

Education pathways to climate outcomes and their potential for climate finance

November 2025

ABOUT THIS REPORT

SUGGESTED CITATION:

CLEAN. (November 2025). Education pathways to climate outcomes and their potential for climate finance. Report prepared by Christina Kwauk, Unbounded Alliance for the Climate, Environment, and Nature (CLEAN) Helpdesk.

Available: <https://www.clean-helpdesk.org/>.

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ACKNOWLEDGMENTS

The author would like to thank all those who contributed their time, insight and expertise throughout the development of this paper. In particular, the author would like to extend special thanks to Carlton Evans, Manisha Gulati, Shanice Mohanlal, Nhlanhla Mthembu, Camilla Pankhurst, Jemima Sinclair, Sarah Lane Smith, and to those who reviewed earlier drafts of this paper, including Lydia Baker, Sarah Beardmore, Frederica Cimato, Olivia Jenkins, and Imelda Phadtare. The author also thanks Jeanette Gurung, Tom Hayes, Aishwarya Katakam, Simon Lucas, Krishnan Narasimhan, and Sinclair Vincent for their time and insights on new innovative pathways to climate finance for the education sector.

ABOUT CLEAN

The Climate, Environment, and Nature (CLEAN) Helpdesk is a tailored query helpdesk that offers support on climate, environment and nature mainstreaming as well as on Paris Alignment and nature proofing compliance. The CLEAN Helpdesk aims to support the United Kingdom government's delivery of meaningful contributions to build resilience to current and future climate impacts, halt and reverse global nature loss, and halve global emissions.

COVER PHOTO:

UN Women (Ryan Brown)

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Executive Summary

Education has the potential to be a critical enabler of climate action, empowering individuals and communities to understand, mitigate, and adapt to climate risks. Education systems – spanning schools, universities, and related infrastructure – are both platforms for climate education and major sites for decarbonisation and adaptation efforts. Despite the strategic importance of the sector, its potential to attract climate finance remains underutilised, largely owing to gaps in evidence and methodologies that link educational interventions to measurable climate outcomes.

Responding to this gap, this paper provides a comprehensive but non-exhaustive mapping of ways in which educational investments could drive climate mitigation, adaptation, and resilience outcomes and attract international climate finance as a result. It explores opportunities for co-financing with climate funds, based on

- the type of evidence available; and/or
- the potential for new data and modelling methodologies to generate the evidence of impact required by climate finance institutions.

Specifically, the paper examines five interrelated pathways through which education investments could achieve climate outcomes, and their state of evidence:

1. **Climate-Smart School Environment:** Investments in low-carbon, energy-efficient infrastructure, transportation, and school meals that directly contribute to mitigation and adaptation targets. These activities are often aligned with national climate strategies and are primed for co-financing.
2. **Climate-Responsive Operations in Education:** Focuses on policy, planning, capacity building, and data systems that strengthen the resilience of education systems to climate shocks. These operational activities align with disaster risk reduction frameworks and adaptation finance priorities.
3. **Climate-Relevant Teaching and Learning:** This concerns the development of climate literacy, pro-environmental behaviours, and green skills through curriculum reform or updates, teacher training, and greening technical and vocational education and training programmes. While intuitively vital, more robust evidence is needed to link climate-relevant learning outcomes to climate impacts of relevance to climate finance.
- 4A. **Improved Access for Climate-Vulnerable Populations:** This concerns the sector's ability to serve marginalised groups such as girls, refugees, and children with disabilities by enhancing their adaptive capacity and resilience through improved access to education. Although activities related to access target climate-vulnerable populations, they straddle a fine line between development strategy and climate strategy. Their potential for climate financing depends on the degree to which climate objectives are integrated into the project design. Financing these activities with climate funds may best be explored with bilateral and multilateral development banks.

- 4B. **Foundational Learning for All:** Expands basic literacy, numeracy, and socio-emotional skills, which the evidence base suggests are strongly correlated with greater adaptive capacity and resilience. The link between foundational learning and climate outcome may be indirect and hard to prove; for this reason, these activities will probably require strategic advocacy to be taken seriously by some climate funders as a climate investment.

The paper calls for the development of new indicators, data collection systems, and modelling approaches to better document and measure climate impacts, especially for activities with indirect or complex causal pathways. To achieve this, education stakeholders are encouraged to:

- develop robust methodologies for measuring and verifying the climate outcomes of education activities;
- enhance data systems and modelling approaches to provide credible evidence for co-financing;
- collaborate with climate funders and cross-sectoral partners (agriculture, energy, health, waste management) to maximise impact; and
- mainstream climate objectives as core components of education interventions to unlock larger streams of climate finance.

By strengthening evidence, fostering partnerships, and innovating methodologies, the education sector can unlock new climate finance opportunities and drive systemic transformation for a resilient and sustainable future.

Table of contents

List of tables/boxes/figures	viii
Acronyms	x
Foreword	xi
Key Concepts	xiv
1 Introduction	1
1.1 The Challenge	1
1.2 The Opportunity and the Urgency	2
1.3 Overview of the Paper	3
2 Approach and Methodology	5
3 Education Pathways to Climate Outcomes	7
3.1. Pathway 1: Achieving Mitigation and Adaptation Targets through a Climate-Smart School Environment	9
3.1.1. Overview	9
3.1.2. Examples	9
3.1.3. Data and Evidence	11
3.1.4. Areas for Further Exploration	15
3.2. Pathway 2: Achieving Climate Resilience through Climate-Responsive Operations in Education	17
3.2.1. Overview	17
3.2.2. Examples	17
3.2.3. Data and Evidence	19
3.2.4. Areas for Further Exploration	21
3.3 Pathway 3: Achieving Climate Outcomes through Climate-Relevant Teaching and Learning	24
3.3.1. Overview	24
3.3.2. Examples	24
3.3.3. Data and Evidence	26
3.3.4. Areas for Further Exploration	29
3.4. Potential Pathway 4A: Enabling Climate Outcomes through Improved Access to Education for Climate-vulnerable Populations	33
3.4.1. Overview	33
3.4.2. Examples	35

3.4.3.	Data and Evidence	35
3.4.4.	Areas for Further Exploration	36
3.5.	Potential Pathway 4B: Enabling Climate Outcomes through Foundational Learning for All	39
3.5.1.	Overview	39
3.5.2.	Examples	39
3.5.3.	Data and Evidence	41
3.5.4.	Areas for Further Exploration	43
4	Conclusions and Areas for Further Exploration	45
5	References	49
6	Annexures	57
	Annex 1: Education pathways to climate outcomes	58
	Annex 2: Examples activities under Pathways 1-4A	58
	Annex 3: Rapid mapping of evidence of Pathways 1-4B	58

List of tables/boxes/figures

Figure i: Overview of Climate finance framework	xii
Figure ii: Illustrative list of financing instruments for climate change mitigation, adaptation and resilience	xiii
Figure iii: Risk Layering of Disaster Risk Finance Instruments	xviii
Figure iv: Common Disaster Risk Finance Instruments	xix
Figure v: Principles of Effective Disaster Resilience	xix
Figure 1: Snapshot of Pathway 1	10
Figure 2: Snapshot of Pathway 2	18
Figure 3: Snapshot of Pathway 3	25
Figure 4: Snapshot of Pathway 4A	34
Figure 5: Snapshot of Pathway 4B	40
Table i: Relationship between sectoral co-benefits and targeting.	xiv
Table ii: Examples of co-benefits (non-exhaustive) in education and climate	xv
Table 1: Key to Annex 1	7
Table 2: Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 1	11
Table 3: Sample Indicators of Climate Impacts for Pathway 1 Activities	15
Table 4: Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 2	19
Table 5: Sample Indicators of Climate Impacts for Pathway 2 Activities	22
Table 6: Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 3	27
Table 7: Sample Indicators of Climate Impacts for Pathway 3 Activities	29
Table 8: Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 4A	36
Table 9: Sample Indicators of Climate Impacts for Pathway 4A Activities	37
Table 10: Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 4B	42
Table 11: Sample Indicators of Climate Impacts for Pathway 4B Activities	43
Table 12: The state of the evidence, challenges to navigate, and opportunities for climate finance	45

Box i: Activity based finance and results-based finance linked to climate action	xvi
Box 1: How to interpret Annex 1	7
Box 2: A note on GEDSI-responsive climate finance under Pathway 1	17
Box 3: A note on GEDSI-responsive climate finance under Pathway 2	24
Box 4: A note on GEDSI-responsive climate finance under Pathway 3	33
Box 5: A note on GEDSI-responsive climate finance under Pathway 4A	38
Box 6: A note on GEDSI-responsive climate finance under Pathway 4B	44

Acronyms

CLEAN	Climate, Environment, and Nature Helpdesk
CSO	Civil society organization
EE	Environmental education
ESD	Education for Sustainable Development
FCDO	Foreign, Commonwealth and Development Office
GEDSI	Gender equality, disability and social inclusion
GHG	Greenhouse gas
HICs	High-income countries
ICF	International climate finance
ICT	Information and communications technology
LMIC	Low- and middle-income country
MDBs	Multilateral development banks
NAPs	National Adaptation Plans
NDCs	Nationally Determined Contributions
NGO	Non-governmental organization
ODA	Official development assistance
SDGs	Sustainable Development Goals
SIDS	Small island developing states
STEM	Science, technology, engineering and mathematics
TVET	Technical and vocational education and training
VCM	Voluntary carbon market
WASH	Water, sanitation and hygiene

Foreword

Why education and climate must align

The climate crisis is already disrupting education systems around the world, with impacts being felt by millions of children. Floods, droughts, wildfires, tropical storms and extreme heat are damaging school infrastructure and transportation, making it more difficult for children to attend school and affecting their ability to learn even when in school. In many cases, children are too hungry, thirsty, or overheated to concentrate, and teachers are similarly exposed. Climate stressors are weakening the enabling factors for children to access quality education, reducing household income, driving widespread displacement, and increasing poverty and acute malnutrition rates. Adaptations and maladaptations that negatively impact children's education and wellbeing are commonplace. Schools are regularly used as emergency shelters during crises, households are forced to migrate for better livelihood opportunities, and families sometimes resort to early marriage and child labour at the expense of education. These impacts affect vulnerable children in low- and middle-income countries most, where household resilience, adaptive capacity and fiscal and operational preparedness is weak.

With unique physiological and cognitive vulnerabilities, children are among the most vulnerable groups to the effects of climate change and environmental degradation¹. Despite this, only 2.4% of climate finance from key multilateral climate funds can be classified as supporting projects incorporating child-responsive activities,² and an even smaller share is directed specifically to education. Private sector contributions are harder to track but are likely to be minimal; examples of such financing in education are few and far between. This is a missed opportunity. More attention, climate action and finance should go towards meeting the unique and cross-sectoral needs of children and young people – including and especially through education.

