



SYNTHESIS REPORT

Climate change and education

From evidence to action

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Introduction

2023 was the warmest year on record, and 2011–2020 was the hottest decade. The UN reports that ‘to ensure a safe and liveable planet ... humanity must phase out global coal production and use by 2040, and reduce oil and gas production and use by three-quarters between 2020 and 2050.’¹ The world’s poorest countries experience the most devastating impacts of climate change. Over the past ten years, they have endured nearly eight times as many natural disasters compared to three decades ago.²

Education has the potential to play an important role in tackling the global climate crisis. Increasing environmental awareness and education on climate change can contribute to effective adaptation and mitigation. By providing vulnerable communities with the knowledge and tools to understand climate change and its causes, as well as possible approaches to managing associated risks, it is possible to empower communities through education and reduce the adverse effects of climate change.³

The need for education to contribute is widely accepted. In the UN Framework Convention on Climate Change (UNFCCC), Article 6 on education, training and public awareness states that ‘countries shall develop and implement educational and public awareness programmes on climate change and its effects.’⁴ The Paris Climate Agreement Article 12 also emphasises the importance of the role of education in supporting action on climate.⁵

All member states of the UN have committed to working towards ensuring inclusive, high-quality education and improving education for sustainable development, as well as improving life in cities and tackling climate change through adopting Sustainable Development Goal (SDG) 4 on education, SDG 11 on urban settings, and SDG 13 on climate change.

However, while education is key to addressing climate change, the delivery of education is itself vulnerable to climate exposure. All types of extreme weather (drought, flooding and other climate shocks) can result in learners missing school. Education systems and communities need resilient strategies to both adapt to climate change and reduce learning disruptions. Solutions may entail building climate-resilient infrastructure, improving curricula, teacher training on climate disaster risk reduction, and/or socio-economic practices that safeguard learning during climate events.⁶

¹ UN 2024

² World Bank 2023

³ UNICEF 2019

⁴ UNFCC 1992

⁵ UNFCC 2016

⁶ Fitzpatrick & Amenyia 2023

Executive summary

This report considers the impact of the climate emergency on school education in low-income countries, and explores ways in which those wishing to mitigate its negative consequences on learning should respond. The first part of the document reviews the relevant research literature, including research undertaken by EDT. Based on this review we propose a model that seeks to comprehensively identify the effects on education and learning likely to arise from a range of events caused by climate change, if no action is taken. The second part of the report highlights some practical measures that can be taken to minimise learning loss caused by climate events.

There is now a substantial body of robust research that confirms the extent to which childhood exposure to climate shocks can have a profound negative impact on learning. Climate change induced stressors such as droughts, flooding, crop failures and extreme temperatures can be highly disruptive for schools, and their adverse effects tend to be more damaging to children from poorer households and other vulnerable groups. Climate change exacerbates existing inequalities. The intersection, for example, of new climate shocks and pre-existing gender inequality heightens the risk that girls will be disproportionately impacted.

These findings from the global literature have been confirmed by EDT's recent research projects that investigated the disruptive impact that climate events are now having in Kenya and Rwanda. In both countries we found widespread recent evidence of extreme weather making it dangerous or impossible for students to access schools. In Rwanda, 52% of school leaders surveyed reported experiencing damage to school buildings following extreme weather events. In areas prone to drought, the impacts on education were broad and far reaching. In rural parts of Kenya, a loss of income due to the death of livestock and crop failure during drought meant that children were often pulled from school. Such direct impacts are also associated with more indirect consequences. In the city of Nairobi, for example, children reported wading through sewage waters to get to school during periods of heavy rainfall, resulting in exposure to disease.

Drawing on this evidence base, we propose an impact model which identifies the forms of educational disruption likely to arise as a result of two prevalent types of weather event brought about by climate change:

- » **heavy rain and wind**
- » **drought and extreme heat**





We map the consequences of these two types of weather event in terms of the likelihood of greater absenteeism, lower levels of concentration, and learning loss.

The second part of this report proposes three purposeful forms of action likely to reduce the harmful consequences of climate change:

- 1. Improve general levels of education to help people be resilient to climate-related challenges:** Foundational core skills and climate resilience are not alternative policy goals; equipping school leavers with good academic, personal and social skills will help them to adapt to climate challenges.
- 2. Build climate-resilient education systems at a national level:** Helping schools to play their part will require action across several fronts: increased finance, better data gathering from the frontline, curriculum reform, teacher training, improvements in school infrastructure, and a cross-sectoral approach that cuts across different ministerial responsibilities.
- 3. Use schools as a key resource for the empowerment of local communities:** Schools have huge potential to promote disaster risk reduction methods at a local level, with students and families. Schools can play a major part in mitigating the damage caused by long-term and extreme climate events, through sharing locally relevant information about climate change with communities.

The impact of climate change on education

A growing body of literature shows that climate shocks have far-reaching impacts on learning and children's development more broadly. Early exposure to climate change induced stressors – such as droughts, flooding, and related crop failures – has profound longer-term consequences on a wide range of outcomes such as physical growth, educational attainment, and future economic prospects. Oxford University's Young Lives longitudinal study in Ethiopia, India, Peru and Vietnam found that:⁷

Childhood exposure to climate shocks has a profound negative impact on learning and development: Children who experienced malnutrition (due to climate-induced crop failures) in their early years performed significantly worse in literacy and numeracy tests in later childhood. Childhood exposure to climate shocks such as droughts, flooding or cyclones had a long-term negative impact on basic mathematics, and social and emotional skills outcomes.

The adverse effects of climate change can have intergenerational impacts on children's development and learning: The Young Lives study in Ethiopia and India revealed that children whose mothers had been exposed to climate change stressors such as flooding and related famine were physically stunted and performed poorly in school.

The adverse effects of climate change are more damaging to children from poorer households: Due to limited financial resiliency, poor households are more likely to withdraw their children from school for engagement in both paid and unpaid work.

The intersection of climate shocks and gender inequality compounds gendered risks and barriers experienced by adolescent girls: When climate stressors such as droughts lead to additional household chores, such as walking further afield to collect water for domestic use, the burden invariably falls on adolescent girls. These additional responsibilities reduce the time available to study, and this exacerbates the risk of girls dropping out of school.⁸

⁷ Young Lives 2023
⁸ Young Lives 2023



Findings from other studies show that climate stressors have negative impacts on education across several dimensions, including enrolment, retention, school completion rates, and learning outcomes. In Uganda, for example, negative rainfall shocks were associated with lower primary school enrolment rates among older girls.⁹ In rural Ethiopia, higher rainfall was negatively correlated with the enrolment and grade attainment of males, relative to females, as male children were often pulled out of school to assist with farm labour.¹⁰ In India, children who experienced positive rainfall events were more likely to drop out of school. This phenomenon was attributed to higher agricultural productivity, leading to higher returns on child labour, compared to the returns on schooling.¹¹

Research into the impact of El Niño rainfall on education in various countries found that exposure to flooding was associated with lower test scores, which persisted as the children got older. In Mexico and Ecuador, for example, children who experienced El Niño flooding during the first two years of life scored lower on cognitive tests five to seven years later, and exhibited poorer language development and working memory when tested between the ages of two and six.¹² In parallel, a cross-regional analysis that covered 16 countries in Latin America found that exposure to natural disasters, including floods and tropical cyclones, was found to lead to an average of 0.3 fewer years of education.¹³

This reinforces the findings of previous research projects conducted in Malawi, Burkina Faso, Vietnam and Zimbabwe, which established that exposure to negative rainfall shocks was associated with adverse educational outcomes – including poorer cognitive ability, lower school enrolment, delayed school entry, reduced grade completion, and increased child labour.¹⁴ Similarly, childhood exposure to drought has also been found to have adverse effects on learning. In particular, research conducted in India found that exposure to drought during infancy was associated with lower cognitive scores and a diminished likelihood of school enrolment.¹⁵

A growing body of research literature shows that high temperatures can also have a profound impact on learning, and this is often comparable in scale to the impacts of flooding and extreme drought. In Southeast Asia, for example, children who experienced extreme temperatures early in life were predicted to access one and a half years less schooling than those who experienced average temperatures.¹⁶

