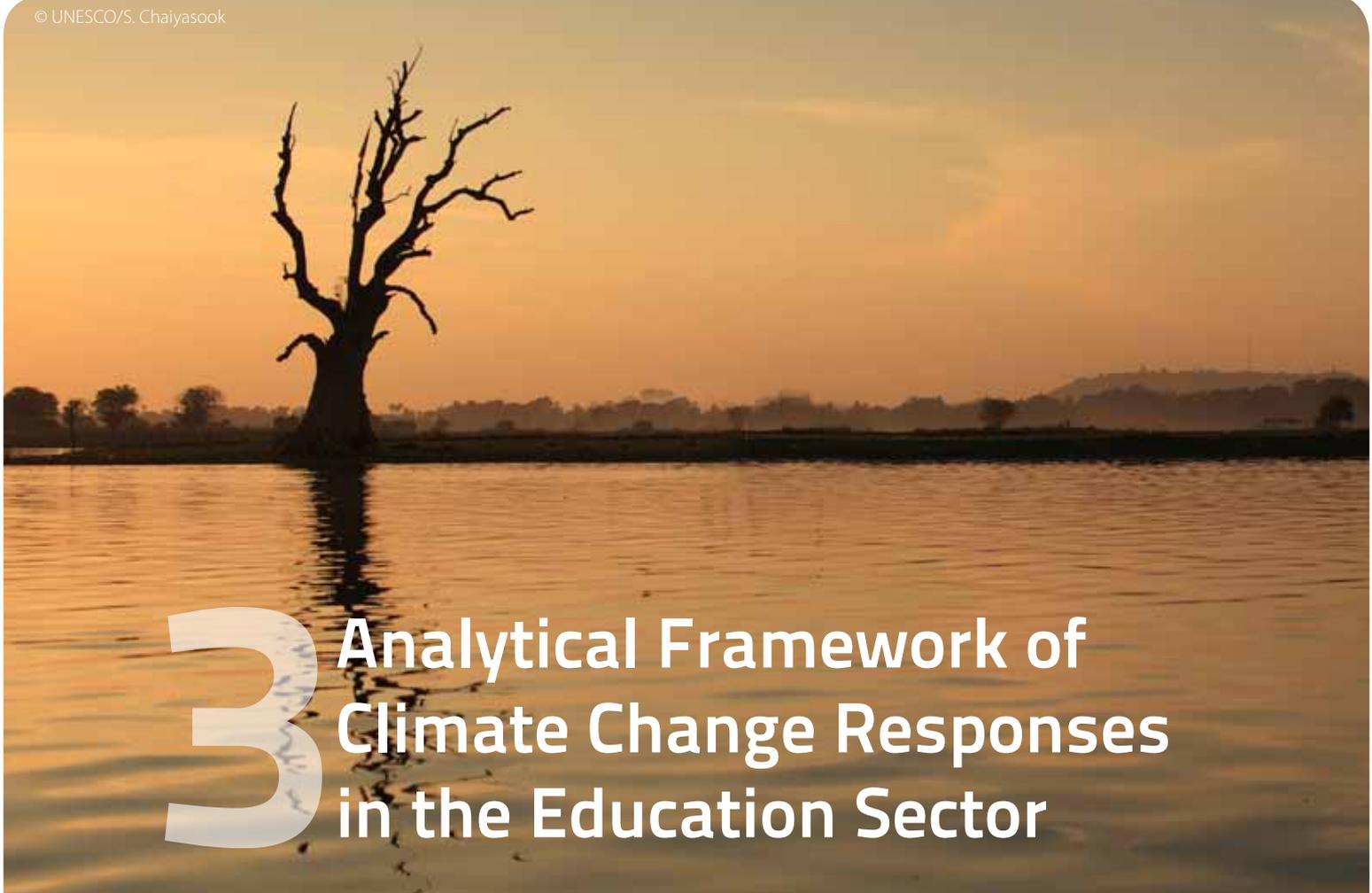
Different stakeholders will prioritize different scenarios and wish to influence outcomes. There are multiple opportunities for intervention. Breiting et al. (2009) note that 'education is conspicuous by its absence' in the recently published Danish national climate policy document. This seems to be true of other countries as well. One reason could be that national climate policy documents target the populace whereas education is within the purview of the Ministry of Education, which is left to translate the national climate policy document into its own curriculum development for schools.

As is especially apparent from the Danish report by Breiting et al. (2009), CCE features various stakeholders – NGOs, teacher networks, consultants, and others - who interpret CCE and influence whether it will be integrated in a broader ESD framework or whether it will imply a re-interpretation of ESD. As the same stakeholders are present in other countries as well, there is good reason to believe that the ongoing international negotiation among them will have a decisive influence on CCE and ESD over the next few years, thereby determining the role that education will play with respect to both climate change and sustainable development more broadly.

Although researchers warn that the emergence of CCE as a key field may represent a step in the wrong direction, this does not mean that the issue of climate change necessarily entails a narrowing of focus to the detriment of other issues currently included within ESD (Læssøe et al., 2009). Indeed, discussions about climate change can give rise to consideration of far-ranging issues such as water shortage, agriculture, energy supplies, class tension, conflicts of interest regarding the distribution of goods, economic growth, political governance, lifestyles, and ethics. Climate change intensifies the challenges within all these areas, while climate mitigation and adaptation will certainly affect such intertwined issues. Seen in this light, the contemporary focus on climate change may be useful for ESD, even from the empowerment perspective. For this to happen, however, CCE must be conceptualized as more than simply climate change science, and CCE must be effectively integrated as a central theme within ESD, rather than an independent field.

2.2.2 The role of research in the development of CCE

During this transitional moment, research in education sectors can play a significant role in shaping the relationship between ESD and CCE. First, researchers can help by clarifying and documenting the existing relationship. Second, research on CCE can fulfill an innovative function, challenging the pervasive assumptions about CCE and deliberately working to bring about dialogue and long-term planning. The nascent field of CCE is currently in need of both clarification and dialogue. A national report from South Africa illustrates the constructive role of research in bridging CCE and ESD. Lotz-Sisitka (2009) describes how climate change requires educators to transcend the local focus of social learning projects by connecting actions in one region to climate consequences in another. Lotz-Sisitka and Le Grange (2009) also point out that the empowerment view of CCE (where people's empowerment to take actions) poses a far greater challenge to the field of education, as it is needed to foster action research with proactive response to the climate change. There is a stark contrast between the enormity of this task and the limited scale of current ESD projects around the world. The urgency and global nature of climate change reveal a pressing need to develop and strengthen ESD, which means that researchers, as well as practitioners and other ESD stakeholders, are faced with an important task in the coming years.



3 Analytical Framework of Climate Change Responses in the Education Sector

Although the role of education in addressing the challenges of climate change is being increasingly recognized¹, the capacity of education to contribute to adaptation and mitigation measures has yet to penetrate mainstream development thinking. In order for this to happen it is argued firstly that the potential of the full range of educational channels – formal and non-formal, and from primary through tertiary and adult education – should be focused on. While recognizing the importance of content-specific concepts such as ecology, we do not see the education sector's response to climate change as simply the provision of new curriculum inputs; rather, the challenges of climate change require all concerned to look to fundamentals and examine the degree to which existing educational provision is adapted to and prepares people for radically different futures. Furthermore, although the focus of this framework is largely on potential education impacts and responses to climate change in developing country contexts, we also recognize the central importance of the exploration of these issues in industrialized countries.

In practical terms, the integration of climate knowledge and skills into existing education systems represents both immediate and longer-term challenges for responding to climate change. The immediate task is to climate proof education systems (adaptation), while the longer term call is to develop education systems that equip learners with the requisite skills, knowledge and attributes to deal with future challenges. In many ways the latter is not new, but is at the heart of the very purpose of both education and development agendas. What has changed, however, is the nature and urgency of the challenges faced – locally, nationally and globally. Table 1 provides a generalized chronological view of the possible sequencing of educational responses.

Article 6 of the UNFCCC directs countries to consider education, training and public awareness as integral to responses to climate change. Increasingly, country plans developed utilizing the UNFCCC framework do incorporate education-specific elements. However, the degree of success of such plans will be determined by the extent to which countries recognize and are able to adequately resource responses to extreme weather events, changes in seasonality, population movements, and demand side and health impacts on enrolment, attendance and educational performance. These challenges will need to be addressed both in terms of educational infrastructure as well as teaching and learning.

1 For example, see recent statements from the G8: http://www.g8italia2009.it/G8/Home/G8-G8_Layout_locale1199882116809_Atti.htm.