Education has the potential to build substantial climate resilience and equip future generations with the knowledge and skills to respond to climate challenges. Education has clear and well proven returns for individual and household income and LMIC growth, all of which are key determinants of climate resilience. More directly, there is evidence that education can improve disaster risk awareness,³ climate awareness among individuals and their families, and climate-resilient adaptive behaviour in sectors such as agriculture.⁴ This positive relationship between education and climate change is increasingly recognised internationally. However, there is not enough research, evidence, or innovation to realise the climate co-benefits from education or to maximise the eligibility of education investment for climate finance.

This Education & Climate Finance collection, commissioned by FCDO from the CLEAN helpdesk, sheds light on how and where the education sector can access climate co-finance for improving the resilience and adaptation of education and delivering better climate outcomes through education. With more high-quality co-financing between the education and climate sectors, we

1 Marin, Schwarz, & Sabarwal, 2024; Nordstrom and Cotton, 2020.

2 UNICEF, 2023.

3 Muttarak & Lutz, 2014.

4 Deressa et al., 2009; Hisali et al., 2011; Khan et. al, 2020.

have an opportunity to protect children’s education and to contribute meaningfully to climate adaptation and mitigation.

FCDO’s commitment

In our 2022 Position Paper, the Foreign, Commonwealth & Development Office (FCDO) committed to better understanding education’s contributions to the climate agenda and how this could be better reflected in climate and disaster risk finance. Since then, we have worked with partners to advance this agenda:

- **BRACE:** As a board member of the Global Partnership for Education (GPE), FCDO supports the *Building the Climate Resilience of Children and Communities through the Education Sector* (BRACE) initiative. Co-financed by GPE and the Green Climate Fund (GCF), BRACE is supporting South Sudan, Cambodia, and Tonga to strengthen education system resilience including through climate finance.
- **CREST:** FCDO is funding the *Climate Resilient Education Systems Trial* (CREST) in partnership with the International Rescue Committee (IRC). This is the first pilot to use parametric insurance in education. The project explores how innovative disaster risk financing can protect learning during climate shocks.

The challenge

Through this work with partners, we have identified two key challenges:

1. **Making the case for education:** The education sector needs stronger evidence on how and where education investment and delivery contribute to climate outcomes—resilience, adaptation, and mitigation. Without clear methodologies, data and evidence, it is difficult to meet the eligibility criteria of climate financiers and to ensure that we are optimising climate outcomes through education investment.
2. **Understanding the opportunities:** There is a wide range of climate finance mechanisms—public, private, and disaster risk finance—but gaps in capability, knowledge and understanding mean that opportunities for more and better use of climate finance are often missed, particularly in sectors such as education, which have low baseline capability and knowledge of climate mechanisms.

About this collection

This mini collection of papers on the climate-education nexus includes an introduction and two think-pieces that begin to address these challenges. Aimed at anyone interested in better understanding the opportunities and risks for climate finance in the education sector, it encompasses:

- **Introduction:** This sets out key principles and information on climate and disaster risk finance, relevant to the education sector, to help frame the think-pieces that follow.
- **Paper 1:** *Education pathways to climate outcomes and their potential for climate finance* by Christina Kwauk explores how education contributes to climate outcomes. It identifies

four key pathways – from climate-smart school environments to foundational skills, – and assessing which are already eligible for climate finance and which need further evidence (including data and methodology development).

- **Paper 2: Mapping of climate finance instruments and potential for use in the education sector**, by Manisha Gulati, maps the climate finance landscape and highlights mechanisms that could be a good fit for education. It draws on case studies and expert insights to identify risks, opportunities, and next steps.

Together, these papers ask: '**How can we build better links between climate finance and education?**' The answer lies in strengthening the evidence base, improving knowledge and capability, and exploring new funding models.

Looking forward

Progress so far has been driven by collaboration. FCDO is grateful to our partners, GPE, Save the Children, IRC, UNICEF, and others, for their leadership and innovation. We hope this collection will spark new ideas, partnerships, and action.

FCDO remains committed to this agenda. We will continue to use our technical, political, and financial resources to help forge connections between the education sector and climate finance.

Key concepts

This introduction provides an overview of some key concepts in climate finance, including as they relate to the education sector. It is designed to be read in conjunction with the Foreword and the two substantive papers in this collection:

- **Paper one** by Christina Kwauk explores the pathways through which education contributes to climate outcomes.
- **Paper two: Mapping of climate finance instruments and potential for use in the education sector** by Manisha Gulati maps the climate finance landscape and highlights mechanisms that could be a good fit for education.

Overview of climate finance

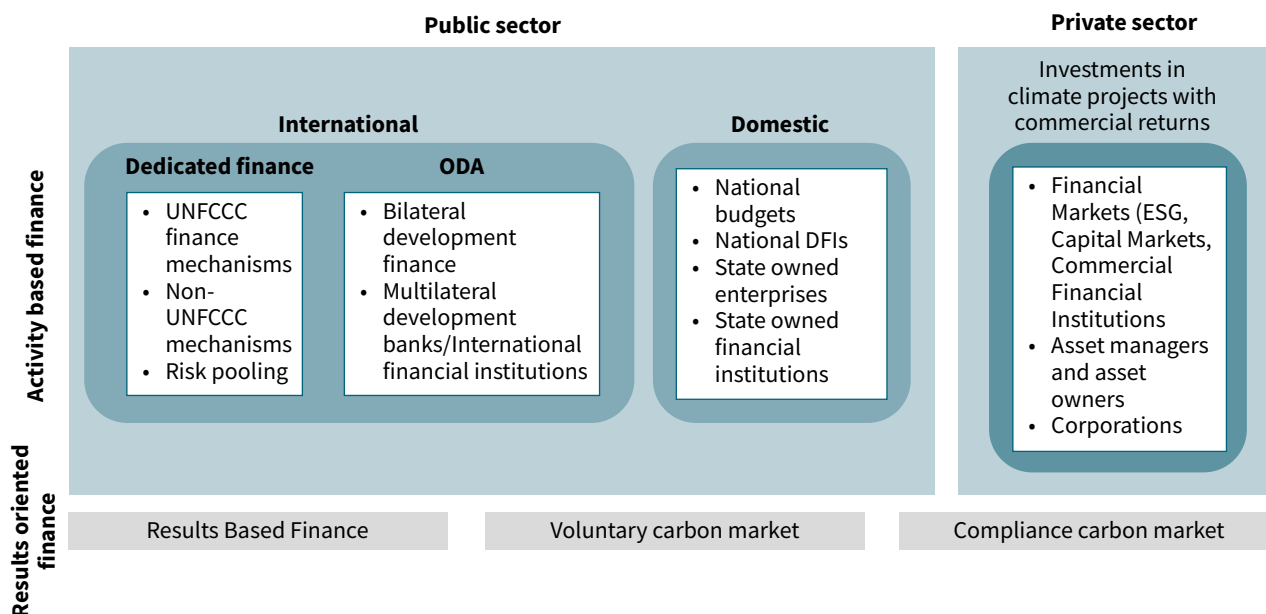
There is no universal internationally agreed upon definition of climate finance. Climate finance is a multifaceted concept that is sometimes conflated with related and overlapping concepts of green finance, sustainable finance, and low-carbon finance.⁵ For the purposes of these papers, ‘climate finance’ refers to any financing intended to reduce emissions, reduce vulnerability to negative climate change impacts, or maintain/increase resilience to negative climate change impacts. Climate funders, therefore, are any funders, public or private, who spend resources in pursuit of these aims.

Climate finance is delivered through a complex infrastructure, with multiple instruments and funding sources (See Figure i).

Public climate-related financing instruments involve a multitude of dedicated funding channels with differing structures of governance, modalities and objectives (see **Figure 2** in Paper two: Mapping of climate finance instruments and potential for use in the education sector). Public climate finance providers often have different windows under which different actors can access finance. The requirements to access finance under different providers, and even different windows from the same provider, can vary.

⁵ Grantham Research Institute, LSE, 2023.

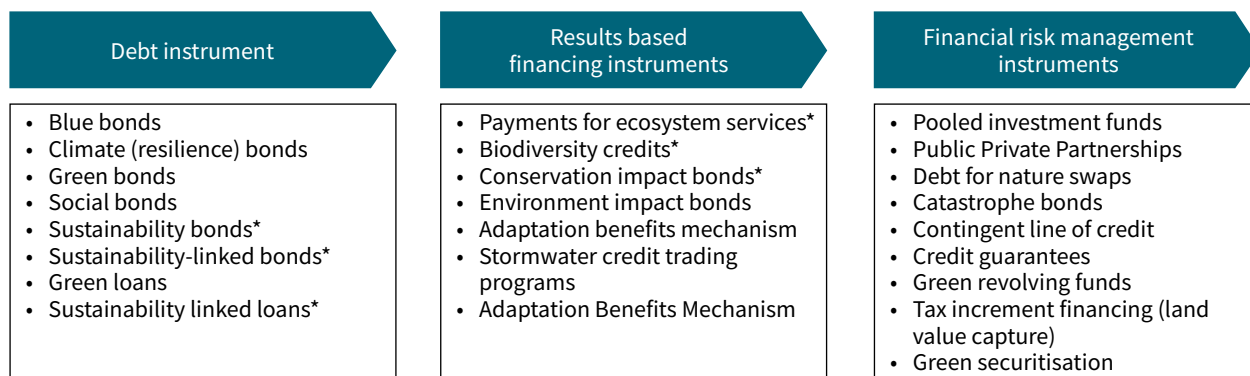
Figure i. Overview of climate finance framework



Source: Adapted from presentation by the World Bank⁶

Climate finance from the private sector does not usually operate with designated pots. A range of financing instruments enable access to capital from the private sector (see Figure ii).

Figure ii. Illustrative list of financing instruments for climate change mitigation, adaptation and resilience



*May involve climate finance

Source: NAP Global Network⁷, International Institute for Sustainable Development⁸, the World Bank⁹, and IMF¹⁰

6 Hallegatte, 2025.

7 NAP Global Network, 2024.

8 Gouett, M., Murphy, D. & Parry, J., 2023.

9 World Bank, 2023.

10 IMF. (n.d).

Climate finance concepts

Just as there is no universally agreed upon definition of climate finance, there are no universal criteria for accessing it. With such a diverse architecture, it is important not to make generalisations or assumptions. However, there are a series of concepts which crop up across different instruments, which are important to understand when considering accessing climate finance for education.

Additionality

Additionality refers to a requirement for climate finance to only support activities and outcomes that would not have occurred without the dedicated climate funding. This principle is not only a safeguard intended to direct scarce climate finance to where it is needed most (where it has greatest additionality) but also to protect the integrity of other development financing.

Additionality is not universally applied. But where it is, a clear, intentional link between activities being funded and the expected climate outcomes is required, demonstrating that the climate outcomes would not have happened under business-as-usual financing or delivery or through traditional development finance.

Additionality is critical for carbon credits and some global funds - like the Green Climate Fund (GCF). These funding mechanisms have distinct ways of defining and measuring additionality. Additionality may not be as important for some bilateral or philanthropic donors.

Direct, indirect, and 'co-benefits'

There are different ways of categorising the benefits of investments at the nexus of climate and education and different climate funders use different terminology.