⁹ Björkman-Nyqvist 2013

¹⁰ Mani et al. 2013

¹¹ Randell & Clark 2016

¹² Randell & Gray 2019b

¹³ Randell & Gray 2019b

¹⁴ Shah & Steinberg 2013

¹⁵ Shah & Steinberg 2013

¹⁶ Randell & Gray 2019a

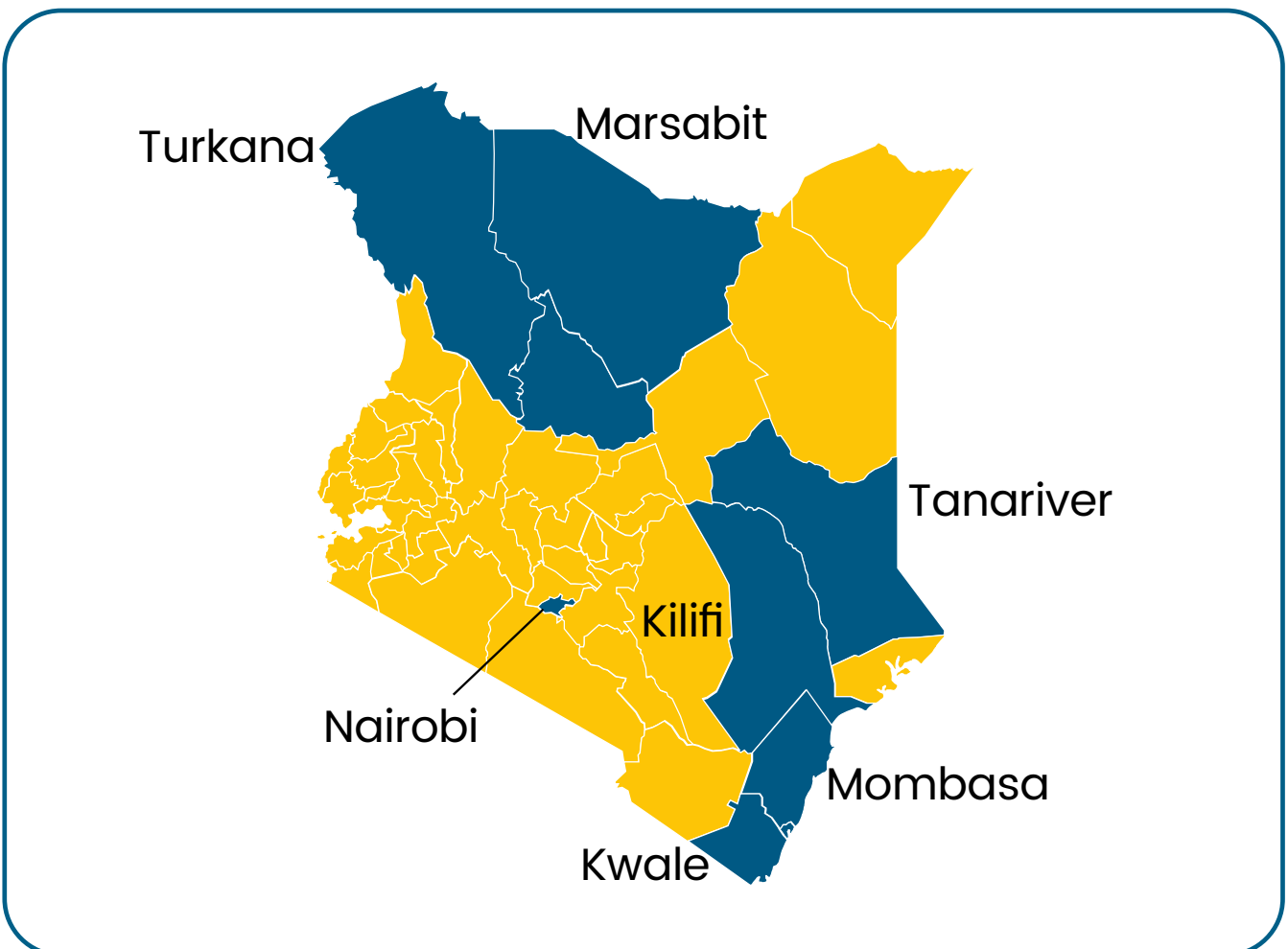


Lessons from current and recent EDT research

EDT research in Kenya and Rwanda has explored the various complex causal pathways in which climate change negatively impacts education. We conducted qualitative data collection in six counties in Kenya (Mombasa, Nairobi, Turkana, Tana River, Kilifi and Kwale), and across all provinces in Rwanda, exploring the impact of climate change on education amongst communities in these contexts. Our diagram on pages 10–11 outlines our key findings from both studies, indicating the direct and indirect impacts.

Direct impacts typically include access to schools being denied, sometimes for long periods of time. Damage to schools and surrounding infrastructure during extreme weather events can make it dangerous or impossible to access schools.¹⁷ In Rwanda, 52% of school leaders surveyed reported experiencing damage to school buildings as a result of extreme weather events, with 74% of them reporting that repairs to fix the damage came from the school budget, diverting funds from teaching and learning activities.¹⁸ In Rwanda, damage to school infrastructure was also reported to lead to temporary issues such as large class sizes (due to children from two classes sharing one classroom) until the damage was repaired.

These direct impacts are also associated with more indirect impacts. In Nairobi, for example, children reported wading through sewage waters to get to school during periods of heavy rainfall. This resulted in reported illnesses such as cholera from sewage waters, and malaria from increased mosquito activity due to standing water.¹⁹



¹⁷ Fitzpatrick & Amenya 2023

¹⁸ Fitzpatrick & Amenya 2023

¹⁹ Fitzpatrick & Amenya 2023

TURKANA FACTS

Turkana population



926,976

Livelihood



67%

Livestock farming



4%

Crop farming



3%

Fishing

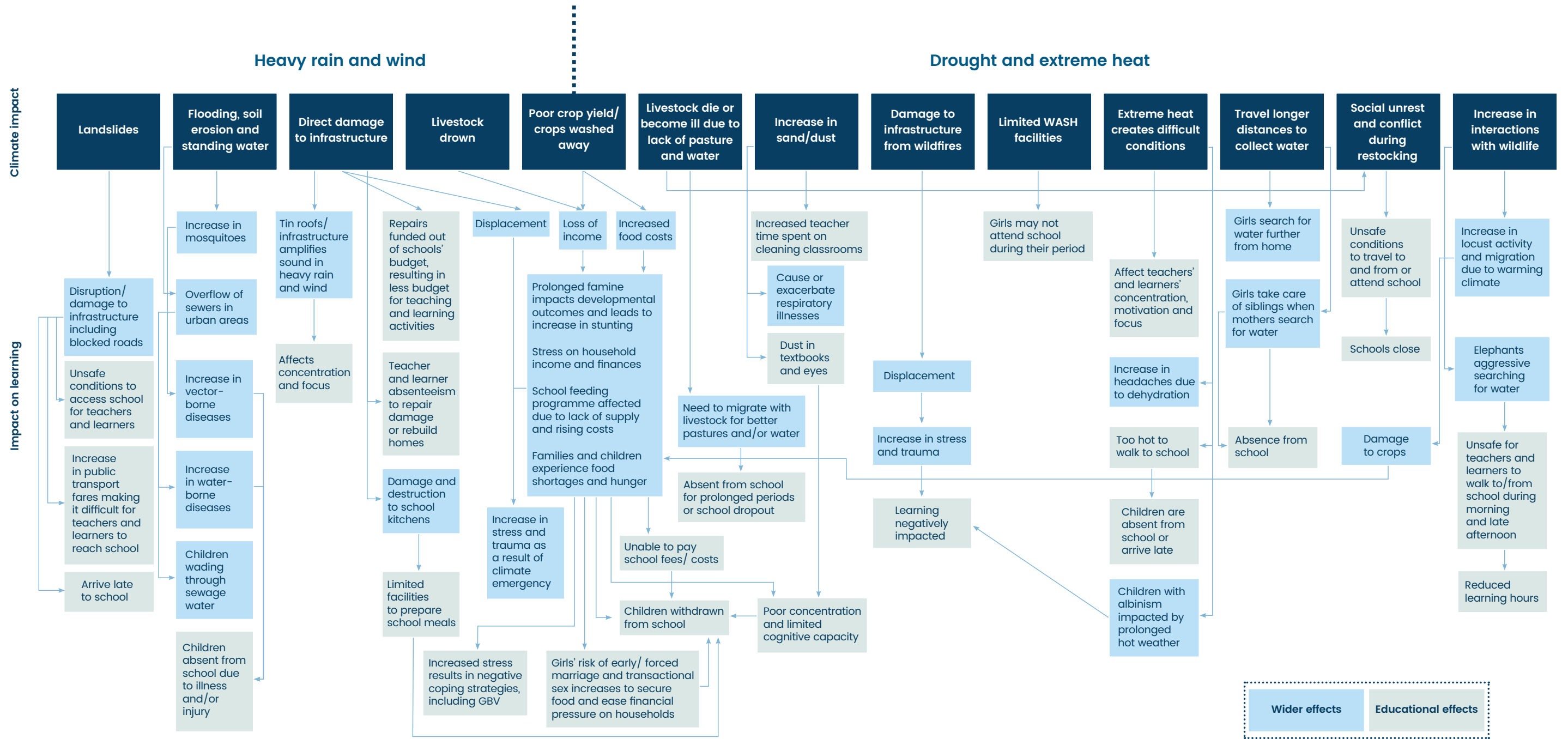
Weather events can also be linked to children struggling to concentrate whilst in class. In EDT's forthcoming publication on climate change and education in Rwanda, heavy rain on tin roofs, extreme heat and hunger, were all associated with difficulty concentrating. The heavy rain and extreme heat represent direct impacts. Hunger represents an indirect impact because it is caused by a combination of food shortages due to crop damage, the resulting increased food prices, and poverty. Hunger was one of the most pervasive topics cited as negatively impacting learners. We visited one school in Kenya that had managed to maintain its school feeding programme due to contributions from a local religious group, and hunger was not cited as a hindrance for school attendance. This particular school reported fewer negative impacts of climate change, which was attributed to both its feeding programme and boarding facility.