Table 1: The possible sequencing of educational responses

| Climate Change Adaptation | | Climate Change Mitigation |
|---------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| School location risk assessment | School/community water catchment systems created | Pedagogy and assessment systems promote higher order thinking in support of sustainable livelihoods |
| Climate proofed school design (e.g. flood and typhoon resistant design) | Incorporate design elements that create improved learning environments (e.g. appropriate levels of natural lighting, sanitation facilities, reduced noise from rain) | Orientation towards new low carbon technologies and sustainability. |
| Education sector adapted to seasonality changes (e.g. in timing of school year, exam calendar, textbook distribution) | Curriculum, assessment and teacher education reforms regarding climate change and disasters | Integrated school interventions that protect cognitive development |
| Disaster preparedness capacity, including to respond to internally displaced children, minimize school disruption, and respond to new migration streams | Increased 'scientific literacy' among students at all levels | Reduced environmental impact of construction and education materials (e.g. minimizing use of burnt bricks and tiles in construction, utilizing more energy efficient cooking apparatus) |
| Climate-related disaster risk reduction teaching and learning in school | | |
| Sharing indigenous knowledge for climate change adaptation | | |

3.1 Climate Change Education Interventions

3.1.1 Climate proofing education infrastructure

Climate change proofing of educational infrastructure in order to minimize the risks and associated costs of weather-related damage is clearly an important starting point. This would entail better risk assessment in making decisions about school location and improved building design and maintenance to better withstand severe weather events (Das, 2008) as well as slower incremental deterioration. This may include building school and community water catchment systems. A concerted focus on school design and upgrading offers opportunities both to reduce environmental impact in terms of material use (e.g. minimizing use of burnt bricks and tiles in construction, utilizing more energy efficient cooking apparatus), and also to incorporate design elements, which create improved learning environments (e.g. levels of natural lighting, sanitation facilities, reduced noise from rain impact, spaces conducive for learning).

3.1.2 Capacity to respond to displacement and migration streams

The impacts of climate change are widely predicted to result in significant population movements. Save the Children's (2008) *Legacy of Disasters* report, for instance, cites an estimate that by 2010 there will be 50 million environmentally displaced people. The scale of such events ranges from short term national population displacement resulting from extreme weather events to wholesale international population movements associated with the inundation of low lying islands. The need to respond to periodic forced in- and out-migration of student populations who are displaced by extreme weather events suggests the need for climate proofed schools in terms of structures and functions, and schools in 'buffer zones' capable of accommodating expanded numbers of students at short notice. In addition to the structural demands of climate proofed schools, such movements present additional challenges in dealing with the functional aspects of schools to meet both the specific educational needs of immigrants (e.g. language of instruction) as well as the potential conflict at classroom and community levels for the usage of the schools during and after the climate events.

In extreme circumstances, such as those potentially facing some low lying islands, as well as in lowland areas like Bangladesh and the coastal areas in the lower Mekong Region, there is a need to make preparations for mass evacuation to mainland areas. In the most severe incidences it is likely that whole lowland region populations will have to evacuate areas that are inundated or become uninhabitable. Investment and preparations are therefore needed to ensure that these populations have the language, skills and qualifications which will assist them in the relocation process, and in re-establishing healthy lives and stable livelihoods in new locations.

3.1.3 Education sector adapted to seasonality changes

In addition to extreme weather events, climate change is also being implicated in changes in seasonality. In most countries seasons have shaped the timing of the school year, and in many developing countries key processes in the management of educational provision have evolved to accommodate associated weather patterns. These include the timing and duration in which school building and maintenance is practicable, the examination cycle and textbook distribution. Similarly, disease incidence (and by implication school attendance) is also known to follow similar patterns. Given the significance of seasonality in many developing countries, school systems will need the capacity to align with the change. Countries with significant regional climatic differences will also need to consider the benefits of decentralized decision making about the timing of key education dates and processes.

3.1.4 Re-orienting teaching and learning

As outlined above, in the context of climate change there is a clear need to reconsider existing approaches to education, and especially their potential to provide learners with education and training that will help them respond to a diverse and rapidly changing world. Educational responses to climate change should not consist solely of adding new 'inputs' to curricula. Addressing climate change also requires the promotion of key areas of knowledge and skills. These will be needed at all levels (primary, secondary, tertiary, and adult education) as well as via diverse modes of delivery (formal, non-formal, and professional development).

A range of specific topics and content areas are needed to address environmental change and impacts, and these may vary significantly depending on particular contexts and needs. However, an indicative outline of key areas of knowledge and skills includes:

a. Knowledge of climate change and wider environmental processes

This includes both specific, content-based knowledge (e.g. climate, deforestation, habitat loss, water cycle, soil erosion, air pollution) as well as awareness of strategies to address pressing environmental concerns (e.g. reducing carbon consumption, encouraging low carbon development, reducing deforestation through sustainable forest management, improving water and waste management).

b. Knowledge of local environmental conditions, associated risks and management strategies

The precise content of this area will depend on local and national contexts and concerns. Possible topics might include: the annual flood cycle and how to manage it; sustainable agricultural methods; existing areas of pollution and potential strategies for improved water, soil and waste management; sustainable forest management; and awareness of valuable endemic species (both flora and fauna) and how to protect them.

Education on climate risks and vulnerabilities, and their increasing trends, as well as options for reducing climate risks are important in creating the required culture for climate change resilience. Public awareness, education, and specific knowledge programs targeted at community, local and national governments and at international levels depending on requirements are also a focus under the theme of knowledge and education. Development interventions, such as compulsory primary education and optional higher education systems, as well as other sectors, such as media, need to be used as vehicles for sharing knowledge and providing education on climate risk reduction.

New knowledge is important to understand vulnerability trends, particularly in the context of climate change. Similarly, local knowledge, especially traditional systems of knowledge, also provides options to engage in sustainable development. It is important that systems of knowledge sharing and education take this into consideration and facilitate effective sharing across levels.

c. Disaster risk reduction (DRR)

This is a relatively new area of work in international development and research in which countries are supported to identify and plan for emergencies, such as natural disasters as well as other environmental risks, such as water contamination, soil erosion, deforestation (leading to landslides), and disease resulting from inappropriate waste disposal. The underlying idea is that hazards only become disasters if society is unable to cope with the ensuing disaster risks and impacts; thus, the goal of DRR is to increase society's risk response capacity and reduce their vulnerabilities. The focus of DRR is frequently based at the community level, for which a full range of tools and methodologies has been developed for community-based DRR, including community disaster committees, community evacuation and rescue plans, and local first-aid training (Chambers, 2002; Maceda et al., 2009; Mercer, 2010; ProVention Consortium, 2006; Twigg, 2007). Recent research suggests that these participatory strategies can have a considerable impact on community health and well-being².

While DRR has been quite community focused, CCA experience generally stems from global policy agendas, rather than DRR's practical implementation (Thomalla et al., 2006; Tearfund, 2008). Whilst global policies are essential in guiding practical action, policy and action at the community level where climate change effects are being experienced are urgently required (DFID, 2005; Schipper and Pelling, 2006; Shea, 2001; UNDP, 2004; UNFCCC, 2007).

It would therefore appear more effective, financially and otherwise, to embed CCA within existing DRR tools. CCA strategies at the community level are similar to, if not the same as, DRR strategies. In addition, many indigenous communities have coped effectively with climatic extremes for centuries, albeit with losses at times. Whilst today's rate of change may be reducing the viability of indigenous knowledge, it should still be considered a valuable resource to draw upon for devising new technologies or techniques for CCA (Anchorage Declaration, 2009; Campbell, 2006; Gaillard, 2007; Shea, 2003). For example, the integration of indigenous and scientific knowledge may strengthen the ability of indigenous communities to cope with climate change, whilst retaining their traditional practices (Kelman et al., 2009; Mercer et al., 2008, 2009, 2010).

It is agreed that most DRR actions can contribute to CCA. However, there is no mechanism to transfer these actions for CCA. Therefore, the education sector can play a major role in transferring the experiences of DRR to climate change response. Based on this analysis, we propose a framework in which climate change adaptation actions are classified based on the five priority areas of Hyogo Framework for Action (HFA): HFA 1: institutionalization, HFA 2: risk assessment, HFA 3: capacity building, HFA 4: vulnerability reduction, and HFA 5: emergency response (education in emergency). See Table 2.

² See, for example, work by children in a climate change initiative (<http://www.childreninachangingclimate.org/default.php>)

Table 2: Framework for analyzing international examples of responding to climate change in education sector

| | Formal Education | | | Non-formal/Informal Education | | |
|-----------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------|-------------------------------|----------------------|---------------------------|
| | School | Higher education (college/university) | Research | Adult education | Vocubulary education | Indigenous Knowledge (IK) |
|  | <p>Specific adaptation actions based on the five priority areas of the Hyogo Framework for Action (HFA: 2005-2015): HFA1: institutionalization, HFA 2: risk assessment, HFA 3: capacity building, HFA 4: vulnerability reduction, and HFA 5: emergency response (education in emergency).</p> <p>Based on the location, hazard intensity is different. Therefore, specific actions (for typhoons, flood, drought, earthquake, tsunami and landslides) can be proposed in the action plan.</p> <p>It can have two components: on education, there can be 3R education or KIDS ISO education (focusing on ISO 14,000 for the kids).</p> <p>For the infrastructure parts, it can focus on standards/guidelines of: Building materials, Energy, Water, Waste, Sanitation, and 3R systems in the school. This can be used for existing schools (through eco-retrofitting) or can be included in the building codes for new schools.</p> <p>The eco-school concept can be a very good tool for a pilot demonstration.</p> | | | | | |



4 Climate Change Response in the Education Sector: International Examples³

A number of successful practices have emerged that address different aspects of climate change adaptation and mitigation, including in economically very poor regions. They are successful because they use indigenous knowledge and innovation, involve women and children in a meaningful manner and make the best use of available resources and experience. Despite having features specific to the socio-cultural contexts of the areas where they originate, most practices can be adapted and replicated outside their original milieu, benefitting many more people.