In simplest terms, the relationship between education and climate can be conceptualised bi-directionally:

1. Education investments with climate benefits
2. Climate investments with education benefits

Education investments can either be 'climate targeted' or not and have climate co-benefits (or not). Similarly, climate investments can either target the education sector or not and have education co-benefits (or not). The phrase 'co-benefits' is commonly used (but not universally) and tends to refer to benefits which are secondary to the project's main objectives.

Table i. Relationship between sectoral co-benefits and targeting

	Targeted to Education Outcomes	Targeted to Climate Outcomes.
Education Sector Intervention	Traditional education sector interventions , e.g. structured pedagogy. May have climate co-benefits such as improved individual adaptive capacity but unlikely to be eligible for climate finance where additionality is a requirement. May be eligible for other sorts of climate finance if the connection to climate is made more explicit and/or climate outcomes can be established and measured.	Education sector interventions that explicitly target climate co-benefits , e.g. climate infrastructural adaptations such as sustainable classroom ventilation and cooling. Likely to be eligible for climate finance co-investment if climate outcomes are robustly established and measurable.
Climate Sector Intervention	Climate sector interventions that explicitly target education development co-benefits , e.g. installing solar panels within school infrastructure. Straightforward eligibility for climate finance and, if effective for education outcomes, eligible for wider development co-finance.	Traditional climate sector interventions , e.g. climate resilient agricultural innovations. Straightforward eligibility for climate finance. May also have education co-benefits e.g. via better household investment in education but in many cases this is not an explicit objective nor a measured outcome.

Table ii: Examples of co-benefits (non-exhaustive) in education and climate

Entry point	Example	Primary Benefits	Co-benefits
Direct climate change mitigation and adaptation interventions targeted toward education	Installing solar panels on school roofs	Climate benefit of reduction in GHG emissions from utilization of solar energy.	Education benefit from reliable off-grid power to improve the learning environment.
	Building the resilience of the education system to climate shocks through infrastructural adaptations and DRR sectoral plans	Climate benefits from increased resilience and adaptive capacity of vulnerable populations.	Education benefits from more time in school thanks to closures averted.
Climate change mitigation and adaptation interventions not targeted towards education	Providing clean cookstoves to communities	Climate benefits from reduced deforestation and GHG emissions from burning firewood.	Education co-benefits of reduced household labour (especially for girls) allowing increased time for education.
	Efforts to reduce air pollution produced by coal power plants	Climate benefit of reduced GHG emissions.	Education co-benefits from less learning days lost due to respiratory ill-health.

Entry point	Example	Primary Benefits	Co-benefits
Interventions in the education sector targeted toward climate	Green skills education	Education benefit is the transferal of skills which will support employment of young men and women.	Climate co-benefit from improved labour supply for green sector.
	Remedial learning interventions that support children after natural disasters	Education benefit from increased learning outcomes.	Climate co-benefits from more resilient and adaptive populations.

Across all of these example intervention types, some outcomes are more direct and clearly attributable than others. For instance, there is a relatively clear-cut and intuitive pathway from disaster risk reduction plans and activities in schools, to improved climate resilience as an outcome. However, the relationship between foundational learning and improved climate adaptive behaviours is less direct, with potential climate benefit likely to manifest quite a long time after initial investment. Similarly, sometimes the education co-benefit is clear and intentional. For example, where solar panels are installed on schools, there is a direct (although secondary) impact on the learning environment. However, a clean-cookstoves project may not explicitly target, or measure, education co-benefits, focusing instead on gender equality and time use, meaning the relationship is less direct.

Importantly, whilst less direct and/or immediate connections may be harder to make the case for, methodologies for robustly establishing causality between interventions and outcomes, including in the context of complex interactions and over long time periods, do exist. This kind of robust research and evidence should be leveraged to shed light on where and how education interventions can leverage climate outcomes most effectively and at scale, and vice versa. Conversely, pathways between activities and outcomes which may seem intuitive and clear may be proven not to be effective for climate outcomes when tested rigorously (for example, there is yet to be credible evidence on effectiveness of green skills interventions for driving sustainability transitions, esp in LMICs).

These considerations have implications for what education investments are likely to be eligible for climate finance from different instruments, based on how direct they require the benefits to be, whether additionality can be clearly established and whether they provide activity or results-based financing (see below).

Activity vs results-based financing

Climate finance can target activities or results (See the box below). The distinction here is whether climate finance is agreed based upon intent and thus designed to have climate benefits, or upon the achievement of those results.

Different climate finance instruments preference different approaches. For instance, the carbon market (a private sector instrument) works on a results-based approach, whereby credits are paid for carbon emissions reduced or avoided. The global climate funds tend to allocate climate finance based on activity, with projects designed to deliver mitigation or adaptation benefits.

Multilateral Development Banks (MDBs) tend to allocate climate finance according to design but have a relatively rigorous approach to measuring and reporting results.

Box i. Activity-based finance and results-based finance linked to climate action

Activity-based finance is provided before a project becomes operational. Some examples of activities in this context are:

- Improvements in business processes, supply chains and sourcing. For example, improving the efficiency of water production processes.
- The implementation of adaptation measures to protect own assets and operations. For example, improving storm and flood resistance of buildings.
- Solar or wind energy projects, the installation of electric charging infrastructure, procurement of electric buses, and the construction of green buildings.

Results-based finance is paid when results are achieved or when intermediate milestones are reached (with monitoring and verification), such as:

- Reduced or avoided emissions.
- People with increased adaptive capacity or climate resilience.

Source: Manisha Gulati

Different results and reporting approaches

There is no universally agreed approach to measuring and reporting climate results and spend. A summary of some approaches is set out below.

3. The **OECD DAC Rio Markers** require programmes climate focus to be either principal, significant, or not targeted. This labelling defines what proportion of spend can be counted as climate finance. This approach is used by bilateral donors and some global climate funds.
 - Principal programmes have climate outcomes as their main objective. The majority (or all) of the project's costs can be justified as international climate finance.
 - Significant programmes are those in which climate mitigation or adaptation is not a key driver but still an explicitly stated goal of the project. The activity is not principally undertaken in pursuit of climate objectives but has been explicitly designed or adjusted in support of, or in response to, climate objectives. The proportion of the programme which is delivering climate outcomes is eligible for international climate finance.
 - Non-targeted programmes do not include climate mitigation and adaptation objectives, or they are extremely limited or superficial. As a result, they do not qualify for international climate finance.
4. MDBs use a methodology for tracking climate adaptation finance that classifies three types of adaptation activities based on the degree to which climate adaptation outcomes are primary objectives in project design.¹¹
 - Activities that have been climate-adapted in response to actual, perceived, or expected climate impacts, or where adaptation measures have been integrated to ensure the project's objectives are met despite climate change impacts. Adaptation is not the primary goal, but an adjustment made to make the project more resilient. These activities can claim at most 10% of total project costs as eligible for climate finance (if the exact additional cost to adapt the project to climate change is difficult to quantify).

¹¹ EIB, 2022.

- Activities that have significant objectives of climate adaptation and development that directly address climate risks and contribute to building adaptive capacity, alongside wider development objectives. These activities can typically claim up to 50% of total project costs as climate finance.
- Activities that enable adaptation and focus on addressing the underlying causes of vulnerability to climate change or on removing barriers to adaptation. Adaptation is the primary objective and the project itself is a dedicated adaptation measure. In this case, up to 100% of project costs are eligible for climate finance.

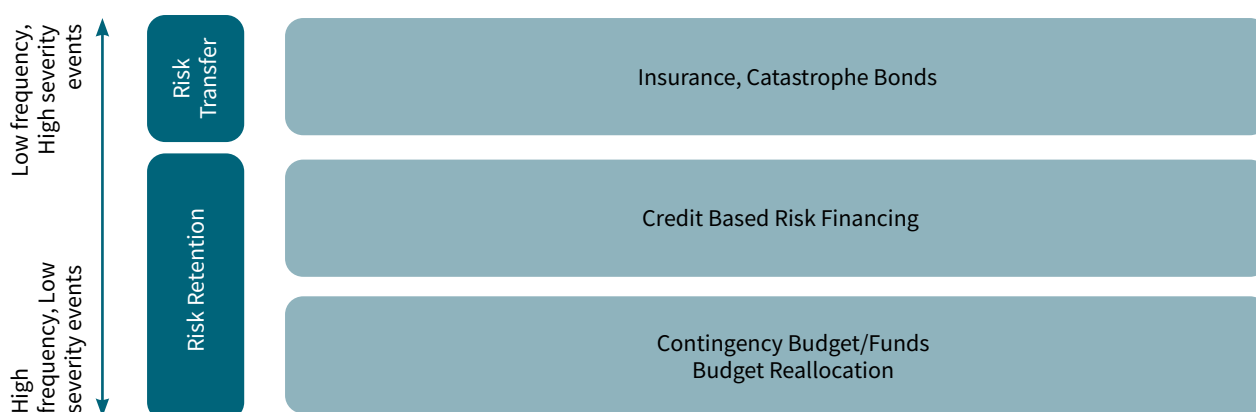
Disaster Risk Finance (DRF)

Disaster Risk Finance (DRF) is closely related to climate finance since it addresses the fiscal impacts and economic losses caused by natural hazards such as cyclones, droughts, earthquakes, and floods, and supports countries to increase their financial resilience to natural disasters. DRF encompasses a broad range of financing strategies aimed at managing the fiscal impacts of hazards- including climate, environmental, technological failures and conflict and crisis. As such, a large proportion but not all of DRF can be categorised as international climate finance.

The objective of DRF is to help minimise the cost and optimize the timing and effectiveness of meeting post-disaster funding needs without compromising development goals, fiscal stability, or wellbeing. Disaster Risk Finance Instruments (DRFI) can be disaggregated into (a) funding focused on protecting and managing risk of impacts on lives and livelihoods; (b) funding aimed at minimising damage to assets and supporting the reconstruction of those assets and the services they provide post-disaster; and (c) funding intended for immediate operational and humanitarian responses following a disaster (see Figure iii).¹²

Different DRFI are used to address different levels, types and frequency of risks. DRFIs can also vary in terms of who is the risk owner- i.e. whether they involve retention or transference of risk to another entity (see Figure iv). Generally speaking, risk retention is more suitable for higher frequency low severity events, and risk transfer for high severity events yet lower frequency events.

Figure iii: Risk Layering of Disaster Risk Finance Instruments



Source: Adapted from Global Shield against Climate Risks¹³ and the EU-WB/GFDRR Global Partnership on Disaster Risk Financing Analytics¹⁴.

¹² Sirivunnabood & Alwarritzi. 2020.

¹³ Global Shield. (n.d.).

¹⁴ EU-WB/GFDRR, 2020.

DFR can also either be arranged before the onset of a disaster (Ex ante) or afterwards (Ex post) (Figure iv), with some accompanying implications in terms of timeliness and liquidity. For example, humanitarian aid can take many months to raise, transfer and deploy in the wake of a disaster, whereas contingent lines of credit involve finances held nationally in reserve, ready for deployment at the onset of a natural disaster.