In areas prone to drought, the impacts on education were broad and far reaching. In Turkana county in Kenya, for example, a loss of income due to the death of livestock and crop failure during drought meant children were often pulled from school.²⁰ This was partially due to the need for increased household work and other forms of labour, to make up for the shortfall in income, but also due to a lack of food which had a negative impact on children's ability to concentrate and limited energy to walk to school. Times of drought were also associated with conflict over access to water for cattle, and later during 'restocking' to protect cattle from theft. The economic impact of drought also resulted in an inability to pay for school fees, and unsafe conditions for children attending school during conflict.

Many of the same factors that impact children also impact teachers, and this adds another layer of complexity to the impacts of climate change on education. Where roads are blocked for students, they are also blocked for teachers, and teacher absenteeism was reported in both Kenya and Rwanda during flooding and landslides. In Rwanda, one school reported teachers' houses being damaged during floods and landslides, and the community's efforts to rebuild them. The psychological impact of homes being destroyed, in addition to the logistical challenges, can impact teachers' and students' ability to attend school.

²⁰ Ameyna & Fitzpatrick 2022

The impact of climate change on education and drivers of vulnerability



Systemic drivers of vulnerability

Individual and household drivers of vulnerability		Infrastructure: <ul style="list-style-type: none"> » Level of investment in public infrastructure » Poverty levels » Access to climate-resilient infrastructure » Availability of credit and finance systems » Maturity of preventative and emergency/disaster response units (inc. healthcare) » Access to early warning systems/accurate weather forecasts 	Environment: <ul style="list-style-type: none"> » Implementation of risk reduction environmental management approaches » Access to seasonal, climate-resilient crops Demography: <ul style="list-style-type: none"> » General age and health status of the population » Location of community 	Inclusion and evidence: <ul style="list-style-type: none"> » Role of vulnerable and marginalised groups' voice in policy discussions and decision making » Availability of disaggregated data and evidence for policy making (sex and disability)
Demographic characteristics <ul style="list-style-type: none"> » Gender » Age » Race » Disability/health status » Sexual orientation 	Socio-cultural characteristics <ul style="list-style-type: none"> » Inoculation status » Education status (inc. literacy) » Socio-economic status » Language(s) spoken » Employment status » Industry employed in » Location » Housing material » Access to credit, finance and assets 			



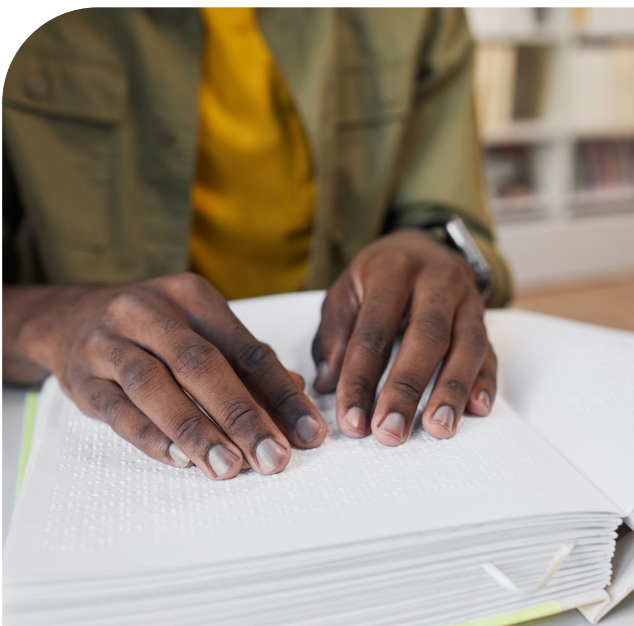
Differential impact on marginalised groups

Not all learners are equally affected by the impacts of climate change. In EDT's research in both Kenya and Rwanda, children with disabilities were often cited by school leaders as being the most negatively impacted. Direct impacts related to damage to infrastructure, which potentially makes it challenging for children with disabilities to attend school safely. It can also be challenging to navigate areas affected by landslides. Children with physical disabilities may also be more affected by floods, as they may be unable to relocate, and damage to infrastructure can result in particularly poor learning environments for them.

Access to education may not only be limited to physical barriers. In Mombasa, for example, a school leader told us that during periods of economic hardship in households, which typically coincide with droughts, children with disabilities are the first children in the household to have their school fees stopped.

Children with disabilities may also have less access to information about climate change, compared to their peers. Children in one school for the visually impaired in Kenya noted that they have fewer resources about climate change compared to their peers, due to limited resources in Braille.

Protracted climate crises have varying impacts on boys and girls. In families experiencing the prolonged effects of climate change, such as droughts, adolescent girls often endure the most consequential long-term impacts. They are at a greater risk of early marriage in times of weather-related crises because their dowries can help ease the burden of scarce household resources.²¹ ²² They are also likely to be withdrawn from school to help alleviate the extra domestic burdens usually shouldered by women in households under climate-related stress, or they attend school less frequently so that they can complete household responsibilities like fetching water and caring for younger siblings.²³ In contrast, boys may be pulled from school to engage in labour activities, such as moving cattle with their fathers.²⁴



²¹ Fitzpatrick & Ameyna 2023
²² Kwauk et al. 2019

²³ Fitzpatrick & Ameyna 2023
²⁴ Fitzpatrick & Ameyna 2023

The negatively reinforcing impacts of poverty and climate change on education

Climate change exacerbates and further drives existing inequalities through increased exposure and vulnerability. A 2019 United Nations Development Programme (UNDP) report states that 'income inequality across countries may already be about 25% higher than it could have been without climate change'.²⁵

Furthermore, even in high-income countries, poverty increases the risks and vulnerabilities associated with climate change. In a 1980 heatwave in the Great Lakes region of the United States, for example, free electric fans were distributed to the affected population. However, a large proportion of those who died from complications due to the heat were on fixed incomes and feared the high utility bills that would have resulted from using the fans.²⁶ In a 1995 Chicago heatwave, the majority of those who lost their lives were also from low-income households.²⁷ This picture is similar elsewhere globally. In the 2019 Hurricane Dorian, the hardest hit people were those living in informal shanty towns populated by poor Haitian immigrants.²⁸

The intersectional challenges linking poverty, gender and climate change are also complex. In post-disaster situations, women and girls are more likely to experience violence, including sexual violence. As climate change increases family poverty, domestic violence often escalates. This becomes more pronounced as the role of men as breadwinners comes under pressure and further escalates household frustrations. Girls often bear the brunt of the violence, which is expressed in a range of different ways, including physical, sexual, emotional and economic abuse.²⁹

These broader impacts of climate change on poverty, health and violence are all connected to negative impacts on education. EDT's research in Kenya and Rwanda showed that children were more likely to be temporarily or permanently pulled from school during times of economic hardship. Other frequently cited impacts on education related to limited household resources for buying weather-appropriate clothing, or bags to protect books and school materials from weather damage. This was reported in both Kenya and Rwanda.

A lack of funding (or misuse of funds) can also become more pronounced or exacerbated by climate change, so the risk of poverty is an important consideration at a systemic level, not just an individual one. In Kwale county in Kenya, for example, EDT found that some schools that experienced storm damage were still damaged over a year after the initial event.³⁰ One of the schools that had experienced damage also did not receive enough funds to hire the number of teachers required for their student population, so the local community paid for additional teachers' salaries. When livelihoods were disrupted by drought, teachers reportedly stayed on for as long as possible but were periodically forced to leave to find alternative employment due to unpaid salaries.

²⁵ UNDP 2019: 177

²⁶ Sullivan 2021: 22

²⁷ Sullivan 2021: 22

²⁸ UNDP 2019: 180

²⁹ Swarup et al. 2011

³⁰ Fitzpatrick & Ameyya 2023

The role of education in climate change mitigation, resilience building and adaptation

This report outlines three ways in which education can play a role in climate change mitigation, resilience building and adaptation. Firstly, it explores the importance of simply receiving a high-quality education. The report then highlights the principles of resilient education systems and explores a bottom-up approach to empowering communities through knowledge.