Based on the analytical framework presented above, this section will present a variety of good practices to respond to climate change (also see Appendix 1, Table 3).

4.1 Solar Schools in Australia⁴

Climate change education is a relatively new field in Australia. In July 2008 the Australian Association for Environmental Education applied pressure to the Federal Government to improve its practices to educate people about climate change. Climate change education is generally incorporated into ESD and not treated as a separate field. The National Solar School Initiative is a major ESD program that has climate change mitigation as an element. This initiative began in July 2008 and replaced the previous 'Green Vouchers' scheme.

Through the National Solar Schools Initiative, schools are eligible to apply for grants of up to AUD\$50,000 for a range of energy and water efficiency measures including: installation of a minimum 2 kilowatt solar panel; energy efficient lighting; sky lights; shade awnings; and water collection systems (solar hot water systems and rainwater tanks).

³ Examples are summarized in Appendix 1, Table 3. Summary of international experiences.

⁴ See more details at Chambers, Dianne (2009): Sustainable development: The response from education - Australian country report, Melbourne Graduate School of Education, Australia.

The objectives of the scheme are to allow schools to:

- generate their own electricity from renewable sources;
- improve their energy efficiency and reduce their energy consumption;
- adapt to climate change by making use of rain water collected from school roofs;
- provide educational benefits for schools students and their communities; and
- support the growth of the renewable energy industry.

A goal is for all Australian schools to be solar schools by 2016. Educational outcomes are seen as an important aspect of this initiative, supplementing the environmental benefits of reduced greenhouse gas production and stimulation of the national renewable energy industry.

It has been claimed that “while green schools cost two percent more to build, the financial benefits were far greater than this initial cost”(Dianne, 2009). Furthermore, green schools are extraordinarily cost effective in enhancing student learning, and reducing health and operational expenses.

4.2 Cross-Sectoral Programs in Republic of Korea⁵

In south Korea, climate change has been considered as a key theme of ESD and has been included in school topics and subjects, such as: climate (geography), energy (science) and global warming (environment). However, a national curriculum or guideline for CCE has not yet been established.

Korea is striving to better inform and educate its public about global warming and climate change to achieve a national consensus on the country's commitment to international climate change efforts. Many national agendas have been set to encourage industries and individuals to voluntarily take part in these initiatives. Systemic educational programs on climate change inform the public about the adverse effects of climate change and propose preventive measures . By educating children and youth at their early stage about the important role they can play in preserving the environment, they can carry into their adulthood a changed perspective and attitude to make a lasting and positive impact on future greenhouse gas reduction.

To that effect, the government has promoted several activities in the education sector. The environment is being instituted as an independent subject in secondary school curriculum to ensure systematized education concerning energy, climate change and other environment issues. At the primary school level, the environment is introduced within each subject. The Korean government has also encouraged relevant agencies to modify or add entries to textbooks regarding climate change and green growth.

The government is also providing grants to 32 primary schools and junior high schools nationwide that have been designated as “research schools for energy conservation education”. Government approved textbooks are put together and distributed to schools for use during discretionary activities hours where schools can develop educational programs on energy conservation and climate change, both during classes and extracurricular activities. Further programs include energy conservation field trips, lectures and community campaigns..

In addition to activities geared towards young learners, Korea is addressing the goals of the UNFCCC through curriculum of education and training courses for personnel in relevant fields including those in charge of energy management industries, especially the construction sector, and regional government workers who are responsible for energy management. These programs include:

- Educational programs on the cause of climate change and atmospheric pollution for those in fields related to hazard prevention, weather and environment.
- Over 500 science teachers in primary and secondary schools attended the annual “weather education program for science teachers” to better understand the mechanism and cause of climate change.
- The “weather education program for women” provides homemakers with an opportunity to expand their knowledge on climate change by learning what climate change is and how it occurs.

⁵ See full report from Kim, Jong Wook & Chankook Kim (2009): National Report for the project ‘Climate Change and Sustainable Development – The Response from Education’. College of Education, Seoul National University, Korea.

4.3 Provincial Policy Making in Canada⁶

Newfoundland and Labrador was one of the first Canadian jurisdictions to develop a policy to directly address the issues of climate change, with a Climate Change Action Plan in 2005. In the plan, the province acknowledged that climate change is a serious issue and that concerted efforts are needed to reduce greenhouse gas emissions. The vulnerability of Newfoundland and Labrador to the possible impacts of climate change, especially rising sea levels and the destruction of natural ecosystems, seemed particularly salient to the provincial government's interests. The plan outlines government departments' commitments for reducing climate change risks, and affirms the role of education:

"The importance of education in addressing climate change cannot be stated enough. Education on this issue has to be broad enough to include all aspects of this phenomenon: science, direct and indirect impacts (biophysical, social, economic and health), measures for reducing greenhouse gas emissions and measures to adapt to a changing climate."

Furthermore, the plan promises continued support and funding to the Newfoundland and Labrador Climate Change Education Center, which is part of a national network of public education and outreach hubs. The Center's work focuses on educating the public about greenhouse gas emission reduction measures and encourages actions to reduce personal emissions. Extended funding to the Center is expected to assist with program development and expansion of public education efforts. The Plan is described as complementary with the government's ongoing policy objectives and commitment to sustainable development. It is important to note that although the plan endorses increased public education it does not specifically address CCE in formal education settings.

Nonetheless, the provincial department of education has also developed a specialized secondary environmental science course, where climate change is an important issue incorporated throughout. This course is unique in that it takes an issues-based approach to the province's most pressing environmental locating these challenges globally, nationally and locally. It provides extensive local information and detailed contextualized teaching strategies.

Newfoundland and Labrador presents an example where CCE is at the forefront of ESD policies and plans, and the two topics seem to be rapidly finding their way into school curriculum. Although it is difficult to fully explain why this change is being so speedily effected in Newfoundland and Labrador as opposed to the slower uptake in other provinces, the strong provincial recognition of these issues' relevance to local interests may be a contributing factor. Both the provincial government and citizens seem to have accepted that sustainable development and climate change are important and need to be addressed urgently. If this is the case, then one of the reasons for the failure of ESD and CCE in other places may stem from a lack of deep engagement of the public and government. One way to strengthen ESD and CCE efforts in formal education settings may lie in demonstrating to all stakeholders (teachers, students and educational personnel) that these urgent issues are locally and personally relevant.

Another point of interest in Newfoundland and Labrador is the multi-dimensional incorporation of both cross-curricular and specialized courses. The concepts of ESD and CCE are infused into all subjects and at all levels of school curricular, so all students are exposed to the concepts of sustainable development and climate change at various stages in their formal education. The issues are presented as complex, overarching ideas important to all aspects of life; ESD is presented as developmental, growing in complexity and in tandem with students' own cognitive growth. Such spiral curricula seek to build understanding of complex concepts overtime in developmentally appropriate ways. A dedicated course for older students allows them to engage in detailed inquiries into the provinces' most pressing problems, one of which is climate change.

⁶ See full report from Nazir, J., Pedretti, E., Wallace, J., Montemurro, D. and Inwood, H. (2009): Climate Change and Sustainable Development: The Response from Education. The Canadian Perspective. Centre for Science, Mathematics and Technology Education, Ontario Institute for Studies in Education, University of Toronto, Canada.