Figure iv. Common Disaster Risk Finance Instruments

	Ex ante instrument (arranged before disaster)	Ex post instrument (arranged after disaster)
Risk retention¹	<ul style="list-style-type: none"> Contingency fund or Disaster reserve funds Line of contingent credit 	<ul style="list-style-type: none"> Budget reallocation Post-disaster credit Emergency tax allocation
Risk transfer²	<ul style="list-style-type: none"> Insurance/reinsurance Index insurance (Parametric insurance)/reinsurance 	<ul style="list-style-type: none"> Humanitarian aid Crisis response grants Loans for development banks

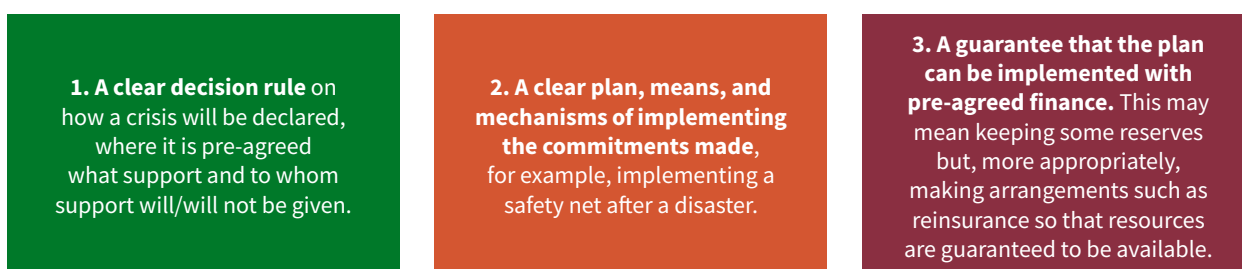
¹ Risk retention refers to the responsibility for a certain level of risk or losses. It may also refer to the amount of risk that a party is willing to accept before transferring any remaining risk.

² Risk transfer refers to the shifting risk from one party to another.

Source: The World Bank¹⁵ and Global Shield against Climate Risks¹⁶

Which DRF instruments are best suited to different situations is a complex and contextually nuanced matter. Factors include capability, income-level, credit rating, fiscal space, indebtedness, climate vulnerability and exposure, eligibility status for IDB financing, and political allegiance. Nevertheless, there are certain cross-sectoral principles of effective disaster resilience which should be borne in mind (Figure v). In particular, disaster financing should enable well planned and prepared activities with clear and transparent trigger points or decision rules. Lastly, planning for recovery of disaster costs is necessary to ensure that these plans can be delivered through pre-agreed financing wherever possible.

Figure v. Principles of Effective Disaster Resilience



Adapted from Clarke & Dercon (2016). *Dull Disasters? How Planning Ahead Will Make a Difference*.

¹⁵ Signer, 2018.

¹⁶ Global Shield, 2024.



Photo credit: Abir Abdullah Climate Visuals Countdown

1

Introduction

Education is critical to effectively responding to climate change. Education serves as a crucial enabler of both mitigation (reducing greenhouse gas emissions and promoting carbon sinks) and adaptation (adjusting to and building resilience to the impacts of climate change). It empowers individuals and communities with the knowledge, skills, opportunities, and agency to understand, mitigate, and adapt to climate risks. When education systems integrate climate literacy, promote sustainable behaviours, and build a range of green skills and adaptive capacities, they lay the groundwork for other climate actions to succeed.

Beyond the act of teaching and learning, education systems themselves are vast, interconnected networks that serve as public infrastructure and social platforms in nearly every community worldwide. These systems – comprising schools, universities, informal learning environments, administrative buildings and facilities, school meal preparation and distribution, etc. – consume resources, shape local economies, and influence societal norms.¹⁷ As such, they are both platforms for climate change education and major sites for decarbonisation and climate adaptation efforts. By greening school operations, retrofitting buildings, and embedding resilience into education infrastructure and practices, education systems can model and deploy climate solutions at scale, acting as microcosms of society that demonstrate and catalyse broader societal transformation toward sustainability and climate resilience.

1.1 The challenge

Despite the education sector's clear contributions to climate mitigation and adaptation, its potential to attract co-investment from climate finance remains significantly underutilised. Climate finance refers to finance from bilateral donors, multilateral development banks (MDBs), dedicated UN and philanthropic climate funds, and private sources. Their funds are used to support activities that reduce greenhouse gas emissions and/or build resilience and adapt to the impacts of climate change.

¹⁷ While no standardised estimate exists for the share of education-related infrastructure within total public infrastructure in low- and middle-income countries, sectoral analyses and empirical calibrations commonly used in the literature suggest that school buildings and related educational facilities typically comprise between 15% and 33% of public infrastructure (cf. Atolia, et al., 2021).

The underutilisation of climate finance is primarily due to the education sector’s lack of rigorous engagement with existing evidence to date and gaps in developing new methodologies to strengthen the evidence base between educational interventions and measurable climate mitigation and adaptation outcomes. A related challenge is that some of the climate benefits of education, especially those dependent on behavioural change, often manifest through complex, indirect causal chains, sometimes over a longer period of time. These can be difficult to robustly attribute and document within the typical timeframe of project monitoring and evaluation. Yet, while it may be challenging to measure the climate impacts of all investments in the education sector, this does not mean the climate impact is impossible to capture. Rather, the challenge reflects a gap between the methodologies used in education outcomes frameworks and those used in climate finance frameworks.

The global education sector has recently begun to develop a more sophisticated understanding of education’s contributions to climate mitigation and adaptation.¹⁸ Indeed, the evidence base suggests that the link between education and climate outcomes is unequivocal and multitudinous.¹⁹ Climate funders have also increasingly recognised the importance of investing in climate initiatives that deliver sustainable development co-benefits, including in education, gender equality, health, and poverty reduction, that are inclusive of children and marginalised groups.²⁰ Importantly, both education funders (public and private funders who historically focus on supporting education) and climate funders (those who historically focus on addressing climate change) are also beginning to recognise that investments in education constitute a climate strategy. That is, the impacts of such investments extend beyond the education sector, strengthening the climate resilience and adaptive capacities of systems and populations that underpin societal resilience and innovation.²¹

Such growth in awareness presents a timely opportunity for education and climate funders to co-invest for co-benefits. The emerging paradigm shift also presents a strategic opportunity to begin jointly developing and refining methodologies to strengthen the evidence base of education pathways to climate outcomes and unlock even more opportunities to co-finance more inclusive, effective climate action.

1.2 The opportunity and the urgency

Recent years have seen a troubling reversal in global development finance trends, including in official development assistance (ODA) for education. These cuts are particularly acute for the most climate-vulnerable countries, where education systems are already chronically underfunded and heavily reliant on external support. This shrinking pool of development finance, together with significant barriers to an ever-evolving landscape of climate finance, hamstring the education sector precisely when it needs to double down on its role as a foundational enabler of climate action.

18 See for example [Bapna, Simpson & Colenbrander, 2024](#); [Cooke & Beardmore, 2025](#); [Dubai Cares & SEEK Development, 2024](#); [Ehlers, Husain, Karboul, et al., 2022](#); [Fitzpatrick & West, 2022](#); [Kwauk & Casey, 2021](#); [Malala Fund, 2021](#); [Sabarwal, Marin, Spivak, et al., 2024](#); [Sims, 2021](#); [UNESCO & MECCE, 2024](#); [Williamson, Satre-Meloy, Velasco, et al., 2018](#).

19 [Lutz, Muttarak & Striessnig, 2014](#); [O’Neill, Jiang, KC, et al. 2020](#); [Sabarwal, Marin, Spivak, et al., 2024](#).

20 See for example [ADB, 2024](#); [FCDO, 2022](#); [Nowack, 2025](#); [UNDP, 2023](#).

21 See for example [Adaptation Fund, 2023](#); [ADB, 2024](#); [Green Climate Fund, 2023](#).

This paper attempts to help education and climate stakeholders navigate this moment in time and to fast-track efforts toward co-investment by education and climate funders in education as a climate strategy. The paper maps known and potential education pathways to climate mitigation, adaptation, and resilience outcomes. It identifies where there is strong evidence and where evidence gaps remain. Where there is insufficient evidence, the paper suggests ways the education sector might collect more (or new) data, which robust (or different) methodologies might be needed, and what changes in project design and monitoring may help strengthen the case for co-financing. Without such an initial mapping of education's climate impacts, education and climate funders continue to risk underinvesting in the very systems and capacities needed to drive and sustain inclusive climate solutions over the long term.

A secondary aim of this paper is to help the education sector better leverage climate and development financing. Specifically, by optimising its contributions to climate outcomes and therefore its eligibility for directing climate co-financing to these activities, the sector can direct increasingly limited development finance to achieve urgent development priorities that are unlikely to be eligible for climate financing. These include addressing teacher shortages, advancing teacher professional development, and removing barriers to access and equity for the most marginalised and underserved populations, including children with disabilities and refugee children.

1.3 Overview of the paper

This paper is organised around five comprehensive, non-exhaustive and interrelated pathways linking investments in the education sector to a variety of climate mitigation, adaptation, and resilience outcomes. These pathways were identified from a desk review of literature on education's contributions to climate outcomes. The five pathways are:

- Pathway 1: Achieving mitigation and adaptation targets through a climate-smart school environment;
- Pathway 2: Achieving climate resilience through climate-responsive operations in education;
- Pathway 3: Achieving climate outcomes through climate-relevant teaching and learning;
- Potential Pathway 4A: Enabling climate outcomes through improved access to education for climate-vulnerable populations;
- Potential Pathway 4B: Enabling climate outcomes through foundational learning for all.

The discussion of each pathway highlights existing or proposed methodologies for capturing the direct and indirect linkages between education investment and different mitigation and adaptation outcomes. It also identifies opportunities, challenges, and considerations to better address methodological gaps in the (actual or potential) measurement, reporting, and verification of education outcomes and/or climate impacts of certain types of investments or activities. Finally, it suggests ways to strengthen the evidence base to better make the case for education activities to be eligible for and attract co-financing from the climate sector. Where the literature was lacking in detail (for example about methodologies for education activities to be funded by the sales of carbon credits), insights were derived from interviews with experts in the field.

The mapping also includes a review of investments in the education sector with more indirect pathways to climate outcomes – namely, Potential Pathways 4A and 4B. For these, climate mitigation or adaptation objectives are not targeted as part of their design or objectives;

however, research has consistently demonstrated that they are highly correlated with adaptive capacity and/or climate resilience. These pathways have been included as ‘potential’ in an effort to ‘bookmark’ their climate relevance so that education stakeholders may at minimum continue to advocate their sustained funding by traditional development funders. At most, stakeholders could begin to identify ways to move these activities from ‘not targeted’ to ‘significant’ status. The goal here is not to displace critical education activities from funding, but to highlight areas where further integration of climate considerations could strengthen their connections to climate outcomes and their potential to unlock new financing.