Differential impact on marginalised groups

There is an established relationship between overall access to education and a reduction in risks posed by climate change. Striessnig found that, when analysing data from countries that experienced at least one natural disaster per year between 1980 and 2010, the proportion of women who completed junior, secondary or higher education was associated with fewer deaths due to natural disaster.³¹ Of course, completion rates do not tell the whole story, and the statistics do not take into consideration the quality of the education. In January 2023, the World Bank reported that 90% of children in Sub-Saharan Africa were unable to read a basic text with understanding by the age of ten.³² It is access to good quality basic education that it is likely to contribute to climate resilience.

The Global Center on Adaptation, in their State and Trends in Adaptation Report 2022, identified education as being 'vital to the development of climate literacy, which is itself vital for improved adaptation'.³³ The potential for children and young people to develop climate literacy, therefore, is hampered by the extent to which there is an overarching learning crisis.

More research is needed to understand the complexities of the relationship between climate change and the level of general education, and the extent to which learning outcomes are equitably distributed. Data from 67 middle- and high-income countries found that the median mortality rate per flood disaster is 26 times higher in countries with an unequal distribution of income, with countries in Africa, Asia and the Americas accounting for the highest number of deaths and mortality rates, while Europe and Oceania lost fewer lives.³⁴ Similar research is required in a low-income country context to explore the connection between education, earning potential, and individual vulnerability to climate disasters.

In 2022, Walker and colleagues conducted an important investigation into the influence of formal education on climate change adaptation amongst pastoral women in Kenya, looking at some of the nuanced differences in the ways that women responded to climate change scenarios.³⁵ They used a participatory adaptation scenario and mapping activity approach, with groups of women who had an average of seven years of formal education and women without any formal education.

³¹ Striessnig et al. 2013

³² Kwakwa 2023

³³ GCA 2022

³⁴ Uppsala Universitat 2023

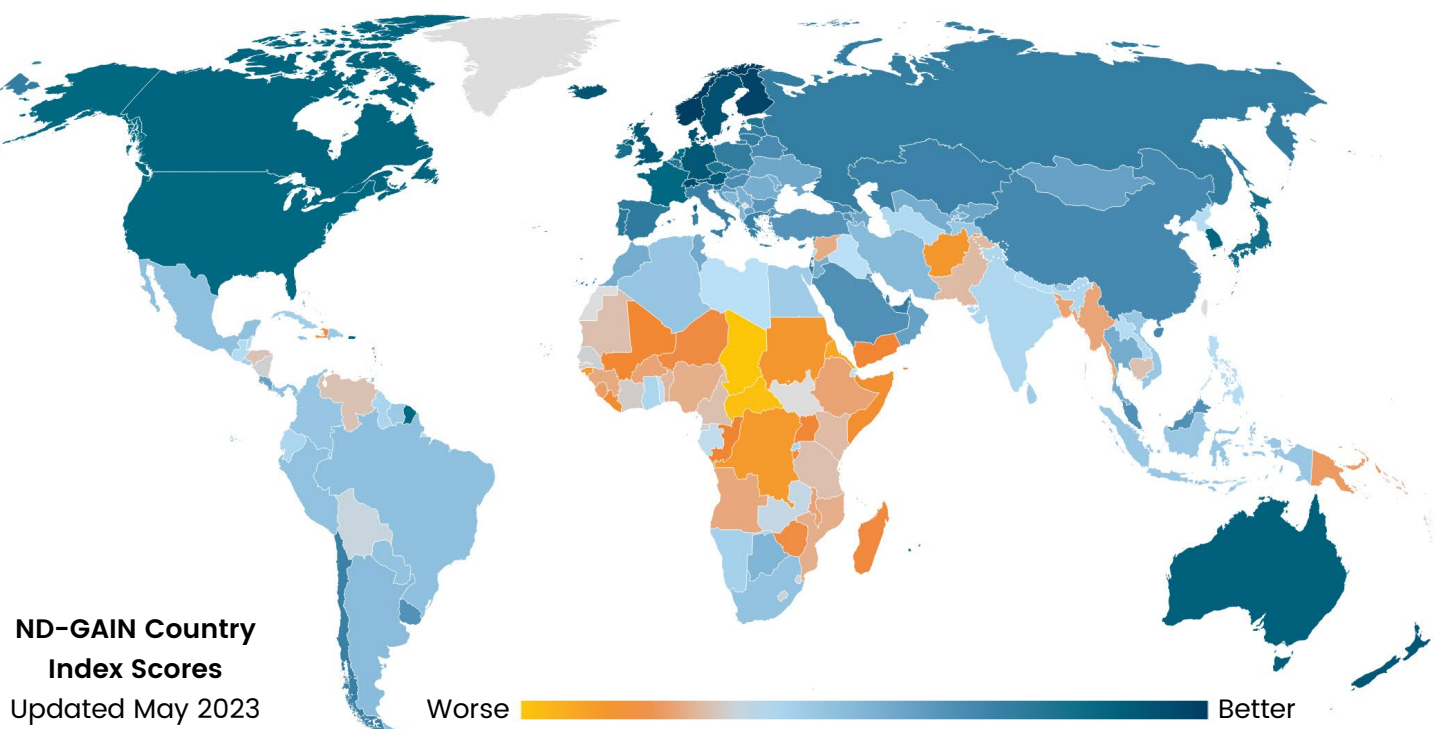
³⁵ Walker et al. 2022

The picture that emerged was complex. The researchers found that participants with a formal education were more risk-averse following a drought, but initially assessed and reacted to signs of drought similarly to peers without any formal education experience.³⁶ They argue that the increased risk perception might be explained by the influence of a formal education on the learning component of adaptive capacity. They also argue that the formal education experienced by these women was insufficient to impact the agency of the pastoral women. We cannot assume that access to formal education will automatically improve adaptive capacity.³⁷ More research is therefore needed to understand the nuances of how education supports mitigating and adaptive behaviours, in order to further build the case for quality education as a vital ingredient in the response to climate change risks.

Building resilient systems

Education systems globally have different levels of preparedness for the increasing threats that climate change poses. Whilst many low-income countries prone to natural disasters have disaster risk reduction policies, plans and strategies in place, these often focus on extreme weather events, earthquakes, tsunamis and volcanic eruptions. Planning is less advanced when it comes to the more prolonged impacts of climate change, such as temperature increases, drought, and the wider socio-economic challenges resulting from the new climatic conditions.

The Notre Dame Global Adaptation Initiative (ND-GAIN) has calculated that ‘people living in the least developed countries have ten times more chance of being affected by a climate disaster than those in wealthy countries each year’, with their analysis showing that it will take ‘over 100 years for lower-income countries to reach the resiliency of richer countries’.³⁸ The researchers at ND-GAIN rank countries annually based upon their vulnerability and their readiness to successfully adapt to climate change. The map below from ND-GAIN shows the results of the country index of climate resilience, and starkly highlights the gulf in readiness between countries in the Global North and the Global South.



³⁶ UNDP 2019: 177

³⁷ Sullivan 2021: 22

³⁸ Sullivan 2021: 22



Building resilient education systems should clearly be a top priority for policymakers in vulnerable countries. The Global Partnership for Education (GPE) has developed a framework for what they call 'climate-smart education systems', and this provides a useful basis for considering how to build education system resilience to climate change. The seven features of the framework are: ³⁹

01

Evidence-based policies and planning:

This explores the extent to which there are policies and plans in place relating to climate change in education and education in climate change, whether there is accountability against these plans (such as monitoring frameworks), and who has clear responsibility for implementation.

02

Cross-sector and internal coordination:

Responding to the challenges of climate change requires multi-sectoral working. Education ministries need to work closely with ministries responsible for the environment and climate change, in addition to ministries responsible for sustainable building practices.

03

Access to climate finance: Climate funds do not typically release information about the amount of money dedicated to education, and most funds are typically geared more towards energy and transport. Supporting governments to access different funds to respond to different vulnerabilities will be increasingly important.

04

Climate data and evidence for education planning:

Many systems currently collect data on climate hazards and have separate systems that gather education data. Harmonising approaches to data collection, analysis and use will enable policymakers to make better-informed decisions about education and climate change.

05

Safer and greener infrastructure: This refers to infrastructure that can withstand potentially extreme weather conditions, and is built using sustainable materials.

06

School safety and educational continuity: This considers what school safety and continuity plans are in place, and whether they adequately respond to the risks posed by climate change. This may include temporary post-disaster education centres, or more ongoing considerations around school safety.

07

Curricula, pedagogy and teacher training:

This considers whether climate change is taught in schools, the types of pedagogies used, and whether teachers have received adequate training to be able to support learners in learning about climate change.