4.4 Eco-Schools in Japan⁷

Since 1997 several ministries in Japan have collaborated on an eco-school program, established to promote environmentally friendly design and construction by equipping both newly constructed and renovated school buildings with ecological features such as photovoltaic cells, solar thermal collectors, other new energy sources, use of wood, roof-top gardening and rainwater recycling. An eco-school comprises:

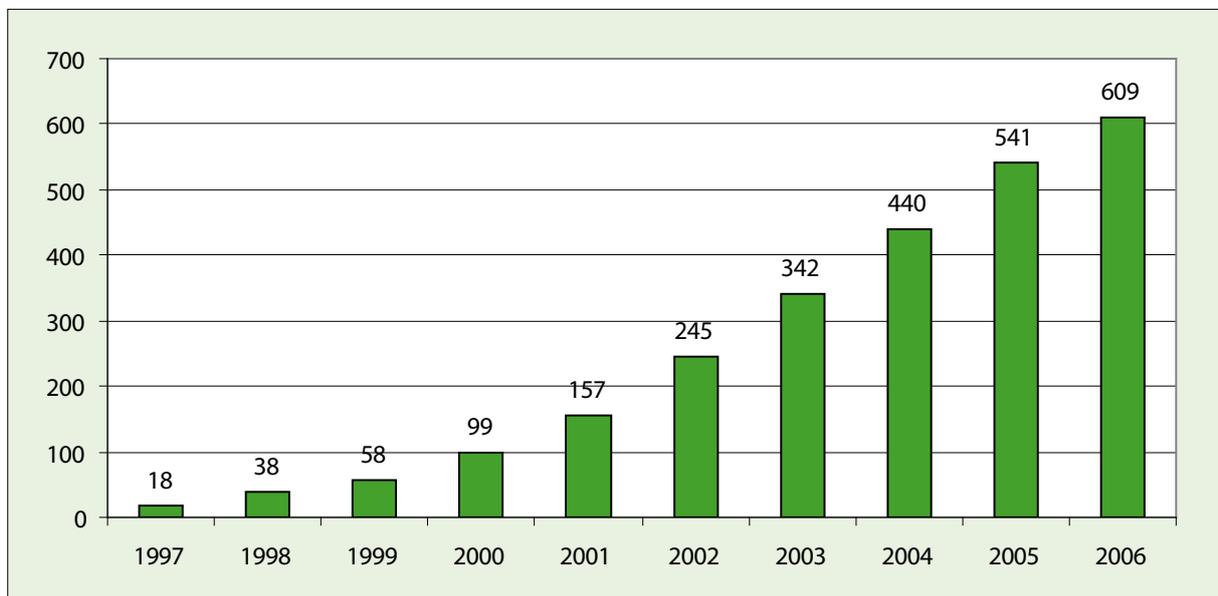
- Facilities: environmentally friendly design and construction;
- Operations: intelligent and extended use; and
- Education: benefits for learning (Ministry of Education, Culture, Sports, Science and Technology (MEXT), March 1996).

Through subsidies or grants, the government encourages local education authorities to build and renovate environmentally friendly school buildings and to operate them in ways that are more intelligent and that extend the use of materials. The program also promotes using the buildings themselves as practical teaching materials for environmental education.

A pilot project, the eco-school program was created within an inter-ministerial cooperation framework. Currently, the following four ministries work together to implement and subsidize the program: Ministry of Education, Culture, Sports, Science and Technology (MEXT); Ministry of Agriculture, Forestry and Fisheries; Ministry of Economy, Trade and Industry; Ministry of the Environment.

Since the program began, more than 600 eco-schools have been built with financial assistance from the ministries. As shown in Figure 1, the steady increase in these schools can perhaps be attributed to the growing interest of local education authorities in environmentally friendly design and construction. In line with their interest and with today's public concern about the global environment, Japan is considering applying the concept of the eco-school to planning school buildings in general.

Figure 1: Total number of eco-schools funded during the 1997-2006 financial years



In order to expand the eco-school concept, the government is planning a study by experts from various fields who will review the schools currently in the program to derive key elements from the most successful models. They will consider how to introduce these elements into other school buildings across the country, including new constructions and those undergoing major renovations. They will also look into other buildings' daily operations, maintenance, repairs, etc.

⁷ <http://www.oecd.org/dataoecd/36/62/39344177.pdf>

4.5 Schools as Shelters: Experiences from Bangladesh and India⁸

In Bangladesh, the construction of cyclone shelters was initiated in the 1960s, and in the 1990s a major program was undertaken for construction of cyclone shelters along coastal areas. Supported by a formidable early warning system and thousands of volunteers, these shelters have reduced the loss of lives by providing safe havens for the population during cyclones.

Cyclone shelters, although useful in saving lives during cyclones and storm surges, can be further effective if their use at non-emergency times is determined appropriately. A shelter that is in constant use, is likely to have proper maintenance. Extending their use as classrooms is perhaps one of the best ways to ensure this. A good model that has emerged in India, is of schools that serve as multipurpose disaster shelters. These shelters also support community training and livelihood programs during non-emergency times, functioning as schools, health and community centers.

In India, for example, local communities have mixed attitudes towards disaster shelters due to their often poor conditions. While most acknowledge that shelters are necessary and important, many are averse to using the shelters present in their villages due to their poor upkeep, which creates doubts about their structural strength. Cyclone shelters that have weathered over the years show signs of decay such as peeling plaster and crumbling ledges. Thus, people fear that the shelter itself may collapse and cause them harm. Thus, the use of cyclone shelters as multi-purpose community buildings is essential in order to attain maximum utilization, as well as to keep their structural strength intact through ongoing maintenance. Schools are an appropriate function, as they are used almost on a daily basis; furthermore, they contribute to education development priorities by providing more education facilities. However, sufficient budget allocations must be made when designating shelters as multi-purpose buildings.

Besides, the shelters need to be maintained so as to keep their structural strength intact. Shelters need to be safe, and they need to look safe. One of the best ways for achieving this is to make them as multi-purpose buildings, housing other functions that will keep the facilities in use and well maintained throughout the year. A good model that has emerged in India is of school cum multipurpose disaster shelters. These shelters also support community training and livelihood programs during normal times.

4.6 Indigenous Knowledge in Assam, India

In India the people of Nandeswar, Assam have successfully conserved soil and water through planting bamboo. This simple yet efficient technique helps protect embankments from being breached and prevents rapid run-off from the river when it overflows. Bamboo planted around fishponds and paddy fields also prevents soil erosion and road damage. Thus, in addition to their traditional use for construction, crafts and paper making, bamboo also helps reduce the flood-induced damages. As this plant is common in many countries, this experience can be applied beneficially beyond the boundaries of Assam.

4.7 Gender Responsive Participation in Sri Lanka

In Sri Lanka, women in marginalized communities have taken an active part in the planning of an integrated program for drought risk reduction, better land use and water management with the aim to improve livelihoods. Women and men both worked on planning and deciding the ways each household would contribute and benefit, and both were involved in identifying the crops, trees and making land use plans which would increase resistance to drought. With decades of practical experience in managing their environment and knowledge of how climate change-related hazards affect them, they have used their knowledge and experience to work out locally appropriate strategies. The process of capacity building and empowerment has allowed women and men to take responsibility for the work being done. The process of social mobilization, particularly of women as equal and responsible partners, has enabled the communities to improve and diversify their livelihoods, taking measures that both sustain their survival, and decrease the risk of drought and landslides. In addition to employing traditional knowledge, the program in Sri Lanka also benefited from increased women's participation.

⁸ See more details at SEEDS Asia (2010). A guiding Note on School as Shelter: Potentials and Challenges. Kobe Japan.

4.8 Disaster Risk Reduction Mainstreamed into School Curricula: Lessons from Madagascar⁹

The Project “I Protect My Country from Natural Disasters” was implemented from April to October 2006 by the National Office for Disaster Risk Management (BNGRC) in close cooperation with the Malagasy Ministry of National Education and Scientific Research. The Project was part of ongoing efforts to mainstream DRR into school curricula in Africa. Such efforts were recommended during a UN/ISDR Africa regional consultative meeting held in Kenya in March 2006, attended by Ministry of Education officials from 19 African countries. The workshop recommended that knowledge acquired during the workshop be shared with primary and secondary school teachers. In line with that recommendation, selected local government officials and teachers were trained in Madagascar, a student manual and a teacher guide on DRR were developed, and DRR was mainstreamed into school curricula.

The Project was implemented by the BNGRC in close collaboration with the Ministry of National Education and Scientific Research. Additional implementing partners were: the Ministry of Interior (through the local government officials mentioned above), the Ministry of Transport and Meteorology, UNESCO, UNICEF and UN/ISDR Africa, and curricula developers, professional illustrators, and teachers. Their respective roles were:

- The BNGRC facilitated the entire process, the training and necessary drills (to demonstrate some practices), and promoted the idea of developing all-reader-friendly textbooks and mainstreaming DRR into school curricula;
- The Ministry of Education and Scientific Research worked on mainstreaming DRR into school curricula, examining approaches in light of the existing national curricula, and provided support to the design and development of the students’ manual and teachers’ guide;
- The Ministry of Transport and Meteorology, through the National Meteorological Service, provided expertise on cyclone, drought, and floods and supported the design and development of the students’ manual and teachers’ guide;
- Local government officials from three cyclone-prone east coast regions, curricula developers from the Ministry of Education, and journalists were trained on DRR in order to draft some of the basic contents of the manuals;
- The curricula developers, professional illustrators, and teachers developed the contents and illustrations for the two manuals; and
- UNESCO and UNICEF supported the printing of the two publications, and UN/ISDR Africa provided technical advice and financial support.

The Project was an effort to implement the Hyogo Framework for Action, Priority for Action 3: “Using knowledge, innovation and education to build a culture of safety and resilience at all levels”. More importantly, the Project helped mainstream DRR into the school curricula, a crucial step towards institutionalizing DRR in society. This was a major objective pursued by the ongoing World Disaster Reduction Campaign 2006-2007 under the theme “Disaster Risk Reduction Begins at School”.

The Project achieved several objectives in a single initiative: (1) raising awareness of DRR among teachers and local government officials from disaster-prone areas; (2) training the teachers on the DRR concept and related activities; (3) developing a students’ manual and teachers’ guide; and (4) mainstreaming DRR into the school curricula.