This paper has been developed through the Climate, Environment and Nature (CLEAN) Helpdesk, an on-demand, free technical assistance facility funded by the UK’s Foreign, Commonwealth & Development Office (FCDO) supporting UK officials with technical assistance related to climate, environment and nature issues. Based on the requirement of the CLEAN Helpdesk for all deliverables to be ‘gender equality, disability and social inclusion (GEDSI)-sensitive’,²² this paper includes some analysis related to GEDSI-responsive climate finance under each pathway. GEDSI-responsive climate finance means ensuring that climate finance initiatives are designed and implemented in a way that addresses the specific needs and priorities of marginalised groups, such as women and girls, people with disabilities, children and youth, refugees and migrants, who are often disproportionately affected by climate change. As the paper is related to education, there is a focus on climate finance that is channelled towards children and youth.

²² The CLEAN Helpdesk defines ‘GEDSI-sensitive’ as interventions / deliverables which include the assessment of and action to meet the practical needs and vulnerabilities of marginalised groups, using an inclusive approach to ensure everyone’s voice is heard.



Photo credit: Ryan Brown UN Women

2

Approach and methodology

This paper draws on concept mapping, expert interviews, and a rapid desk review of academic and grey literature focused on measuring education's contributions to climate mitigation and/or climate adaptation and resilience.

To initiate the mapping of the five pathways, the author developed a conceptual framework linking major educational investments in climate mitigation, adaptation, and resilience by

- investment type (e.g., infrastructure, operations, learning, etc.);
- their associated climate impacts (see [Annex 2](#));
- the necessary data and evidence needed to measure, document, and robustly establish these impacts.

Once the initial mapping was completed (see [Annex 1](#)), it was further refined through an iterative process of reviewer feedback, consultations with experts, and insights from the academic and grey literature.

To determine the state of the data and evidence underlying each education pathway, the author conducted a rapid desk review of the academic and grey literature, including publications produced in the past decade investigating the role of education in climate action. The aim of this review was not to conduct a comprehensive systematic review of the evidence – that would have been beyond the scope of the paper – but rather to gauge how well established the evidence base is behind different education-to-climate linkages. Key questions included:

- What types of data and methodologies are studies and evaluation efforts gravitating towards?
- What innovative approaches exist for collecting data and measuring the climate impact of education investments?
- What methodologies need to be tested further in different contexts?
- What other data and new methodologies might be pursued in the future to fill gaps in current approaches?

In addition to documenting the evidence of climate linkages, the author also documented several other key pieces of information for the studies and evaluations reviewed (see Annex 3), including:

- the rigour of the evidence (e.g., peer-reviewed journal);
- the methods used (e.g., quantitative modelling, case study, etc.);
- the direction of the evidence (e.g., whether the impact was positive, marginal, or inconclusive); and
- the geographic location of the study (e.g., country or region).

Based on the review, the author assigned a colour code to indicate how well established the evidence base is:

- Green indicates an established evidence base (e.g., peer-reviewed, strong results of climate impact, etc.).
- Yellow indicates an emerging evidence base (e.g., primarily grey literature, studies with inconclusive or emergent results, etc.).
- Red indicates limited evidence (e.g., not many studies identified or conducted yet).

It should be noted that given the scope of this paper, these codes are rudimentary. A more rigorous review of the literature and a more systematic classification of the availability and strength of the evidence will be required in order to draw more substantive conclusions about the state of the evidence – something that was unfortunately beyond the scope of this paper.



Photo credit: Matthew Becker, 2012 Peace Fellow, Subornogram Foundation, Sonargaon, Bangladesh The Advocacy Project

3

Education pathways to climate outcomes

This section introduces the five education pathways to climate outcomes. Readers may find it easier to first spend some time exploring the visualisation in **Annex 1**, zooming in and out of the image at their convenience and according to their interests.²³ Alternatively, readers may benefit from reading this section in tandem with Annex 1. Box 1 presents a key to interpreting Annex 1.

Box 1. How to interpret Annex 1

Table 1 provides a key to interpreting the visualisation in Annex 1. Its columns and colour coding are laid out to mirror the Miroboard.





Table 1. Key to Annex 1

Column 1	Column 2	Column 3	Column 4	Column 5
Education Investment			Data & Evidence	Climate Outcome
Climate as Principal/Significant objective			Data collection method or modelling approach needs to be developed	Climate adaptation outcome
Investment entry points with direct pathways to climate outcomes	The <i>channel</i> through which direct impact on climate outcomes occurs	The <i>mechanism</i> that generates evidence of direct impact on climate	Regular data collection or modelling needed at the project level	Climate resilience outcome
Climate as Not Targeted Objective			Data is already regularly collected by governments or programmes	Climate mitigation outcome
Investments entry points with indirect pathways to climate outcomes	The <i>channel</i> through which indirect impact on climate outcomes likely occurs	The <i>mechanism</i> that could potentially generate evidence of impact on climate		



²³ Annex 1 Miroboard. <https://miro.com/app/board/uXjVJO4NQyM=/>.

Box 1. How to interpret Annex 1

Additional Icons				
___ Direct link	 Potential cross-sectoral partner	 Example projects	 Areas for further research	 Author notes / commentary
--- Indirect link				

Columns 1, 2, and 3 represent possible investments in the education sector. Purple blocks represent education activities likely to have climate outcomes as a principal or significant project objective, while red blocks represent education activities where climate outcomes are probably not targeted project objectives. Column 1 indicates the general investment category (e.g., entry point activities that education stakeholders and climate funders might be most familiar with or use to describe an investment). Column 2 indicates the channel through which the education investment might impact climate outcomes (e.g., the physical learning environment, the policy environment, operations, and supporting systems, teaching and learning, etc.). Column 3 indicates the mechanism – the funded activity (e.g., solar panels, a learning continuity plan, climate literacy, etc.) – through which the education investment might generate a mitigation or adaptation outcome(s). It is the impact of the investment or activities in Column 3 that gets measured, where data is collected. It should be noted that not all education investments may be relevant for all geographic contexts. Considerations of climate justice (fairness, equity, and social inclusion) should be made when assessing whether an activity should be pursued in any given context.

Column 4 in **Annex 1** represents potential data and evidence that can be collected or modelled to measure, report, and/or verify the education activity's impact on climate outcomes. This data and evidence is represented as potential indicators in varying shades of blue. Light blue circles indicate indicators for which data, data collection methods, or modelling methodologies do not currently exist or have yet to be deployed beyond a specific project or pilot study and which need further development. Medium blue circles indicate indicators for which data collection or modelling methodologies may already exist but for which regular primary data collection would be needed at the project level. Dark blue circles indicate indicators for which data is already regularly collected; some further development may be needed. These indicators have been informed by the literature and through a rapid assessment of the education activity's likely pathway to impact on climate mitigation or adaptation outcomes.

Column 5 in Annex 1 represents general indicators of climate mitigation and adaptation outcomes to which education activities may be potentially linked. Light green indicates adaptation outcomes, mainly improved adaptive capacity or increased adaptation to the impacts of climate change. Medium green indicates increased resilience to climate shocks and stressors. Dark green indicates mitigation outcomes, primarily the reduction or avoidance of greenhouse gas emissions, the promotion of low-carbon technology and innovation, and/or the promotion of biodiversity and carbon sinks.

Finally, solid lines indicate direct pathways or linkages while dotted lines indicate indirect pathways or linkages. Yellow 'plus' (+) shapes indicate adjacent sectors with which the education sector could collaborate. Yellow boxes give examples of education projects that have pursued a particular pathway to climate finance and/or are currently employing the data collection or modelling methodology to measure, report, or verify its activity's climate outcome. Yellow stars indicate areas where further research is needed. Lastly, white speech bubbles indicate the author's commentary, including assumptions and footnotes.

In addition, readers may find Annex 2 useful for providing more detailed examples of activities under Pathways 1–4A, where climate is a principal or significant objective of the education investment, and how they may achieve mitigation and/or adaptation outcomes. Like Annex 1, Annex 2 is not exhaustive, but rather attempts to provide an illustrative set of examples that go beyond narrowly defined entry points for education pathways to climate financing.

Finally, while a rough snapshot of the evidence landscape for each pathway is included in the data and evidence overviews of each pathway in the sections below, **Annex 3** should be consulted by readers interested in additional depth and/or access to full citations of the literature reviewed. Each tab in Annex 3 corresponds to one pathway, and each tab contains the literature for most mechanisms identified in **Annex 1**.

3.1. Pathway 1: Achieving mitigation and adaptation targets through a climate-smart school environment

3.1.1. Overview

Pathway 1 captures investments in low-carbon and energy-efficient schools, school transportation, climate-smart and climate-resilient infrastructure (including routes to school, and climate-smart and climate-resilient school meals) that directly contribute to climate mitigation and adaptation targets through their impact on climate-smart school environments (see Figure 2 and explore more in **Annex 1**, Pathway 1). This pathway is particularly primed for co-financing, with priority sectors often highlighted in countries' Nationally Determined Contributions (NDCs), National Adaptation Plans (NAPs), and other relevant national climate strategies. By integrating activities like school waste and recycling management, rainwater harvesting techniques, and planet-friendly school meals, these investments not only enhance the climate-readiness (and overall quality) of learning environments but also deliver measurable climate benefits.