³⁹ GPE 2023

Education in climate change strategies, policies and plans

One indicator of the extent to which education has been adequately considered in relation to climate change is the references to the role of education in national climate change policies, strategies and plans. The extent to which this is happening is being monitored by UNESCO, as part of the Global Education Monitoring Report process through the system of country-level Profiles Enhancing Education Reviews (PEER). They report that only 38% of countries have a national-level law, policy or strategy specifically focused on climate change education.⁴⁰

Under the terms of the 2016 Paris Agreement on climate action, countries worldwide agree Nationally Determined Contributions (NDCs) to the education of greenhouse gas emissions.⁴¹ The NDC process also obliges countries to identify action and commit to action intended to build resilience to climate change. In 2021, the environmental campaign organisation Earth Day reviewed the text of NDCs from 165 countries and identified only 29 that made at least modest references to climate education and climate literacy, and none that thoroughly addressed these issues.⁴² The UN uses the term Action for Climate Empowerment (ACE) to describe cross-cutting activities intended as a response to the climate emergency, and identifies 'climate change education' as one of the six core elements of the ACE framework. Earth Day also analysed 82 country-level ACE submissions, and found that only 12 placed any emphasis on education and/or climate literacy. In 2022, Kwauk analysed 140 country-level NDCs, finding that only 40 countries mentioned climate change education, while 104 referenced education more broadly and 99 referenced children and youth.⁴³

There is an urgent need to put more emphasis on climate change education within national planning, but references to the role of education also need to be meaningful and have clearly identified actions. Current practice is variable. India's National Education Policy (2020) is typical of many; it mentions the challenge of climate change but does not set out an integrated response. There are no references to the education curriculum, teaching, learning or resilience building that mention climate change in relation to general education, although there is inclusion at the level of higher education and national research agendas.⁴⁴ However, India's National Curriculum Framework (2005) does include environmental education under the Habitat and Learning curriculum area.⁴⁵

Other countries have similarly differing levels of detail in different national policy documentation relating to climate change education. In the Bangladesh Education Sector Plan 2020–2025, for example, climate change is referenced in relation to curriculum content, and in relation to disaster risk reduction and emergency planning.⁴⁶ The National Education Policy (2010) in Bangladesh references climate change, although it does not provide specific details on how it is to be integrated into school subjects, or included as a standalone subject.⁴⁷



⁴⁰ UNESCO 2024

⁴¹ UNFCCC 2016

⁴² Earth Day 2021

⁴³ Kwauk 2022

⁴⁴ MHRD 2020

⁴⁵ National Council of Educational Research and Training 2005

⁴⁶ Government of Bangladesh 2020

⁴⁷ MoE 2010



Cross-sectoral and internal coordination

The threats posed by climate change require a coordinated approach between the education sector, other sectors and other ministries. Without this coordination, education may not be adequately considered in national plans related to climate change. Education clusters are one source of potential coordination,⁴⁸ in addition to national disaster management and environmental committees that include education sector representatives.

The National Drought Management Authority's (NDMA) early warning system (EWS) in Kenya, which is described in EDT research, is a good example of cross-sectoral collaboration for resilient education systems.⁴⁹ Under the EWS, NDMA uses a system of coloured flags, typically hosted in schools and other public places, to signal a change in the phase of a drought: normal, alert, alarm and emergency. Children are required to pass information to their communities when the phase of a drought changes. For example, when an orange flag is hoisted, it signals that the drought situation has entered an alarm phase, so communities need to prepare for an impending emergency phase by offloading their livestock to minimise losses. School students pass the information to their parents and community members as the drought phase changes. This early warning also helps schools with contingency planning, such as purchasing and stocking foodstuffs before supply chains are disrupted during emergency situations.

Climate finance

Climate change education needs substantial, clearly identified funding. According to the Monitoring and Evaluating Climate Communication and Education Project (MECCE), only 30% of the 80 countries analysed had publicly available climate change education budgets.⁵⁰ When looking at climate finance more broadly, the education sector does not typically feature as a targeted recipient of funds.

In 2023 the Climate Policy Initiative produced an important report measuring global climate finance worldwide by sector.⁵¹ Chart 2 on the next page outlines their analysis. Education is absent because it does not even feature as a sector with sufficient data to support individual categorisation. While the authors stated that climate finance 'must increase by at least five-fold annually, as quickly as possible, to avoid the worst impacts of climate change', they failed to say anything at all about the importance of finance for education.



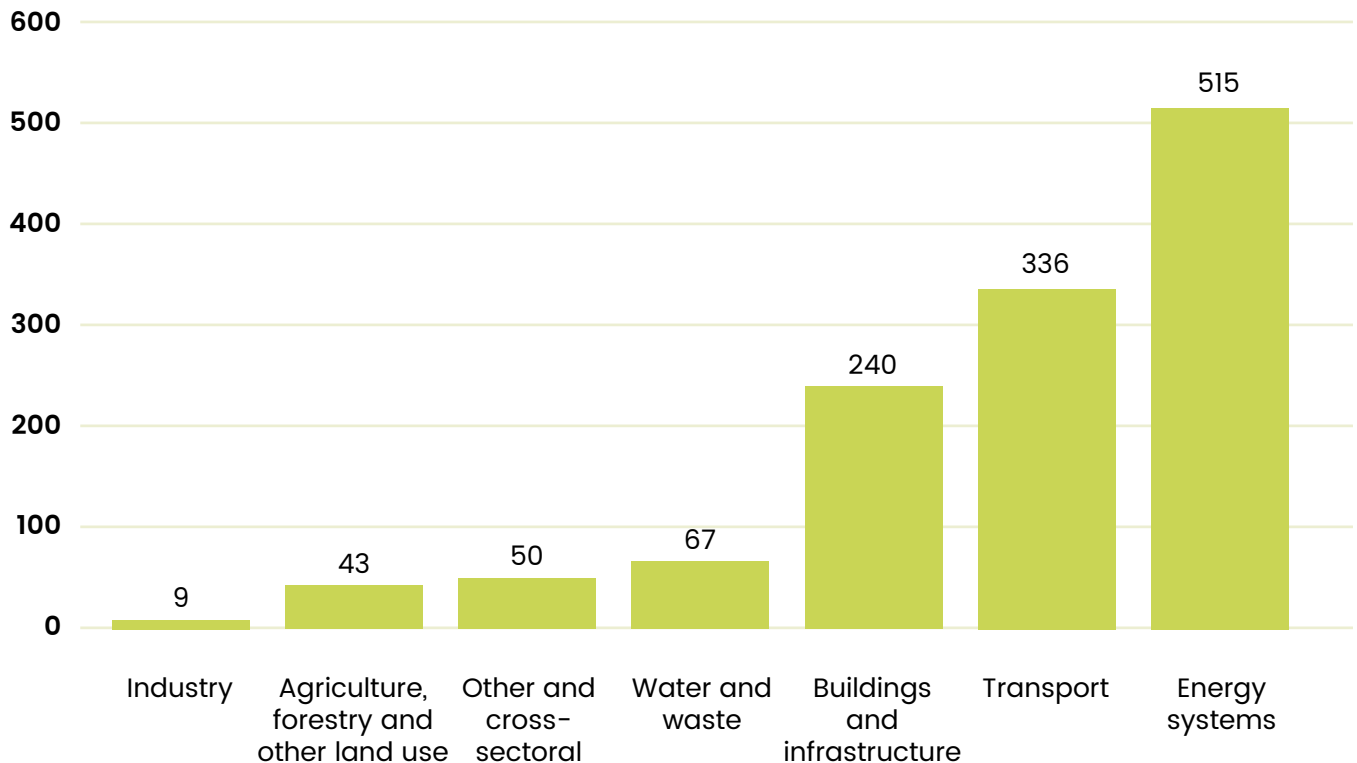
⁴⁸ GEC 2024

⁴⁹ Fitzpatrick & Ameyia 2023

⁵⁰ MECCE 2024a

⁵¹ Buchner et al. 2023

⁵² Buchner et al. 2023: 3

Chart 2: Climate finance expenditure by sector (2023)⁵³

Source: data extracted from CPI 2023 report on Landscape of Climate Finance

There are some signs of a growing awareness of the need to invest in education. One promising development is GPE's Climate Smart Education Systems initiative, implemented in partnership with Save the Children, UNESCO and UNESCO-IIEP. As part of this initiative, partner countries will receive technical support valued at between US\$400,000 to \$700,000.⁵⁴ Other donors and national governments are also increasingly considering climate change financing linked to the education sector. During COP28, the Green Climate Fund, GPE and Save the Children launched a US\$70 million investment to build climate resilient schools in vulnerable countries.⁵⁵ The intervention will start with Cambodia, South Sudan and Tonga, and will be expanded with lessons learned from the initial three countries.

UNESCO is coordinating the Greening Education Partnership (GEP), a global alliance comprising over 1,000 member organisations from 80 countries. The GEP is promoting the idea of a UN multi-partner trust fund for climate education financing.⁵⁶ This would be the first UN-wide climate education financing fund designed to effectively pool finance from a diversity of partners, in order to fund a single unified effort. This type of coordinated approach would represent a huge step in coordinating education finance from a diverse range of international donors in the climate education space.