The process of developing the two manuals and mainstreaming DRR into school curricula involved nine stages that were implemented from April to mid October 2006. The two manuals were developed through a participatory approach involving various stakeholders. The students’ manual explains how to react before, during and after a disaster event with explanations of simple community DRR measures for seven major hazards in the country: cyclones, earthquakes, volcanic eruptions, tsunamis, floods, fires and famine. The teacher’s guide provides guiding questions related to various risks in Madagascar. Both manuals are in Malagasy, the country’s national language.

⁹ See the report at: http://www.unisdr.org/eng/about_isdr/isdr-publications/11-education-good-practices/education-good-practices.pdf

The Project benefited school students, teachers, officials from the Ministry of National Education and Scientific Research and local government officials from three cyclone-prone east coast regions directly. It is expected that through these direct beneficiaries the Project will also enhance their parents', relatives' and communities' knowledge – including that of school dropouts - on how to react before, during and after a disaster event.

This program is a clear example of how various actors can work together and contribute to climate change adaptation via disaster risk reduction. For Madagascar, as island country, climate change has a strong implication in terms of enhancing disaster risks. Therefore, DRR education in school is the first step for adaptation to climate change, which, in turn, leads to climate change education.

4.9 Asian University Network of Environment and Disaster Management

Support for DRR and CCA education at university level can complement efforts to mainstream DRR and CC education at primary and secondary levels. Kyoto University is providing assistance in this area through the Asian University Network for Environment and Disaster Management (AUEDM). Under this unique initiative, 18 universities from 13 countries have come together to share knowledge resources, advocate for policy change, and develop guidelines related to environment and disaster risk management. Prominent Asian universities are sharing information with stakeholders working on these issues beyond their national and thematic boundaries.

AUEDM partners jointly conduct research, share findings and find ways forward on these key issues in the Asia-Pacific, a part of the world that is increasingly at threat due to rising disaster events and climate change impacts. AUEDM also works closely with governments, corporations, international agencies and civil society organizations to establish collaborations that eventually lead to reduction of risk for the most vulnerable communities. AUEDM reflects members' commitment to implementation oriented education and research in the field of environment and disaster risk reduction. The objectives of AUEDM are to:

- Share and work together (bilaterally or multilaterally) in promoting environment and disaster management in higher education (focusing on, but not limited to, post-graduate education);
- Seek possibilities of mutual collaboration on field-based action research (focusing on, but not limited to, climate change adaptation);
- Broaden the scope of education and learning in the environment and disaster management field through collaboration with other stakeholders, such as NGOs and local governments; and
- Document and publish knowledge products in the field of environment and disaster management.

The focus of the AUEDM is to present an opportunity for graduates from a variety of disciplines to expand their experiences through a combined program of taught and research components. Compulsory field work/research is the means of gaining first-hand knowledge and allows for deeper insight into the issues associated with risk and vulnerability assessment, preparedness, response, recovery, reconstruction, rehabilitation, development and the enhancement of community capacity in a broad range of disaster scenarios. Fieldwork plays a fundamental role in the teaching of disaster management and climate change adaptation in lessons through which students acquire practical skills, relevant beyond the classroom, such as observation; experimentation and investigation; problem solving; cooperation; communication and decision making.

4.10 Kids' ISO 14000 Program

It is important for children to learn about natural and man-made phenomena, including their causes and how they can participate in response, mitigation and adaptation efforts. Given the human impact on the increasing frequency and intensity of disasters, it is crucial to encourage children to develop environmentally sustainable behaviors as individuals and as a group.

Furthermore, it is vital for humans to understand their relationship to both local and global considerations. In the case of climate change, countries must work together to reduce greenhouse gas emissions in order to reduce global warming. Thus, environmental education for children should include the following:

- Develop children's sensitivity towards the environment, and an increase in their environmental awareness;
- Develop their understanding of the natural processes and the concept of sustainability;
- Develop their understanding of the impact of human activity on nature and how to reduce negative impacts; and
- Provide children with opportunities to practice working together locally and globally on environmental issues.

The "Kids' EMS Program" was initiated by ArTech, Japan in 2000, and following an agreement between ArTech and ISO, the program is now called the "Kids' ISO 14000 Program". By 2005, more than 100,000 children had participated in the program, which is expanding internationally through the work of UN organizations such as UNU, UNEP and UNESCO, and international organizations such as ISO. The "Kids' ISO 14000" Program is an environmental education program with the following goals:

- To stimulate environmental awareness of children;
- To teach and promote active use of environmental management methodologies with children, such as the Plan-Do-Check-Act cycle; and
- To provide children with experiences to work together locally and globally through group networks.

It is possible and necessary to build synergies between such programs as the "Kids' ISO 14000" and other education activities in the formal, non-formal and informal education sectors. One of the by-products of the Kids' ISO 14000 Program is the increased environmental awareness of children's families through the activities of children in the home.

4.11 Sandwatch

Sandwatch is a grassroots network of schools and community groups working together to monitor and conserve local beaches and near shore environments, and to build these communities' resilience to climate change. Coordinated by a non-profit, The Sandwatch Foundation, the network started in the Caribbean in 1999 and has become an inter-regional activity involving islands as far apart as Cook Islands in the Pacific, Seychelles in the Indian Ocean, and the Bahamas in the Caribbean as well as countries in Europe, Africa, Asia and South America. Sandwatch is supported by UNESCO through its education and science sectors, and has received support from the University of Puerto Rico's Sea Grant College Program as well as many national organizations, both governmental and non-governmental.

Sandwatch seeks to modify the lifestyle and habits of children, youth and adults on a community-wide basis, and to develop awareness of the fragile nature of the marine and coastal environment and the need to use it wisely. It is an educational process through which school students and community members learn and work together to critically evaluate the problems and conflicts facing their beach environments and to develop sustainable approaches to address these issues. With a strong field monitoring component, Sandwatch tries to make science 'live' while remaining inter-disciplinary with applications ranging from biology to woodwork, and from poetry to mathematics.

Each Sandwatch school or group adopts a local beach and regularly takes a series of measurements and tests of their beach using simple and readily available equipment. By measuring how the beach width, currents, waves, water quality and other factors change over time, ideally over more than a year, teams

can determine whether their beach is stable and healthy or stressed and deteriorating, and the nature of the stressors. A Sandwatch climate change database, presently under design, is intended to provide an inventory of beach data against which climate change impacts can be assessed from 2010 onwards.

When a group identifies a problem it can, with the community, develop a project to address and mitigate challenges. Project activities include alerting the media to potential problems such as water contamination (from sewage or agricultural runoff for example), conducting beach clean-ups, replanting mangroves or dune stabilization vegetation, creating signage for proper beach use, monitoring and protecting marine turtle nesting sites, or monitoring the effects of coral bleaching. By keeping the beach and related ecosystems healthy they are made more resilient and better able to adapt to climate change.

All Sandwatch groups are encouraged to regularly post their data, photographs and other project details on the Sandwatch website¹⁰, as well as to contribute articles and photographs to the Foundation's news journal, *The Sandwatcher*, which is published several times each year in English, Spanish and French.

Sandwatch representatives from each country are also invited to participate in regional and international workshops and conferences, where they share their experiences and data and forge partnerships with similar environmental groups. Video conferences and contests between teams are also regularly held to promote the charity's activities. In 2008 the Fiji government endorsed a Sandwatch video competition, citing the cause of combating climate change as a national responsibility.

¹⁰ <http://www.sandwatch.ca/>

5 Conclusion and Way Forward

5.1 Challenge of Climate Change Responses in The Education Sector

Education sector responses to climate change are in early stages, and building a culture of climate resilience at all levels is a long-term strategy. CCE is a critical link in the construction of this new culture. This section discusses the key challenges and gaps along three main lines: (i) inclusive integration of CC responses into school education; (ii) strengthening CCE for community resilience; (iii) climate proofing education infrastructure; and (iv) empowering children for responding to climate change.

5.1.1 Inclusive integration of CC responses into school education

Integrating climate change response (CCR) into school education is a complex endeavor that requires strong national political will, a systematic approach and sustained action. The institutional and technical capacity in many countries is still weak, and the financial resources needed to build these capacities are limited. In addition, there is resistance to incorporating climate change materials on the grounds that the formal curriculum is already heavily charged.

Indicators of performance and effectiveness of the CC curriculum, which would serve as valuable benchmarks for implementation, are also lacking. There is a need to reach consensus on what these indicators should be. In addition, reaching staff and children with disabilities in most countries remains a huge challenge. Learning materials, teacher training, teaching methods, extra-curricular activities have yet to take into account their special needs. Arbeiter-Samariter-Bund (ASB), Indonesia, is the only organization that has reported assisting disaster risk reduction and climate change adaptation education activities for children with disabilities. It supports the development of materials for children and teachers, including special teaching materials for deaf and blind students. ASB also maps school hazards, develops action plans and conducts drills. Many more activities like these, and the support of more organizations, are needed to address the needs of children with disabilities.