3.1.2. Examples

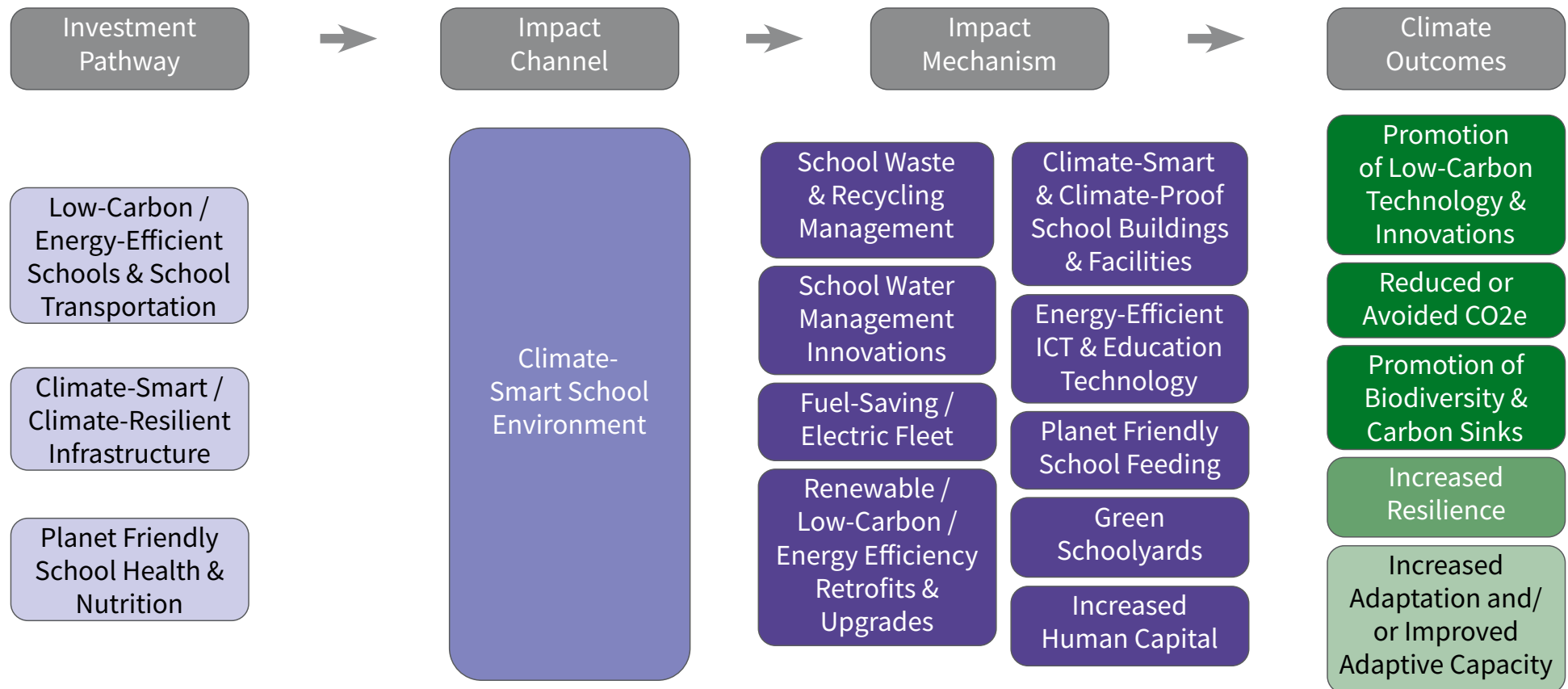
Example activities in this climate-smart school environment pathway include the following ways to contribute to mitigation, adaptation and resilience:

- Removing, reducing, or avoiding carbon dioxide, methane, and other greenhouse gas emissions through the adoption of low-emissions technologies and innovations on school grounds;²⁴
- Strengthening the capacity of educational assets (e.g., school buildings and roads to school) and supporting services (e.g., school health and nutrition) to anticipate, absorb, and/or manage education sector-relevant climate risks like extreme heat or drought;
- Building the resilience of critical school WASH and ICT infrastructure to climate shocks and stressors that could disrupt teaching and learning.

²⁴ Notably, data is not available to understand the education sector's contributions to greenhouse gas emissions across LMICs, although emerging analysis suggests that in HICs like the United States the education sector contributes less than 2% of the country's total annual emissions (**Booyesen, Samuels, and Grobbelaar, 2021; Sinha, et al., 2010; Yang, et al., 2023**).

These outcomes align closely with the mitigation and adaptation objectives of many countries, are often aligned to existing or emerging national or international standards (e.g., international green building standards). They provide a strong rationale and justification for climate (co-) financing. If pursued more systematically across countries, the climate benefits could reach scale quickly.

Figure 1. Snapshot of Pathway 1



Note: See **Annex 1** for more detail.

3.1.3. Data and evidence

Depending on the nature of the activity, Pathway 1 activities have ample evidence of their climate impact and robust methodologies for collecting data and calculating impact, although sometimes these methodologies have not been applied to education settings²⁵ and/or to LMIC contexts.²⁶ Evidence is especially strong with regard to their mitigation outcomes; for instance, the emissions avoided with energy-efficient retrofits to school buildings. Notably, while evidence and methodologies may be strong for measuring mitigation outcomes, this should be tempered by considerations of the relative proportion of emissions that come from schools, especially in LMICs.

Evidence of Pathway 1 adaptation outcomes is less prevalent but emerging. For example, studies have measured the adaptation and resilience benefits of natural ventilation in school buildings to reduce the risk of overheating²⁷ and the value of electric school buses as an alternative back-up energy supply for diesel-fuelled generators. This last benefit helps schools sustain safe operations during climate-related power outages.²⁸ See Table 2, and explore more in Annex 3, Pathway 1, for full citations to the reviewed literature.

Table 2. Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 1

Education investment	State of the evidence	Data gaps
School waste & recycling management	There is emerging evidence of mitigation impacts from investing in school waste and recycling management, including an innovative study ²⁹ on the use of an internal carbon pricing scheme for waste production and incorrect recycling on a university campus.	<p>More methodological development is needed to link the evidence of behavioural change at the individual student level to the aggregated effects at the entire school level or spillover effects at the household level. This should be measured in units that are of interest to the climate sector (e.g., tons of waste diverted from landfills vs. knowledge of the importance of recycling). This would be a more rigorous way of measuring impact on mitigation targets.</p> <p>More data and evidence (and methodological development) are needed in LMIC contexts.</p>

25 For example, research on the environmental impacts of ICT and the potential mitigative solutions around ‘greener’ ICT infrastructure has not been applied much to the education sector but exists beyond it (see [International Telecommunication Union, 2008](#); [Mickoleit, 2010](#)). Conceptual and theoretical work, like [Selwyn \(2021\)](#), might offer education stakeholders the foundations on which to build data and evidence pathways linking greening ICT activities to both mitigation and adaptation outcomes.

26 For instance, electric school bus initiatives have largely been concentrated in high-income countries like the US, Canada, and the UK (perhaps because school buses are more commonly used as a mode of school transportation in these countries). This is probably why the literature on the climate impacts of electric school buses is almost exclusively from such contexts. However, there is a sizeable body of literature on the climate benefits of the electrification of public transportation systems, including buses, in other parts of the world, including LMICs.

27 See for example [Bello, et al., 2025](#); [Kuiri, 2016](#); [Heracleous and Michael, 2018](#).

28 [Liu, Vlachokostas and Kontou, 2025](#).

29 [Lee and Lee, 2022](#).

Education investment	State of the evidence	Data gaps
School water-saving innovations	<p>There is well-established global evidence of the mitigation, adaptation, and resilience impacts of water conservation, water harvesting, and water saving innovations deployed in school settings, including in LMICs.</p> <p>Existing literature contains methodological approaches and benchmarks that can be built upon to create further evidence.</p>	<p>More methodological development is needed on calculating the GHG emissions reductions associated with interventions enhancing the supply of safe drinking water. This could create a new evidence base to access voluntary carbon markets.³⁰</p> <p>Given the importance of gender and WASH, more gender disaggregated analysis of the adaptation impacts of school water-saving innovations could be conducted. This is especially needed in the context of enhancing girls' and young women's adaptive capacities and resilience in drought or water-scarce contexts.</p>
Electric school buses/fleet	<p>Strong evidence is emerging of the mitigation benefits of transitioning the school fleet to electric buses/vehicles, although it is almost exclusively from HIC contexts. There is also emerging evidence of the benefits of electric fleets on the health of children affected by diesel emissions. Electric buses have been found to help schools remain operational during climate-related power outages (i.e., they provide an alternative backup power supply for diesel-powered generators).</p>	<p>More data and evidence (and methodological development) is needed in LMIC contexts, especially where public school transportation is prevalent.</p> <p>More collaboration is needed with other sectors (e.g. transportation, health, energy) to understand how to share the data collection burden and/or data insights (e.g., data on air quality/particulate matter, children's asthma rates, or the energy demand of schools). Evidence of this nature could help leverage finance for both mitigation and resilience outcomes.</p>
Energy efficiency retrofits	<p>Modelling simulations and a well-established body of evidence shows the mitigation benefits of school retrofits (e.g., increased energy efficiency, reduced GHG emissions) and adaptation benefits (e.g., reduced overheating) of energy-efficiency retrofits to school buildings.</p>	<p>More data and evidence are needed from LMIC contexts. This should include results of testing data collection technologies (e.g., indoor thermal comfort sensors, with the data used to monitor continuous temperature.)</p>

³⁰ Gold Standard, 2021.

Education investment	State of the evidence	Data gaps
Energy efficiency retrofits	The evidence base raises important caveats about including temporal dimensions in modelling the climate outcomes of certain solutions, as warming temperatures could cause some solutions to be useful only temporarily before new solutions need to be explored.	
Climate-proof facilities (school safety)	There is emerging evidence from the grey literature of the adaptation and resilience benefits of investments in school safety upgrades in response to climate-related risks and hazards. This includes evidence on the number of schools retrofitted, the value of education assets/facilities protected, the number of lives protected, etc.	<p>More data collection is needed to link evidence on the climate resilience of buildings to evidence on the climate resilience of education systems (e.g., number of days of school closure/school continuity) and education outcomes.</p> <p>More empirical studies are needed on the climate resilience outcomes of safer schools.</p>
Energy-efficient ICT and EdTech	Evidence is limited on the mitigation and adaptation impacts of greening ICT infrastructure in school systems, although there is an emerging conceptual body of literature in the education sector.	More data and evidence (and methodological development) is needed in LMIC contexts. This could draw on the extant literature beyond the education sector and leverage the growing interest in EdTech-enabled climate change education. The interest in EdTech yields an opportunity to explore the carbon footprint implications of such investments, as well as the enhanced adaptive capacity targeted.
Planet-friendly school meals	<p>There is established evidence from HIC and LMIC contexts of the adaptation and mitigation outcomes of investing in planet-friendly school meals.</p> <p>Mitigation evidence relies almost exclusively on life cycle assessment modelling, while adaptation evidence is focused especially on agricultural resilience.</p>	<p>More methodological development is needed, especially in modelling tools to help education systems in LMICs to perform life cycle assessments of their food and nutrition activities. Evidence is needed of how such assessments might help to reduce the agricultural carbon footprint while increasing food security and nutritional outcomes for children.</p> <p>More methodological collaboration with the agricultural sector could help to fill data gaps on the adaptation benefits of this form of education investment.</p>

Education investment	State of the evidence	Data gaps
School-based composting & food waste reduction	There is emerging evidence, especially from the US and other HIC contexts, on the mitigation impacts of school-based composting and food waste reduction interventions, measured in emissions reduced or avoided.	More data and evidence (and methodological development) is needed in LMIC contexts. Evidence is especially needed on where additional mitigation and adaptation benefits may be achieved (e.g., through the additional use of biogas generators for improved energy alternatives).
School-based clean cookstoves	Emerging evidence from LMIC contexts where clean cooking solutions have been deployed in schools. Mitigation impacts are strong in terms of the reduction in deforestation and wood fuel consumption; however the adaptation impacts are more inconclusive, as there appear to be unintended consequences from time saved.	This aspect has a long causal chain of impact, and more data and evidence are needed to better understand the mechanisms of adaptation impacts. For instance, evidence is needed on the resilience benefits of school-based clean cookstoves, such as improved health outcomes and improved learning outcomes from time saved. More methodological development is needed to fill data gaps preventing a full understanding of the opportunities and challenges around clean cooking in schools.
Green schoolyards	Emerging evidence primarily from HICs on the climate impacts of greening schoolyards, especially around increasing biodiversity and carbon sequestration (mitigation) and reducing heat discomfort (adaptation and resilience).	More methodological development is needed, especially of GPS-enabled heat sensing/thermal monitoring tools. These could collect the data needed to understand the adaptation impacts of interventions like increasing shade coverage and afforestation on school grounds.