⁵³ Buchner et al. 2023: 1
⁵⁴ GPE 2023

⁵⁵ GCF 2023
⁵⁶ UNESCO 2023



Climate data

To build resilient systems, stakeholders in the education field need access to timely data on a range of climate indicators, in a format that meets their needs. The variety of potential types of data that are likely to be needed are outlined in the table below. Where appropriate, all data should be disaggregated by gender, disability, age, and any other demographic data relevant to each area.

Type of data	Potential use
Early warning system (EWS) data	Providing schools with access to data on risk through EWS can support prompt action (such as the evacuation or closing of schools) in the event of an emergency
Geographic information systems (GIS) data	GIS data can be used in school mapping exercises to determine which schools are located in areas at high risk of climate hazards and natural disasters. GIS can also be used for planning purposes in determining where new schools should be located, to help determine the optimum position based on the geographic risk levels of that location.
Linked education, health and nutrition data	Climate change can have a wide range of negative impacts on population health both directly (such as heat exhaustion) and indirectly (malnutrition, malaria, cholera and so on). Having a joined-up approach between the health and education sectors can support a coherent approach to addressing interconnected issues.
Socio-economic data	Climate change can have a negative economic impact on communities, and there are indirect consequences of this on education. When households lose income due to crop failure, the death of cattle, or other climate-induced events that negatively impact income, this poses a risk to children's school attendance and enrolment, which may or may not be short term. Education policy decision-makers need to be aware of the wider socio-economic impacts of climate change, to support proactive initiatives to keep children in school at known times of economic hardship.
Education participation data	Understanding how school enrolment and dropout rates are impacted by climate change will continue to be important.
Teacher climate awareness data	Data on teacher knowledge and understanding can support planning around capacity building.
Infrastructure data	Given that damaged infrastructure is often a key inhibiting factor for access to schools during and after natural disasters, understanding the state of school infrastructure nationally and locally is important. This may include the state of disrepair of schools, whether schools are made with sustainable materials, the durability of different building approaches, and whether schools are made with materials conducive to a positive learning environment. Cost data associated with different building types, and the cost of repairs, will also be important for policy and planning.
Student learning data	Creating connections between learner data and climate change can support understanding of the continued negative impacts of climate change. Student learner data may also be needed to determine knowledge and understanding about climate change, and knowledge of disaster risk reduction approaches, depending on the goals of climate change education in different contexts.

In addition to (close to) real-time data, policymakers need access to more robust research to support effective evidence-informed decision making. The Center for Global Development recently published a proposed research agenda that outlines building blocks for climate change and education research, based on the following four themes: impacts on child wellbeing, solutions at scale, education for adaptation, and meaningful collaboration.⁵⁷

Safer and greener infrastructure

Extreme weather events and natural disasters can cause substantial damage to school infrastructure. The 2022 flooding in Pakistan, for example, reportedly resulted in over 30,000 schools being damaged, while 5,500 schools were used to accommodate displaced people.⁵⁸ This disruption led to 23 million children being unable to attend school. Action is being taken to reduce the risk of situations such as this and there is a growing body of knowledge concerning school design and risk reduction. The World Bank promotes school infrastructure resilience to both natural hazards and climate change through the Global Program for Safer Schools (GPSS), which is managed by the Bank's global unit for disaster and climate risk management, with funding from the Global Facility for Disaster Reduction and Recovery (GFDRR).⁵⁹ GPSS aims to ensure that World Bank-financed school infrastructure operations are informed by best practice in climate risk reduction.

Considerations for resilient school infrastructure are often aligned with principles of sustainability. Bioclimatic architecture, for example, is an approach where building design is based on a contextualised understanding of the local climate, with the aim of creating a comfortable environment using local resources.⁶⁰ Optimum temperature and humidity levels can often be reached without the use of air conditioning or heating systems, with ventilation, light and heat controlled through the position of the building, wall insulation, the positioning of windows, and other factors. Although bioclimatic architecture is an important consideration for new builds, its principles can also be applied when retrofitting existing buildings, although with less significant results.



⁵⁷ Abuya et al. 2024
⁵⁸ VSO 2022

⁵⁹ World Bank 2024
⁶⁰ Robles et al. 2015



School safety and continuity

To mitigate against the negative impact of climate change and other natural disasters, ministries of education need school safety and educational continuity plans, and associated guidance tools relating to the assessment of risk, risk reduction and response preparedness.

Policymakers must be agile and, if possible, try to maintain learning continuity in response to climate events. In 2024, Nagesh and colleagues at the Center for Global Development (CDG) published a blog post based on an analysis of the policy response to extreme climate events across South Asia. They highlighted the tendency to respond to crises by simply closing schools rather than taking various forms of adaptive action to maintain learning continuity. The CDG blog post commented that 'education systems often don't respond to shocks, but when they do, they usually close schools'.⁶¹ Only a minority of countries included in their analysis of South Asian countries responded to shocks through adaptive measures such as temporary learning centres and remote or hybrid learning.

The continuity of education requires careful planning. In many contexts, schools may be damaged or used as temporary shelters for local community members who have lost their homes. Planning for temporary learning facilities is particularly important in contexts where schools are located in high-risk environments, and where school buildings are planned for use as temporary shelters.

As noted above, EWSs are an important component of system resilience. The extent to which they are integrated into the education sector and used by schools as part of their approach to school safety can indicate the maturity level of a system. Mobile phone technology can play a useful role. In Indonesia, for example, InaRISK Personal is an app for mobile phones that provides people with up-to-date information about risks, supporting anticipatory actions in the event of disasters.⁶² This app is being used throughout the education system, from primary to upper secondary school, as part of the Disaster Safe Education Unit programme.

Governments often seek to harness the power of non-profit and volunteer organisations to support disaster preparedness. In Bangladesh, for example, the Red Crescent Society set up the Cyclone Preparedness Program (CPP) as long ago as 1970.⁶³ This carries out training on disaster preparedness, and volunteers also go door-to-door to alert people of impending cyclones and support the migration to cyclone shelters for safety.⁶⁴ EWSs should be coupled with protocols around school continuity, to ensure that not only are children kept safe, but they can also continue with their education.



⁶¹ Nagesh et al. 2024
⁶² GSMA 2022: 26

⁶³ BRCS 2024
⁶⁴ World Bank 2022

Teacher training and climate change

The knowledge and awareness of teachers is clearly important, but the extent to which climate-related content is a priority in pre-service and in-service training is variable. A 2021 study by UNESCO found that whilst most teachers surveyed believed teaching about climate change to be important, less than half (42%) believed that they were 'very ready' to teach education for sustainable development.⁶⁵ The MECCE Project maintains an interactive database of climate change education indicators globally. Analysis found that at least one-third of the 80 countries on it do not emphasise climate change in their teacher training plans.⁶⁶ Some countries, however, have taken this challenge more seriously. The Dominican Republic has been committed to the national training of primary school teachers since 2012.⁶⁷ The country's Nationally Determined Contributions (2020) – its national commitments to global efforts against climate change – include plans to include climate change education in teacher training at all levels of the educational system.⁶⁸

In EDT's research in Kenya and Rwanda, a key challenge for teacher training related to the rate of climate change locally. Teachers in Kenya reported that the climate was changing faster than their ability to keep up to date with how to accurately teach students about it. This, coupled with outdated textbooks that reported seasons in a way that was no longer accurate, created a challenge in teaching climate change. A lack of up-to-date resources was also cited as a challenge in Rwanda. Climate change teacher training must therefore be viewed as something that needs to be reviewed on an ongoing basis, with one-off training insufficient.