Similarly, gaps exist with regard to materials and methodologies to assess the socioeconomic impact of climate-induced disasters and programs for out-of-school children. These include working children, very poor children whose families cannot afford their education, and those who for other reasons are not part of the formal education system. The majority are still left out of school-based activities, and often from community-based programs as well. Children of primary school age who are out-of-school will continue to be especially vulnerable to climate risks unless they are featured in a strategy and program for CCE.

Effective informal CCE and other outreach methods need to be designed so that children who are not part of the school system have the opportunity to reduce their vulnerability and enhance their resilience. These vulnerable groups are not part of climate change education efforts reviewed by this study, probably for lack of reporting guidelines in this area. In any case, the inclusion of vulnerable populations in CCE activities remains a recognized yet persisting challenge.

5.1.2 Strengthening CCE for community resilience

The key to effecting significant behavioral change and building community resilience is public ownership of CCE programs. Essential elements in this endeavour include participatory mechanisms, recognition of the role of women, a bottom-up approach and the quantitative and qualitative upgrade of community-based projects. At the moment gaps exist in all these areas.

Community-focused projects should incorporate consistent participatory mechanisms. Local authorities, community leaders and members, project facilitators, all need to be given the opportunity to be genuine participants of CCE programs, from planning and implementation, to monitoring and evaluation. It is important to bring about a shift of people's mentality from dependency on government relief to self-reliance and preparedness. Engaging participation of all community members, especially women, poor and vulnerable people, is encouraged. Effective channels for bottom-up communication from schools and communities to the policy-making authorities at the national levels are essential, but are still lacking in many cases.

Indigenous knowledge and local good practices have also not been sufficiently incorporated in community based activities. They either have not been disseminated widely outside their original milieu or not sufficiently used. There is little evidence that the rich local knowledge of the environment and good practices in CCR are being sought in CCE programs.

This review reveals that top-down approaches in CCE programs are commonplace. In some countries this approach is cited as a key factor behind the passive participation of the communities in the CCR activities (Alias et al. 2009). There is no doubt that national political commitment and nationally initiated programs provide an enabling environment and impetus for CCR programs. However, they are not sufficient for raising public consciousness on climate risks, or for changing mindsets to adopting behaviors that promote climate resilience. Top-down approaches need to be complemented by bottom-up methods, and the views and participation of ordinary citizens sought and valued. Considerable gaps remain in implementing the kinds of activities that build individual and community resilience and mobilize their participation in climate change adaptation, and mitigation planning and implementation.

There are, however, challenges in the actual implementation of bottom-up methods. Involving community members in the processes is time-consuming, while community expectations of quick results and impact are often unrealistic. Effective community mobilization also requires particular skills, but often there are insufficient qualified human resources. The experience of Bangladesh shows that progress in mobilizing people's action also depends on whether awareness-raising programs succeed in addressing the audience as a heterogeneous group, and how messages on CC are tailored to different situations.

Moreover the community-focused projects on climate change adaptation are still relatively few. Where they have been reported, the projects, including those supported by civil society organizations, tend to be limited in coverage and are not necessarily part of a coherent national CCR program. Compared to initiatives at the national level, insufficient attention has been given to community-level and community-led action, with the result that formal and non-formal activities are not yet integrated. As responsibilities for these programs often fall on different agencies, the tendency has been that each is designed and implemented separately from the other. Much remains to be done to dovetail formal and non-formal

education strategies, so that programs are mutually supportive. Additional issues include weak vertical and horizontal coordination. Community sensitization programs have yet to emphasize behavior change communication, a strategy that enables awareness-raising activities to lead to changes in behavior and increased community action

Currently the level of community awareness on climate change adaptation and mitigation is generally low. Some countries outperform in this aspect (Australia, Islamic Republic of Iran, Republic of Korea, and New Zealand) where community programs are implemented systematically. In others, public awareness activities tend to be more sporadic, relatively small in scope and inadequate to reach the masses and all climate risk areas. Materials for public awareness activities and their dissemination are still limited in quantity, content and their target distribution. On one hand, this is due to the factors mentioned above. On the other hand, it is also due to the lack of an institutional mechanism and in some cases low commitment.

5.1.3 Climate proofing education infrastructure

With regard to structural aspects, a commitment to ensuring school safety has been expressed by policy makers. However the challenge lies in the translation of this political commitment into reality. The need for climate proofing schools is huge. It requires significant investment both in financial and human resources, although such investments produce higher returns in the long run.

The ongoing projects that produce school safety manuals and guidelines, train engineers and construction workers, and retrofit and build climate resilient schools, are providing valuable assistance. However, they are still drops in the ocean compared to the scale of demand. Advocacy for resources to make schools safe needs to be intensified. Human resource development could be complemented by the creation of mobile national teams that can be deployed in different locations, applying both new techniques and proven effective local practices. Pools of volunteers can be formed, trained and mobilized for scaling up climate proofing education infrastructure.

Climate proofing schools intend to make education facilities safe for all children and staff. But in most countries school construction standards have yet to be updated to take into account climate risks and to reflect the climate proofing standards. Moreover, the special requirements for children with disabilities are seldom taken into account.

5.1.4 Empowering children to respond to climate change

Mobilizing children in CCE programs, encouraging child-led initiatives both in and out of school and at the community level is an area where major gaps persist. Programs are still designed mainly for children, rather than with them. Despite much advocacy on the benefit and necessity of children's genuine participation in the development of climate change-related initiatives, there are still few child-led CCR activities. Children's meaningful participation, based on their evolving capacity, has been proven effective in their learning in both formal and non-formal education programs. Regrettably, progress in tapping into such potential for CCE has been insignificant. And fundamentally, regardless of the degree of effectiveness, participation is a civic right, not an option that can be denied to children.

Program experience has long shown that when children are genuine partners they are among the most effective change agents and the most reliable agents for sustaining change. There is no evidence that children have taken an active part in the design of activities, or given their views and suggestions on content areas or on teaching methods. There is also little evidence of investment in the expansion of children's knowledge and skills. Gaps remain in the creation of opportunities for establishing children's councils or parliaments to foster child-based advocacy and decision making. These are effective mechanisms for mobilizing children, and have showed their added value in other contexts (UNISDR 2009), such as in promoting whole school improvement, school attendance, child health and protection, and reducing gender inequality.

5.2 Conclusion

Climate change will significantly impact upon the education sector, and education in its broadest sense has a critical role to play in response. Education supports environments of innovation and capacity building associated with technological transfer. As Sir Nicholas Stern (2007) noted in his report, Stern Review of the Economics of Climate Change:

“Fostering a shared understanding of the nature of climate change, and its consequences is critical in shaping behavior, as well as in underpinning national and international action. Educating those currently at school about climate change will help shape and sustain future policy making, and a broad public and international debate will support today’s policy makers in taking strong action now.”

However, the pressing nature of climate change requires educational responses that go beyond the simple provision of new curriculum content. Reflection is also needed regarding the relative emphasis placed on educational access and schooling, as opposed to what is actually learned in classrooms and the degree to which learning equips and empowers people to deal with rapid change. This will in turn require the development of sound pedagogical approaches, curricula, and assessment strategies, as well as of conducive learning environments both inside and outside of educational institutions.

Furthermore, high quality teaching and learning is most likely to take place when it is supported by appropriate approaches to curricula, pedagogy and systems of assessment (Alexander, 2008). Research has frequently shown that systems of assessment in particular can have significant positive and negative impacts on what happens in classrooms (James et al., 2007; Vulliamy, 1988). Standardized testing, for example, which requires students to show mastery of particular curriculum content is likely to lead schools and teachers to rely on memorization and rote learning (i.e. teaching to the test), rather than to use activities which develop critical thinking or problem-solving skills to enhance the adaptive capacity to respond to climate change. In other words, encouraging high quality teaching requires curricula, teaching approaches and systems of assessment, which place value on high quality learning. The potential benefits of such an approach are likely to include increased (meaningful) access and completion levels, as well as the encouragement of critical thinking and lifelong learning skills – including ‘learning to know’, ‘learning to do’, ‘learning to be’, ‘learning to transform’, and ‘learning to live together’ (Delors, 1996) – which are needed to address climate change and future uncertainty.

There is also a need to move beyond the MDG focus on primary education to fully exploit the potential of the secondary and tertiary sub-sectors. More attention also needs to be paid to informal education programs, which in some areas are the only available educational opportunities and which may also be better placed to have immediate impact (Bekalo and Bangay, 2002; Blum and Diwan, 2007).

Education of the kind described in this report has significant potential to both address climate change and to support wider goals for sustainable development – that is, development that attends to the social, economic and environmental dimensions. Support for education that focuses not only on the provision of curriculum content and efforts to increase enrolment, but also on approaches to pedagogy, curricula, assessment frameworks and learning environments can encourage acquisition of particular areas of knowledge and skills as well as resiliency; the development of the individual’s and communities’ capacity to deal with future uncertainty and rapid change.