Note: See [Annex 3, Pathway 1](#), for full citations to the reviewed literature

Education stakeholders may need to tap into cross-sectoral expertise or build internal capacity to track data across an education system, like megawatt hours of clean energy capacity generated through solar energy upgrades, or tons of carbon dioxide equivalent (tCO₂e) prevented based on weight of organic waste diverted from landfills through composting, etc. Other forms of data collection and monitoring may require less technical upskilling; they might include, for instance, establishing systems to count new things in a more timely manner, like number of school facilities closed during extremely high temperatures, and for how long, or the number of native trees planted and maintained on school grounds.

3.1.4. Areas for further exploration

Although this pathway has fairly robust data and evidence, there is room for additional work and innovation on indicator development and data collection and modelling methodologies for measuring the climate impacts of Pathway 1 activities (see Table 3 for sample indicators of climate impacts for Pathway 1 activities). For example, the education sector could invest in research and data systems to help introduce, standardise, or even harmonise the measurement of critical indicators, like adaptive capacity and resilience. This might enable measures that are less about numbers of beneficiaries impacted by an activity and more about precisely measuring a pre-defined metric of adaptation – like reduced heat-related impacts on learners or enhanced food security for learners. For some activities, like clean cookstoves for school canteens, the education sector could be more proactive in establishing stronger links to education co-benefits like improved learning outcomes, which are a necessary precondition for enhanced climate resilience and adaptive capacity. The voluntary carbon market (VCM) continues to evolve its methodologies for labelling carbon credits generated by clean cookstoves with ‘high integrity’ labels.³¹ (These are labels that signal the achievement of gender equality-focused sustainable development outcomes, like time savings from switching from firewood-burning stoves to clean cookstoves.) The education sector could take advantage of advances in carbon credit labelling to generate carbon credits from clean cookstove transitions in schools. However, this would require the development of more robust methodologies to verify improved learning outcomes among children benefiting from this clean energy investment. In addition, a ‘high integrity’ label might apply to the achievement of quality education-focused sustainable development outcomes.

Table 3. Sample indicators of climate impacts for Pathway 1 activities

Sample indicators	
Weight of non-organic waste diverted from landfills and incinerators through recycling	Weight of food and yard waste diverted from landfills through composting and/or anaerobic digesters
Weight of organic waste diverted from landfills and incinerators through anaerobic digesters	Proportion of school meals that are planet-friendly
School attendance and retention, disaggregated by gender	Food miles reduced for school feeding programmes
Number of people, disaggregated by gender, and social institutions with improved access to clean water and reliable WASH facilities	Number of children and households receiving climate-friendly foods, disaggregated by gender and other identifiers of vulnerability
Number of fuel-saving/electric vehicles deployed	Number of trees/native species planted and maintained
Number of new asthma diagnoses among children and youth, disaggregated by gender, geography, and other identifiers of vulnerability	Greenhouse gas emissions reduced or avoided (tCO ₂ e)
Number of people, disaggregated by gender, and social institutions with improved access to clean energy	Clean energy capacity installed (MW)

³¹ Civillini, 2025.

Sample indicators	
Time spent on teaching and learning, disaggregated by gender	Amount (\$) of loss and damage of physical and digital education infrastructure
Number of schools retrofitted/upgraded with renewable energy, clean cookstoves, climate-proof designs, etc.	Number of people with improved (climate) resilience, disaggregated by gender and other identifiers of vulnerability
Number of schools and education facilities maintaining delivery function during climate disruption	Number of people supported to better adapt to the effects of climate change, disaggregated by gender and other identifiers of vulnerability

*Note: See **Annex 1**, Pathway 1, for how these indicators map onto the different Pathway 1 activities and their associated climate outcomes, as well as the status of their methodological development*

Measuring these different mitigation and adaptation outcomes and reporting on the data and evidence at the programme- and education systems levels could enable the education sector to better leverage (co-)financing opportunities with climate funders. Some activities with direct and measurable emissions reduction – like the clean cookstove example above or investment in solar-powered boreholes – may even qualify these climate-smart education environment investments for the voluntary carbon market.

Notably, investments in this pathway have historically stemmed from non-education sectors, like transportation, infrastructure, energy, and agriculture, and may have found their way to deployment in education settings. An example might be a green public infrastructure project that includes schools, hospitals, and administration buildings. Evidence has already emerged of the potential of these activities to generate education co-benefits, like increased school attendance, increased time spent on teaching and learning, increased access to clean water by learners and teachers, etc. With this growing body of evidence, many more education stakeholders are beginning to understand that climate investments may be closely linked with investments in climate-smart education systems. With more proactive engagement by the education sector, such climate investments could become education co-investments, implemented through partnerships between education and non-education sector colleagues.

For example, education stakeholders (government, NGO, CSO, etc.) could work closely with colleagues in the energy and waste management sectors to direct the education sector’s organic waste (food waste, yard waste, etc.) to school-based or industrial anaerobic digesters. This would support the production of biogas, reducing the emissions of methane from the decomposition of organic waste in landfills while also reducing the reliance on fossil fuels as a source of energy. Educators could also work together with colleagues in the water, sanitation, and hygiene (WASH) sector to deploy low-carbon water purification systems in schools, or with colleagues in the agriculture sector to create school meal supply chains with local smallholder farmers growing climate-resilient crops or those who practise regenerative farming.

Finally, each activity in this pathway can be paired with climate-relevant green learning curricular entry points to enhance and/or integrate climate-relevant teaching and learning opportunities (see Pathway 3 in this document). For instance, the roll-out of school-based food composting and anaerobic digesters could be paired with the development of teaching and learning materials for teachers of all subject areas. These should cover core concepts through

the lens of food waste, clean energy, and climate change, turning the school's composting and biogas generation activities into a living learning lab. If the project generates carbon credits, the education co-benefits could increase the premium of the carbon credits being sold with an extra 'high integrity' certification label.

Box 2. A note on GEDSI-responsive climate finance under Pathway 1

Climate finance under Pathway 1 (Achieving Mitigation and Adaptation Targets through a Climate-Smart School Environment) has potential to be designed and delivered in a way that is GEDSI-responsive. For example, activities related to strengthened capacity to anticipate, absorb, and/or manage education sector-relevant climate risks like extreme heat or drought could be targeted to include more marginalised groups. Climate risks such as extreme heat and drought, as well as climate shocks, particularly affect marginalised learners, such as those affected by conflict and displacement, girls, and children with disabilities.

There is also an opportunity for activities related to climate-smart school environments to simultaneously create more accessible school environments. For example, while undergoing construction work to make school buildings more climate resilient, efforts could also be made to make school buildings more accessible to learners with disabilities; for example, by adding ramps and WASH facilities for learners using wheelchairs.

3.2. Pathway 2: Achieving climate resilience through climate-responsive operations in education

3.2.1. Overview

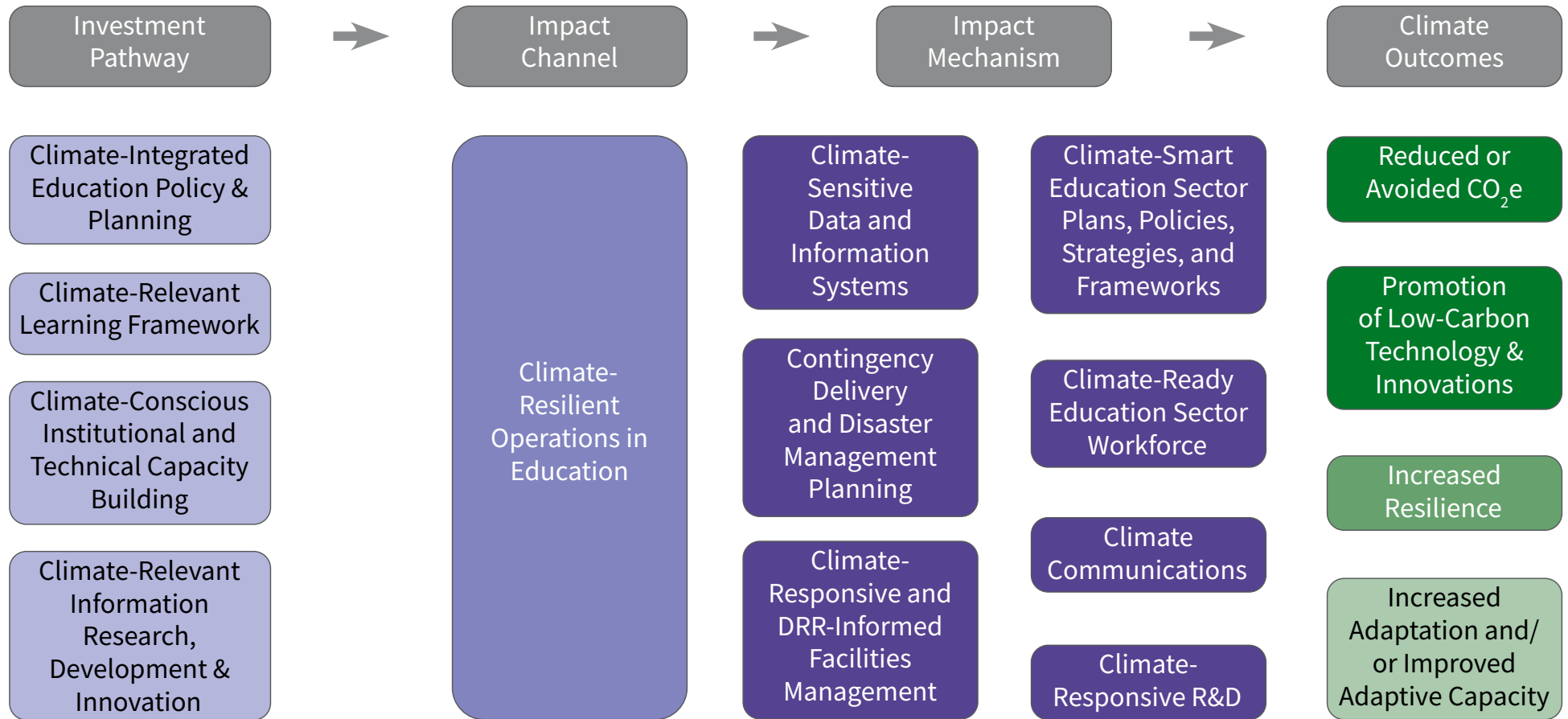
While Pathway 1 focuses on the material infrastructure and dimensions of education systems, Pathway 2 focuses on the more intangible and operational dimensions (e.g., processes and practices) of climate-resilient education systems. This includes activities that are typically associated with policy and planning, institutional capacity building, data and monitoring systems, and research and innovation (see Figure 2 and explore more in [Annex 1](#), Pathway 2). This pathway is aligned with disaster risk reduction-oriented frameworks and the Comprehensive School Safety Framework. It may also find strong alignment with priorities highlighted by countries' National Adaptation Plans (NAPs) and other regional and global adaptation frameworks.