⁶⁵ UNESCO 2021
⁶⁶ MECCE 2024a

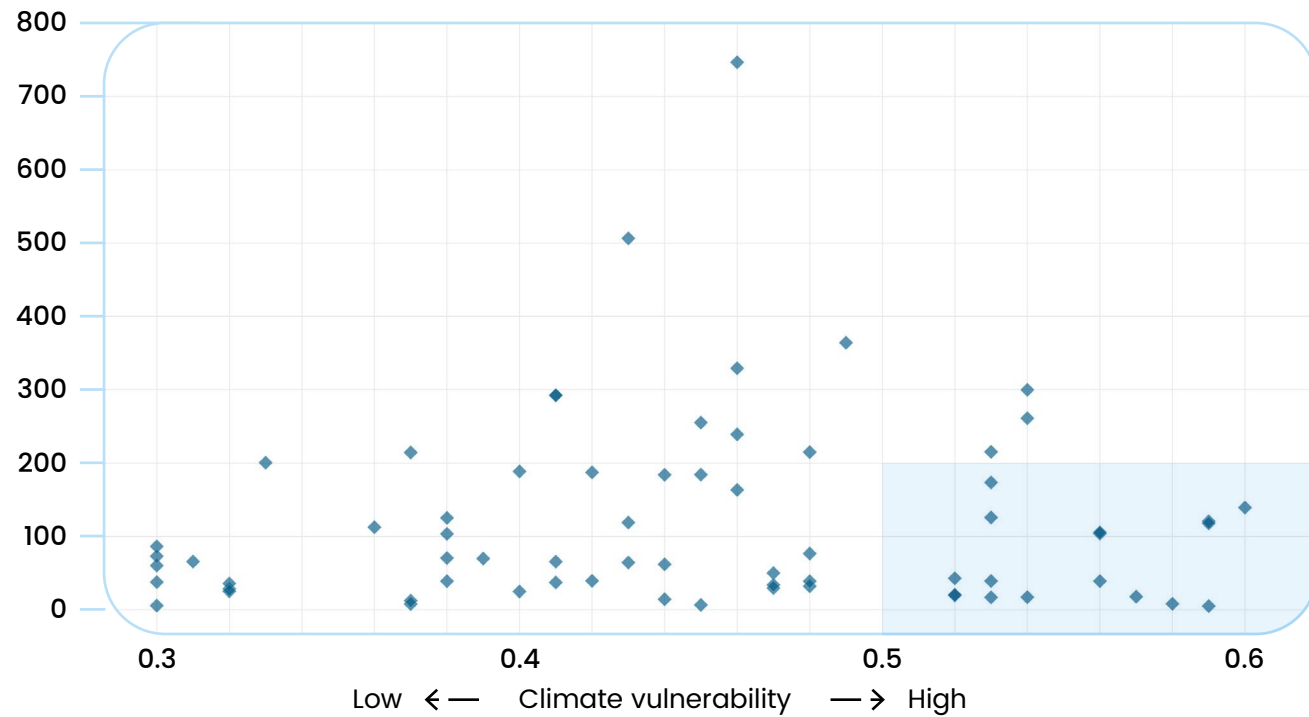
⁶⁷ UNDP 2023
⁶⁸ UNESCO 2024

Climate change education in curricula

MECCE data suggests considerable variation in the extent to which climate change is given due prominence in the national curriculum for schools.⁶⁹ This issue is one of the indicators which MECCE seeks to track worldwide, and it currently has data for 161 countries. The MECCE investigators searched national curriculum documents for references to climate change education using a 1–5 scale, where 1 = zero key climate words identified and 5 = a very high level of climate words identified. They found that 80% of countries (n=128) had zero, very low or low numbers of references in core documentation for schools. Only one country was given the grade of 5, indicating a very high level of references. Many countries with a high degree of climate vulnerability were categorised as having a very low level of references to climate education in curriculum documentation.

More data is likely to emerge in the coming years, as climate change makes its way firmly onto education agendas globally. OECD's Programme for International Student Assessment (PISA), for example, has indicated that tests in 2025 will measure 'the degree to which 15-year-olds are knowledgeable of, concerned about, and able to act on environmental issues as a result of science education'.⁷⁰ Interestingly, this approach is about understanding the integration of climate and environmental issues in science education, as opposed to a broader view of climate and environmental change being integrated into a broader subject base via education curricula. This is probably due to science being a core subject of interest for PISA.

Chart 3: The extent to which climate change is included in national curriculum policy vs climate vulnerability levels (MECCE, 2024b)



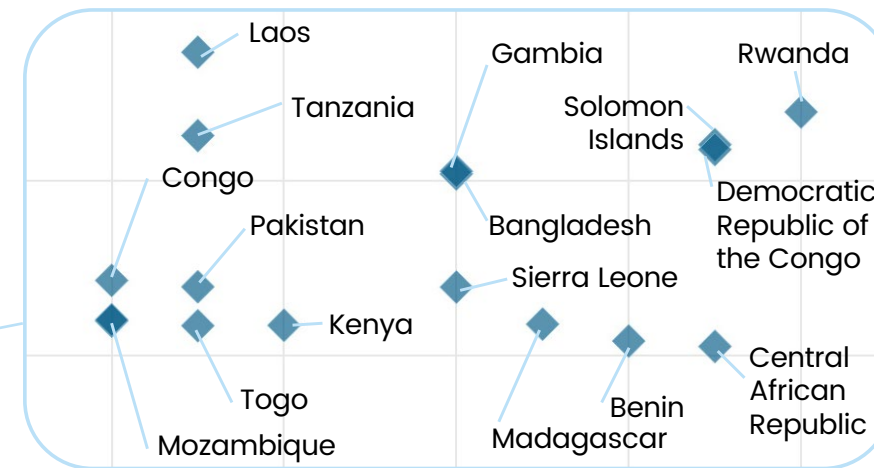
Source: data extracted from CPI 2023 report on Landscape of Climate Finance

MECCE's interactive data tool enables users to compare different indicators. When comparing the inclusion of climate change language in the national curriculum with country climate change vulnerability levels, it is evident some of the countries with the highest levels of vulnerability have the lowest levels of climate change language included in their national curriculum policies.

Of course, the nature and quality (as well as the quantity) of curriculum content matters. Defining the focus of climate change education at school level can be problematic. There is a degree of consensus in the literature that a cross-curricular approach to teaching about climate change, through integrating it into a wide range of subjects, is the best approach. Beyond this, much is contested.⁷¹ Rousell and Cutter-Mackenzie-Knowles reported that climate change was an under-theorised area of inquiry in their systematic literature review.⁷² Views about what should be taught about climate change are linked to belief systems. For some, climate change education should impart factual knowledge⁷³, while others see it as the promotion of eco-justice, with the aim, for example, of addressing global inequities that have resulted in the least-polluting countries experiencing the most devastating impacts.⁷⁴

Back in 2010, Pruneau et al identified three challenges related to climate change education that are still relevant today:⁷⁵

- 01 Cognitive challenges: Many people are confused or ill-informed about the causes of climate change.**
- 02 Sociological and psychological challenges: When faced with information about climate change, an anxiety response is common – so at an unconscious level this can lead people to avoid thinking about climate change and avoid making it a priority for action.**
- 03 Behavioural challenges: Climate change education must lead to action but changing ingrained behaviour patterns is difficult and unattractive to many people.**



Those planning for climate change education need to be mindful of all three challenges. It is necessary to impart accurate information, and thereby address the cognitive challenge but this alone will not lead to adaptation and mitigation without awareness of the psychological and behavioural barriers to action. We need to understand better how climate change education for mitigation and adaptation can bring about a 'change [of] habits in the long term'.⁷⁶ Studies typically lack longitudinal data that demonstrates long-term behaviour change as a result of climate change education.⁷⁷ Data often leans towards demonstrating short-term knowledge gains over long-term behavioural change.

⁷¹ Climate Generation n.d.; IBE-UNESCO 2016; Schreiner et al. 2005; UNESCO 2016

⁷² Rousell & Cutter-Mackenzie-Knowles 2020

⁷³ Monroe et al. 2019

⁷⁴ Kruger et al. 2020

⁷⁵ Pruneau et al. 2010

⁷⁶ UNESCO and UNFCCC 2016: 3

⁷⁷ Anderson 2012



Considerations about climate change education should also be context specific. What should be prioritised, for example, in countries with high levels of vulnerability and low levels of literacy and numeracy skills? In such a context, climate literacy education needs to go together with a relentless drive to build strong foundational skills.

In 2020 Rousell and Cutter-Mackenzie-Knowles published a systematic review of studies of climate education. It found that the school curriculum has typically been a weak mechanism for changing students' attitudes and behaviour, and that 'young people's understandings of climate change are generally limited, erroneous and highly influenced by mass media'.⁷⁸ They called for a new more participatory pedagogy, and an approach that helps teachers be aware of common misconceptions, and how their own misconceptions may have been influenced by the media.

In a report published by the Brookings Institution in 2022, Kwauk and Casey argue that we need to go beyond incremental curricular reform intended to simply add climate change concepts to an existing curriculum.⁷⁹ For them, the scale of the climate emergency requires radical action that goes beyond these desirable but modest and marginal reforms. They make the case for 'a new green learning agenda' that seeks both to develop 'green skills' and address underlying problems of inequity. Kwauk and Casey have produced a green skills framework for climate action, gender empowerment and climate justice, that encompasses a wide range of skills needed for green transitions [chart 4]. According to the latest World Bank report, *Choosing our future: education for climate action*, "80 percent of global business leaders believe that green skills will be the most important driver of the green transition".⁸⁰

For lower- and middle-income countries, huge educational transformations would be required to support the development of these skills amongst learners. While the Brookings report sets out an exciting vision of transformation, with green skills development at the heart of societal change for the better, policymakers clearly need to balance the need for action to address learning deficits in literacy and numeracy with the more ambitious prize of transformation through green skills.