As those facing the most imminent impact of climate change have effectively expressed, climate change in the context of sustainable development necessitates a holistic approach conducive to a better quality of life within a long-term time frame, rather than one aimed at short-term gains (Alias et al. 2009). Sustainable development strategies are multifaceted, taking into consideration economic, social, cultural, environmental, participatory, and political factors that affect human welfare. Communities can only be fruitfully and effectively realized if the stakeholders are adequately educated to understand the values underpinning sustainable development and to participate in relevant and appropriate action on climate change.

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Appendix 1

Summary of international examples

| Aim ¹¹ | International examples | Objectives | Key messages |
|--------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Enhance the capacity of staff in education and training sector to respond to climate change | Climate Change Action Plan in 2005 of Newfoundland and Labrador jurisdictions in Canada | The Action Plan outlines commitments for reducing climate change to be enacted by most government departments. The plan affirms the importance of education in addressing climate change. | Education on climate change needs to be broad enough to include all components of the phenomenon: science, direct and indirect impacts (biophysical, social, economic and health), measures for reducing greenhouse gas emissions and adaptation measures. A way to strengthen ESD and CCE efforts in formal education: demonstrate to all stakeholders (teachers, students and educational personnel) that the issues are locally and personally relevant and urgent. |
| Integrate climate change and climate change responses into the Education and Training program in the national education system | In south Korea, the environment is being instituted as an independent subject in the secondary school curriculum to ensure systematic learning and teaching on energy, climate change and other environmental issues, whereas the environment is introduced in relation to each subject at the primary school level. Moreover, the Korean government has encouraged compiling and publishing agencies to modify or add entries regarding climate change and green growth in textbooks. | Better inform and educate the public about global warming and climate change to achieve a national consensus on Korea's commitment to international efforts on climate change. | Education on climate change informs the public about the adverse effects of climate change and promoting preventive measures for its occurrence and risks. Educating children and youth about the important role they play in preserving the environment helps them carry into their adulthood a changed perspective and attitude towards the environment. |
| | Disaster risk reduction mainstreamed into school curricula: Lessons from Madagascar | Raise awareness of DRR among teachers and local government officials from disaster-prone areas. Train teachers on the DRR concept and related activities. Develop a student manual and teacher guide. Mainstream DRR into the school curricula. | The process of mainstreaming DRR into the school curricula also allowed for the institutionalization of DRR in schools, which is a crucial step towards institutionalizing DRR in society. |
| | Indigenous knowledge | Mobilize community participation and use indigenous knowledge in responding to the impacts of climate change, while also involving all members of society, including women, in the processes. | Inclusion of both women and men, as equal and responsible partners, in capacity building and empowerment initiatives enabled communities to better improve and diversify their livelihoods, taking measures that both sustain their survival and decrease the risk of drought and landslides. |
| | Kids' ISO 14000 Program | Stimulate environmental awareness of children. Teach and allow opportunities to practice environmental management methodologies to children, such as the PDCA cycle. Allow opportunities for children to work together through group networks locally and globally. | Non-formal/informal education programs should obtain understanding and support from educational authorities to create synergies with the formal education system. Through working with children, the program also increased the environmental awareness of their families. |

11 These aims are adopted from the key tasks of the Vietnamese Action Plan to respond to Climate Change for Education Sector.

| Aim | International examples | Objectives | Key messages |
|----------------------------------------------------------------------------------------------|--------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Study and propose models of climate proofing schools in the climate-affected regions | National Solar Schools Initiative in Australia | <p>Schools to generate their own electricity from renewable sources.</p> <p>Improve their energy efficiency and reduce their energy consumption.</p> <p>Adapt to climate change by making use of rain water collected from school roofs.</p> | <p>Program has education and environmental benefits.</p> <p>While green schools cost two percent more to build, the financial benefits were far greater than the initial cost.</p> <p>Green schools are extraordinarily cost effective in enhancing student learning and reducing health and operational expenses.</p> |
| | School as Shelters: Experiences from Bangladesh and India | Promote climate proof educational facilities, and the use of shelter facilities as educational facilities. | <p>Cyclone shelters can be further effective if used in non-emergency times for alternative purposes.</p> <p>The use of cyclone shelters as schools is perhaps one of the best ways to ensure that the shelter is properly maintained as schools are used almost on a daily basis.</p> <p>Supporting shelters as schools further contributes to education development goals.</p> |
| Improvement of school equipments, and learning tools for climate change education in schools | Sandwatch Program | <p>Modify the lifestyle and habits of children, youth and adults on a community-wide basis and develop awareness of the fragile nature of the marine and coastal environment and the need to use it wisely.</p> <p>Critically evaluate the problems and conflicts facing their beach environments and develop sustainable approaches to address these issues.</p> | <p>Each Sandwatch school or group is trained to take measurements using simple instruments and make observations on the health of their local beach, and the nature of any stressors.</p> <p>The program teacher science research and methodology skills as well.</p> <p>A Sandwatch climate change database (in process) is intended to provide an inventory of beach data from 2010 onwards against which climate change impacts can be assessed.</p> |
| Research for climate change education in schools | Asian University Network for Environment and Disaster Management (AUEDM) | Share information, networking and advocating for policy change, as well as developing guidelines regarding environment and disaster management | <p>Higher education institutions can share information on knowledge resources, advocate for policy change, and development guidelines related to environment and disaster risk management amongst themselves and with the larger group of stakeholders working on these issues beyond their national and thematic boundaries</p> <p>Partners jointly conduct research, share findings and find ways forward on these key issues in the Asia-Pacific.</p> |

Appendix 2

Resource Materials

| Website | |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Children in a Changing Climate (<i>Plan - ED's Website</i>) | http://www.plan-ed.org/climatechange/ |
| CO2nnect Initiative | http://www.co2nnect.org |
| <i>It's getting hot in here Project</i> | http://itsgettinghotinhere.org |
| RES- European Youth fighting against Climate Change | http://youthforum.org/en/mode/312 |
| Children in a Changing Climate (CCC) | http://childreninachangingclimate.org |
| The Climate Project - India | http://climateprojectindia.org/index.php |
| Earth Child Institute | http://earthchildinstitute.com |
| <i>The Role of Participatory Video in Amplifying Children's voices on Climate Change Project</i> | http://childreninachangingclimate.org/project_5.htm |
| The Young Climate Savers (India) | http://www.youngclimatesavers.com/content.aspx?id=1 |
| The Youth Exchange Project | http://www.youthxchange.net |
| Papers | |
| A right to participate: Securing children's role in climate change adaptation | http://www.childreninachangingclimate.org/docs/FINAL.pdf |
| Climate change and children | http://www.unicef.org/publications/files/Climate_Change_and_Children.pdf |
| Climate change, children and education for sustainable developments: A child-friendly schools approach to adaptation and risk reduction (UNGEI, 2008) | http://www.ungei.org/resources/files/EERP_modular_contents_web.pdf |
| Climate change and urban children - Impacts and implications for adaptation in low- and middle-income countries (IIED) | http://www.iied.org/pubs/pdfs/10556IIED.pdf |
| In the face of disaster - children and Climate Change (Save the Children) | http://www.savethechildren.org.uk/resources/online-library/in-the-face-of-disaster-children-and-climate-change |
| Linking the Convention on the Rights of the Child with climate change | http://www.una.org.uk/learnabouthumanrights/Slide%20Presentations/Child_Rights&Climate_Change.pdf |
| Our climate, our children, our responsibility - The implication of climate change for the world's children (UNICEF) | http://www.childreningachangingclimate.org/docs/UNICEF_our%20responsibility.pdf |
| The importance of children and young people and the global framework for action on climate change (UNFCCC) | http://www.naturvardverket.se/upload/english/06_climate_change/pdf/article_6/workshop_article_6_laurence_pollier_02.ppt |
| Factsheet on Climate Change (UNICEF 2008 J8; Junior 8 summit running parallel to the G8) | http://www.j8summit.com/files/CC_Factsheet_J8_2008_final_5_28.pdf |
| UNICEF PD/IRC policy paper on Climate Change and Children: a human security challenge | http://www.unicef-irc.org/publications/pdf/climate_change.pdf |
| We care for our climate (WMO) | http://www.wmo.int/pages/publications/showcase/documents/WMO975_E.pdf |
| Youth Report 2009 ("Youth & Climate Change" - in preparation) | http://www.un.org/esa/socdev/unyin/wyr09.htm |

Environmental & Climate Change Education

| Website | |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|
| 7th episode in the Patrimonto World Heritage Adventures cartoon series: The Great Barrier Reef - World Heritage and Climate Change (in preparation) | |
| Alliance for Climate Education | http://www.climateeducation.org |
| ASEAN Environmental Education Inventory Database (AEEID) | http://www.aeeid.aseansec.org |
| Christian Aid | http://www.learn.christianaid.org.uk/ |
| Clim City | http://www.cap-sciences.net/climcity/index.html |

| | |
|-------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Climate choices - Children Voices | http://www.climatechoices.org.uk/ |
| Connecticut Climate Change (Resources for Students and Educators) | http://ctclimatechange.com/StudentsEducators.html |
| Cycles of the Earth and Atmosphere - A website for teachers | http://www.ucar.edu/learn/ |
| Defi pour la terre | http://www.defipourlaterre.org/ |
| Eco Kids | http://www.ecokids.ca/pub/index.cfm |
| Eco-Schools | http://www.eco-schools.org.uk/ |
| Education World | http://www.educationworld.com |
| Environmental Management Authority, Republic of Trinidad and Tobago (EMA) | http://ema.co.tt/cms |
| Environmental Online (EMO) | http://www.joensuu.fi/eno/basics/briefly.htm |
| Exploring the Environment (ETE) | http://www.cotf.edu/ete |
| Fiches educatives "Climat" de l'ADEME | http://www.ademe.fr/particuliers/fiches/climat/ |
| GEO Youth project | http://www.unep.org/GEO/GEO_Products/GEO_Education/ |
| Good Practices on Education for Sustainable Development (UNESCO) | http://unesdoc.unesco.org/images/0015/001524/152452eo.pdf |
| Green School Project in Mauritius | http://www.npc mauritius.com/greenschool/ |
| IUCN's Commission on Education and Communication (CEC) | http://www.iucn.org/about/union/commissions/cec |
| Live & Learn Environmental Education | http://www.livelearn.org/default.asp |
| Maldives Environmental Management Project | http://www.mhte.gov.mv/memp/awareness/ |
| Make the Link Be the Change Project | http://www.plan-ed.org/learningcentre/bethechange |
| Ozzi Ozone (UNEP) | http://www.unep.fr/ozonaction/topics/children.htm |
| PLAN-ED Resource Centre | http://www.plan-edresources.org/ |
| PLAN-ED Learning Centre | http://www.plan-ed.org/learningcentre |
| Sandwatch and climate change | http://www.sandwatch.ca/climate_change.htm |
| San Francisco Environment | http://www.sfenvironmentkids.org |
| Share-Net Project | http://www.wessa.org.za/index.php/Education/Share-Net.html |
| TAGD Initiative on Climate Change (UNICEF) | http://www.tagd.org.uk/Campaigns/ClimateChange.aspx |
| The Carbo School Project | http://www.carboeurope.org/education/ |
| Climate Change and Children's Voices | http://www.climatechoices.org.uk/ |
| Climate Change Matters | http://www.climate matters.net |
| The Cool It Project | http://www.rbkc.gov.uk/coolit |
| The Energinus Programme | http://www.pge.com/energinus/ |
| The Environment Online (ENO) | http://www.joensuu.fi/eno/basics/briefly.htm |
| The US Environmental Protection Agency - resources for kids and students | http://www.epa.gov/students/ ; http://www.epa.gov/climatechange/kids/ |
| The Kid's ISO 14000 Programme | http://www.iso.org/iso/kidsiso_home.htm |
| The Small is Beautiful Project | http://alofatuvalu.tv/US/04_small/page_04_us.html |
| The World Wildlife Fund (WWF) and Climate Change | http://wwf.panda.org/about_our_earth/aboutcc/ |
| The Swedish International Centre of Education for Sustainable Development (SWEDESD) | http://www.swedesd.se |
| TUNZA Environmental Series for Children (UNEP) | http://www.unep.org/TUNZA/ |
| Resources for Learning & Teaching on Climate Change | http://www.teachers.ash.org.au/jmresources/climate/change.htm |
| Resources for teachers from Global Learning and Observations to Benefit the Environment (GLOBE) | http://classic.globe.gov/ |
| UN CyberSchoolbus Lesson Plans | http://cyberschoolbus.un.org/ |
| What's up with the weather? (NOVA & Frontlines) | http://www.pbs.org/wgbh/warming |

| Papers | |
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| Climate Change and Sustainable Development: The Response from Education - a joint research project among leading education institutes | http://www.intlalliance.org/fileadmin/user_upload/documents/DPU_recommendations.pdf |
| Climate Literacy: The Essential of Climate Sciences - A guide for individuals and communities | http://downloads.climate-science.gov/Literacy/Climate%20Literacy%20Booklet%20Hi-Res.pdf |
| Curriculum Guide for the Climate Impacts Map (<i>Union of Concerned Scientists' Website</i>) | http://www.climatehotmap.org/curriculum/index.html |
| Future Scientists: women and men; highlights of an international encounter | http://unesdoc.unesco.org/images/0011/001183/118361eo.pdf |
| SERREAD Project (Ocean Science Education for the Pacific Island Region) | http://www.argo.ucsd.edu/SERREAD_report_AST8.pdf |
| The Weather Matters: Talking about Climate Change - A guide for teachers and students | http://www.theweathermakers.org/tacc/ |

Adaptation to Climate Change

| Website | |
|------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Community-Based Adaptation (ELDIS) | http://www.eldis.org/index.cfm?objectid=63551B3B-FDA9-0941-1EAC7111660B5FC5 |
| Dialogue on climate change adaptation for Land and Water Management | http://www.iisd.ca/climate/sdalw |
| Papers | |
| Article 6 of the UNFCCC and the New Delhi Work Programme (UNFCCC) | http://www.naturvardsverket.se/en/In-English/Start/Climate-change/European-Regional-Workshop-on-Article-6-of-the-Convention/Day-1/ |
| Enabling Adaptation: Priorities for Supporting the Rural Poor in a Changing Climate (WRI Issue Brief) | http://pdf.wri.org/issue_brief_enabling_adaptation.pdf |
| IPCC Fourth Assessment Report: Working Group II Report "Impacts, Adaptation and Vulnerability" | http://www.ipcc.ch/ipccreports/ar4-wg2.htm |
| New Approaches to climate change Adapt or Die (<i>The Economist</i>) | http://www.economist.com/world/international/displaystory.cfm?story_id=1220 |
| Report on the expert meeting on adaptation for SIDS (UNFCCC) | http://unfccc.int/resources/docs/2007/sbi/eng/11.pdf#page=1 |
| Viet Nam: Climate Change, Adaptation, and Poor People (2008 Oxfam Report) | http://www.oxfam.org.pe/resources/policyclimate_change/viet_name_report08.html |
| Vulnerability and Adaptation to Climate Change in small island developing states (UNFCCC background paper) | http://unfccc.int/files/adaptation/adverse_effects_and_reponse_measures_art_48/application/pdf/200702_sids_adaptation_bg.pdf |

Other links on Climate Change and Sustainable Development

| Website | |
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| European Environment Agency's "Eco Agents" Website | http://ecoagents.eea.europa.eu |
| Climate Action Network | http://www.climateactionnetwork.org/ |
| Climate Action Network Europe ASBL | http://www.climnet.org/ |
| Climate Change and the Pacific Islands | http://www.unescap.org/mced2000/pacific/background/climate.htm |
| Friends of the Earth | http://www.foe.co.uk/campaigns/climate |
| The Climate Change Frontlines | http://www.climatefrontlines.org |
| The Nevis Historical & Conservation Society's Biodiversity Website | http://www.bio-diversity-nevis.org/index.htm |
| Safe for the Planet | http://www.savingtheplanet.tv/ |
| Science Daily | http://www.sciencedaily.com/news/earth_climate/global_warming |
| UNDESD | http://www.grdc.org/sustdev/un-desd |
| UN DESA Division for Sustainable Development | http://www.un.org/esa/dsd/index.shtml |

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| USP's Pacific Center for Environmental and Sustainable Development | http://www.usp.ac.fj/index.php?id=8132 |
| Earth Day Network | http://www.earthday.net/ |
| Papers | |
| Case Studies on Climate change and World Heritage | http://whc.unesco.org/en/activities/473 |
| Climate change and poverty | http://www.research4development.info/PDF/Articles/degrees-of-separation.pdf |
| Climate Change Mitigation - What we do? (OECD) | http://www.oecd.org/dataoecd/30/41/41753450.pdf |
| Education for Sustainable Development and Climate Change; UNESCO Policy Dialogue 4: ESD and Development Policy | http://unesdoc.unesco.org/images/0017/001791/179122e.pdf |
| Hurricane and Climate Change: Is there a connection? | http://www.ema.co.tt/docs/Articles/Climate%20Change.pdf |
| IPCC Fourth Assessment Report: Working Group III Report | http://www.ipcc.ch/ipccreports/ar4-wg3.htm |
| Learning for Sustainable Living: An Education for Sustainable Development - Resource for Schools Developed by BirdLife International | http://www.cceindia.org/esf/download/paper27.pdf |
| Policy Document on the Impact of Climate Change on World Heritage | http://whc.unesco.org/en/CC-policy-document/ |

Through a review of academic articles and project documents, this paper explores the relationship between the education sector and climate change. It introduces how education is both impacted by and has an impact on this phenomenon, and proposes various sector responses. Different theoretical frameworks for where and how climate change education fits into the education sector are made concrete with case studies from across the globe. An essential introduction to climate change and education, this paper brings together theory, policy and practice. A useful read for those working in either the education sector or on climate change.



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• Mom Luang Pin Malakul Centenary Building
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