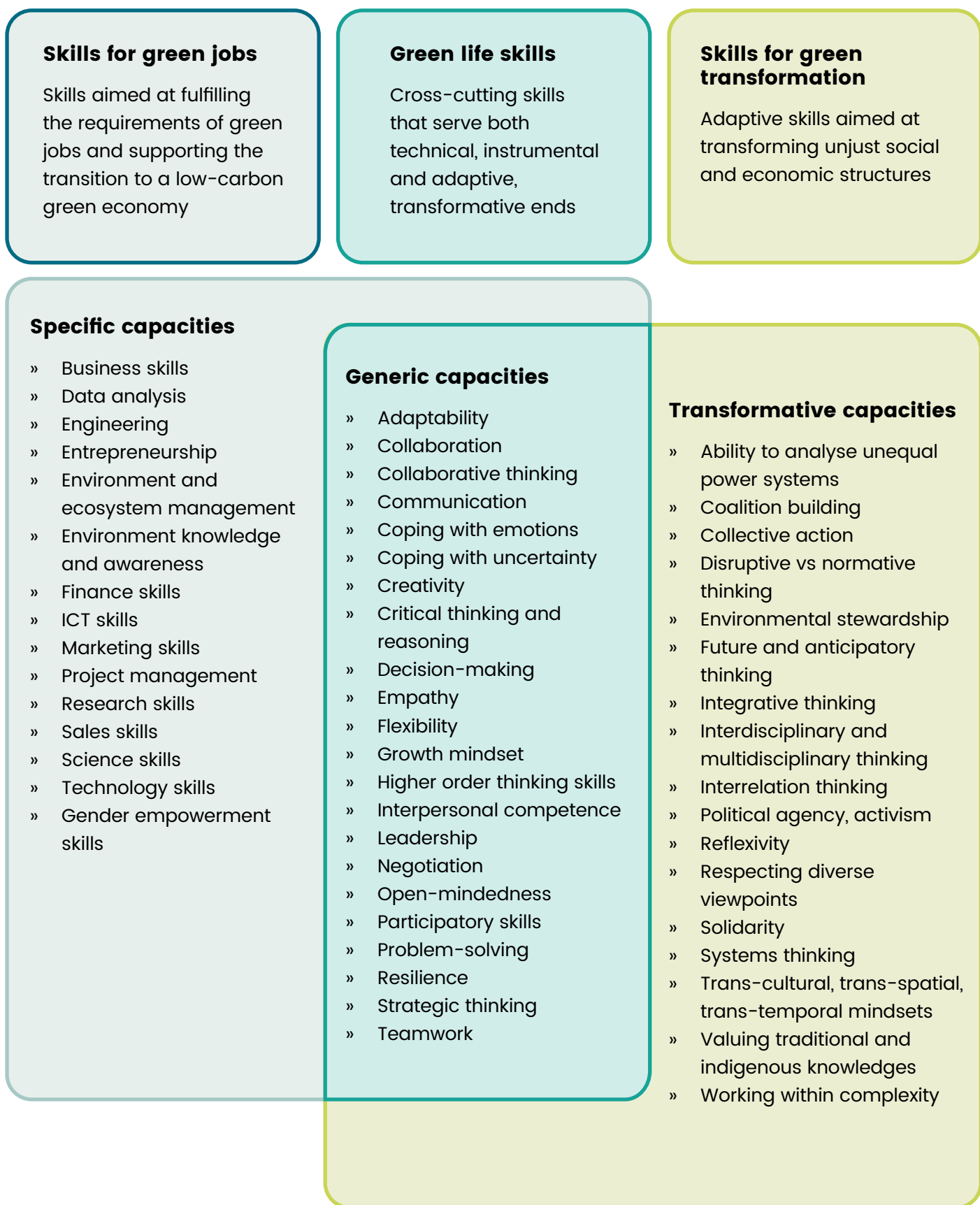
⁷⁸ Rousell & Cutter-Mackenzie-Knowles 2020: 191

⁷⁹ Kwauk & Casey 2022

⁸⁰ Sabarwal et al. 2024: 47



Chart 4: Green skills framework for climate action, gender empowerment and climate justice





Disaster risk reduction education: teaching and learning about managing locally relevant life-threatening risks

According to George and Oliva, disaster risk reduction (DRR) ‘aims to reduce the damage caused by natural hazards like earthquakes, floods, droughts and cyclones, through a policy of prevention. School-based disaster preparedness or risk reduction is the application of DRR in the context of a school community, and targets everyone involved in teaching and learning activities – including students, teachers, education personnel, support staff, and headteachers’.⁸¹

Support is available in the field of DRR. Technology has a role to play and George and Oliva conducted an interesting review of immersive technologies and digital games for school disaster preparedness in 2019.⁸² DRR education is a core aspect of the Comprehensive School Safety Framework developed by the Global Alliance for Risk Reduction and Resilience in the Education Sector (GADRRRES).⁸³ This framework is intended to promote systems and policies focused on child rights, sustainability and resilience, safer learning facilities, and school safety and educational continuity management. It also supports risk reduction and resilience education, to develop ‘individual and community understanding and capacity to assess all hazards and risks’.⁸⁴ Here, climate-smart action is integrated within a systematic view of risks to school safety. The framework seeks to protect child rights and resilience in the education sector through climate change risk reduction, response preparedness, and the strengthening of social cohesion and psychosocial well-being.

There are many instances of creative risk reduction in action. The Philippines is a positive example of DRR education being integrated into the curriculum from K-12.⁸⁵ A wide range of educational materials designed to strengthen resilience amongst school children have been made available over recent years. This was made possible through a strongly coordinated effort between many different stakeholders: Local Climate Change Adaptation for Development, House Special Committee on Climate Change, Albay Representative Joey Sarte Salceda, Department of Education, Climate Change Commission, a national panel of technical experts, and other government agencies.



⁸¹ George & Oliva 2019

⁸² George & Oliva 2019

⁸³ GADRRRES 2022

⁸⁴ GADRRRES 2022

⁸⁵ Balala 2020



Supporting communities to build resilience: the potential role of schools in sharing knowledge with communities

It is important to see building resilience within communities from the bottom up as aligned with, and fundamentally part of, the best approach to building system resilience. Adopting a community-based methodology can support the use of indigenous and local knowledge and can create more ownership over adaptive practices.

Schools can act as positive examples to their local communities in showing sustainable practices. For example, through an eco-schools project in Abaco Island in the Bahamas, one school responded to the damage to crops and buildings caused by Hurricane Dorian in 2019 by growing their own vegetables and recycling table scraps.⁸⁶ The vegetables produced by the school provided the local community with fresh produce. Singh and Shah outline many other examples of promising practices in their case studies on adaptation and climate resilience in schools and education settings.⁸⁷

EDT's recent research in Kenya and Rwanda has explored the current and potential role of schools in sharing locally relevant information about climate change – people tend to respect teachers, and this is a vital resource. In Kenya, participants reported that they have trust in educators imparting information to them; in some instances, they were prepared to take advice from educators (school leaders and teachers) more readily than from government officials. This indicates a potentially important climate outreach role for schools. However, this function depends on the supply of relevant information that schools can promote and endorse.

Using schools to promote climate change messages requires some sensitivity. In both Kenya and Rwanda, we documented examples of school children being provided (via their schools) with information related to the negative environmental consequences of chopping down trees. While the need to protect woodland is beyond doubt, there is a need to understand and respect the scale of the economic challenges faced by many marginalised communities. In places where local timber is a vital resource, there are obvious potential tensions in using children to cascade government messages to communities where this is a vital source of income. There are potential tensions between what children are learning about climate and environmental change, and the stark realities of the local economic situation. Education should arguably support the development of agency over decisions children actually have power over, and find ways to impart knowledge whilst being sensitive to local conditions.



⁸⁶ Singh & Shah 2022

⁸⁷ Ibid

Conclusion

In 2024 UNESCO and MECCE published *Education and Climate Change: Learning to Act for People and Planet*. The analysis of the problem in their report is completely consistent with our reading of the evidence:

- » Climate change-related disasters disrupt education
- » Education's role in combating climate change is not given the space it deserves in international education agendas
- » Teachers feel underprepared to teach climate change education.

We endorse the UNESCO/MECCE view that action is needed on several fronts, and we have identified three vital steps needed to reduce the harmful consequences of climate change:

- 1. Improve general levels of education to help people be resilient to climate-related challenges**
- 2. Build climate-resilient education systems at a national level**
- 3. Use schools as a key resource for the empowerment of local communities.**

Policy in such an important area as climate change must be evidence-based. This report demonstrates that there is now a robust body of research about both the impact of climate change on school systems in the Global South and the forms of action needed in response. We urgently need schools and school systems that are resilient to climate shocks and effective in supporting the reduction of risks and adaptation to climate change. The challenge is to act on the evidence to build this capacity to adapt and mitigate.



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