3.2.2. Examples

This pathway encompasses activities such as:

- Creating climate-sensitive data systems for climate-integrated planning, monitoring, and response;

Figure 2. Snapshot of Pathway 2



Note: See **Annex 1** for more detail.

- Institutional and technical capacity building activities on conducting climate risk and vulnerability assessments for the education sector;
- Strengthening a climate-ready education sector workforce (decision-makers, managers, programme officers, etc.);
- Strengthening channels for communicating and disseminating climate-relevant information, like early warning systems and awareness-raising campaigns, to school leaders, learners, their households, and their communities.

The pathway also includes activities that may typically fall under Education in Emergencies programming,³² and aligns with the priorities of climate funders on preventative actions. These include disaster risk reduction planning and management to build systems resilience and sustain education continuity in the face of emergencies. At a minimum, the operational and education system strengthening activities in Pathway 2 might easily be classified as Type 1 adaptation activities according to the Joint Methodology for Tracking Climate Change Adaptation Finance.³³ This applies especially if the project’s objective is to adapt the education system to climate risks and minimise disruptions in function and delivery caused by climate shocks and stressors.

3.2.3. Data and evidence

Data is needed to track the evidence linking Pathway 2 activities to adaptation (and potentially also mitigation) outcomes. For this, the education sector will need to produce more rigorous and systematic research and evaluations of climate-related activities. Existing evidence tends to be anecdotal, curated best practices, and/or case studies documenting project or tool development and implementation (see Table 4 and explore Annex 3, Pathway 2, for full citations to the reviewed literature). Methodologies tend to be aggregations of counts – for example, the number of children protected, the number of days of learning lost, the number of climate indicators being monitored, the number of people supported, number of buildings retrofitted/upgraded, etc. Less prevalent are empirical measures such as changes in anticipatory capacity, climate risk perception, or cognitive performance; evidence of emissions avoided or reduced; impact on decision-making and communication during or after a climate-related disruption to education, etc.

Table 4. Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 2

Education investment	State of the evidence	Data gaps
Climate-related data and information management systems (climate risk assessments)	There is emerging evidence stemming primarily from the field of disaster risk reduction and efforts to increase the capacity of education systems to plan, monitor and respond to disasters.	There is a need for more methodological development and data collection beyond counting facilities and physical assets. Data is needed on the impact of adaptive management, downstream engagement, and other adaptation and mitigation indicators, in order to better illustrate the impact of improved climate-related data and information on decision-making.

³² Education in Emergencies is often considered a sub-sector of the education sector that is focused on protecting, sustaining, and restoring quality learning opportunities during crises, emergencies, or conditions of prolonged instability (see [INEE, 2024](#)).

³³ [European Investment Bank, 2022](#).

Education investment	State of the evidence	Data gaps
Climate-related data and information management systems (climate risk assessments)	The evidence landscape appears to be focused on documenting how many education facilities have been identified for climate-relevant upgrades and how data has been used to facilitate recovery responses.	
Contingency planning and education continuity planning/delivery	<p>Limited evidence of the climate adaptation and resilience impacts of efforts to enhance educational continuity</p> <p>Current evidence landscape appears to be focused on documenting best practices rather than measuring whether and how certain strategies, activities, and investments lead to or are associated with observable measures of increased resilience, at a systems level and individual level.</p>	<p>More methodological and perhaps also technological development is needed to collect data on the impact of continuity planning and delivery on adaptation and resilience indicators that do not impede disaster recovery and response efforts. Innovative methodologies may be needed, along with plans for data collection deployment as part of response and recovery efforts.</p> <p>There is a need for more indicator development for each phase of educational continuity. This could serve as the basis for data collection and the generation of evidence on the achievement of systems resilience.</p>
Climate-responsive education policy and planning	<p>Limited evidence of the climate impact of investments in enhancing or creating climate-responsive education policies and plans.</p> <p>The current evidence landscape appears to be focused on documenting best practices rather than measuring their impacts.</p>	More methodological development is needed to understand the impact of strengthening the climate-responsiveness of education policies on the downstream mitigation, adaptation, and resilience actions pursued and achieved.
Climate-ready education sector workforce	Limited evidence of the climate impact of investments in the climate-readiness of the education sector workforce. There is some evidence on the impact of teachers' and principals' climate confidence on students' climate-related learning outcomes; also on the pursuit of downstream mitigation and adaptation actions in the school system.	<p>More intentional data collection and methodological development is needed for tracking the impact of investments in the education sector workforce's capabilities and readiness to address the adaptation and mitigation needs of the education system.</p> <p>More development of indicators of what a climate-ready workforce is/exhibits/should be and how to measure these traits, competencies, skills, etc.</p>

Education investment	State of the evidence	Data gaps
Climate-ready education sector workforce		Methodological development is needed for classifying and measuring the range of green skills required in the education sector workforce (e.g., the nature of green skills for school facility managers, leadership, and educators, respectively).
Climate communications in education settings (early warning systems)	<p>Very limited evidence of the impact of improved climate-related communications on adaptation and resilience outcomes in the education system and among staff and beneficiaries. Evidence is needed on the impact of early warning systems in the context of education settings, for example.</p> <p>Emerging participatory approaches to early warning may create opportunities for youth engagement and climate-related learning.</p>	More research on climate communications in education settings is needed to understand its role in enhancing the resilience and adaptive capacity of education systems.

Note: See [Annex 3, Pathway 2](#), for full citations to the reviewed literature

3.2.4. Areas for further exploration

More robust approaches to data collection methodologies and climate-related data management systems have yet to be developed and/or deployed by the education sector.³⁴ This includes approaches to real-time data collection or natural experiments that could generate evidence of adaptive management, where changes made as a result of developing a national climate information system, for example, are monitored, tracked, and reported. In addition, there is a need to know whether climate-resilient education systems actually create climate-resilient learners and communities. For this, research is needed on the development and application of tools that measure changes in adaptive capacity, climate awareness, and/or climate literacy.

Given the current data landscape and the anecdotal nature of the evidence of adaptation outcomes achieved in education systems, a key area for further methodological exploration is the development of impact evaluations. These could generate more robust data and evidence of the climate impact of investing in the intangible and operational aspects of education systems. Table 5 shows sample indicators for measuring the climate impacts of Pathway 2 activities. These include approaches to quantitative and qualitative research design (modelling approaches, ethnographic case studies, survey methodologies, etc.); the development of indicator frameworks and proxies for measuring climate outcomes at an education systems level; and associated data collection methods. Where studies currently exist, the data is often focused on the documentation of process and programmatic outputs.

³⁴ Fitzpatrick & West, 2022; Sheffield, et al., 2017.

Table 5. Sample indicators of climate impacts for Pathway 2 activities

Sample Indicators	
Number and value of education assets identified and protected and/or level of exposure to climate hazards reduced as a result of climate-relevant education sector data being tracked and monitored	Evidence of downstream engagement (e.g., subnational level, or by schools, designated focal points, school management committees, etc.) in adaptation actions in response to new policies
Evidence of adaptive management (e.g., changes made to policies or programmes based on the monitoring data)	Number of climate-integrated education sector policies and plans, including attention to GEDSI
Number and timeline of climate risks, impacts, outcomes, and indicators monitored in education settings (including learning achieved)	Evidence of emissions reduced as a result of changes made to activities based on new regulation (e.g., Scope 1 or 2 emissions)
Number of children protected from physical harm/being impacted by climate impacts, disaggregated by gender and other identifiers of vulnerability	Number of people with improved (climate) resilience, disaggregated by gender and other identifiers of vulnerability
Number of schools with relationships with local disaster management agencies	Programme-level measurements of climate-relevant learning, socio-emotional, and behavioural outcomes
Number of learners returning to school/ training post-climate event, per time interval, disaggregated by gender and other identifiers of vulnerability	Number of people supported to better adapt to the effects of climate change, disaggregated by gender and other identifiers of vulnerability
Number of days of learning lost owing to climate disruptions or shocks (including school closure, attendance)	Amount (\$) of investment in and/or number of mitigation and adaptation research for education financed
Number of schools and education facilities maintaining delivery function and learning continuity during climate disruption	Evidence of adaptation, resilience, and adaptive capacities enhanced as a result of research innovations developed, piloted, or deployed
Amount (\$) of loss and damage of physical and digital education infrastructure and materials	Evidence of emissions reduced by the education system or its beneficiaries as a result of research innovations developed, piloted, or deployed

Note: See Annex 1, Pathway 2, for how these indicators map onto different Pathway 2 activities and their associated climate outcomes, as well as the status of their methodological development

In the case of benchmarking a climate-ready education sector workforce, attention should extend beyond teachers and school leadership to other critical personnel in the education sector (e.g., facilities managers, district level staff, etc.). Methodological development is needed to ensure that outcomes measured at the education-system level are connected to climate impact. These measurements should include the degree to which the education sector workforce is climate-ready and the impact that a climate-ready education sector workforce has on mitigation, adaptation, and resilience outcomes.

Given the systems-strengthening and institutional capacity-building nature of Pathway 2, most Pathway 2 activities are likely to find an easier way to public sources of climate finance from bilateral and multilateral development funds than from private funders, since private funders generally seek a financial return on their investment or verified proof of social impact for a high-integrity carbon offset. To establish eligibility for climate finance, education stakeholders should establish a strong business case for how a project's activities respond to and address climate vulnerabilities in the project context.

Moreover, activities must go beyond standard development practice in the education sector and clearly demonstrate how the activity addresses specific climate risks, vulnerabilities, or impacts. This concerns the principle of additionality; i.e. proof that the climate benefits of an activity occurs because of the dedicated climate funding and would not have occurred under an 'education as usual' scenario. For example, for climate-sensitive data systems, evidence will be needed on the proportion of activities focused on setting up and training enumerators and analysts on the data collection modelling methodologies used for tracking climate-relevant hazards. Such evidence should include the duration of these activities and their impact on learners. Evidence will also be needed on the development of data dashboards for monitoring the impact of greening inputs in school infrastructure on learner outcomes. This kind of research would probably be eligible for adaptation finance through multilateral development banks and bilateral development funders. However, activities related to tracking attendance or completion – data which education systems should already be collecting, even if this data is used for climate-related monitoring or planning – would probably not be eligible.

Notably, while Pathway 2 activities primarily build climate resilience and adaptive capacity within and through the education system, some activities may also enable important mitigation outcomes and should be explored further. For example, climate-smart education sector plans and policies could set important emissions regulations and emissions reduction targets for the sector, directly influencing changes in sector-wide activities that have measurable mitigation outcomes. Indeed, Gold Standard, a standard-setting body for the carbon market, is currently piloting a methodology for certifying the climate mitigation impacts resulting from new government policies and regulations, albeit in the energy and land-use sectors.³⁵ Education sector stakeholders, especially those in high-emitting country contexts, could draw lessons from the forthcoming results of this pilot and explore the development of similar such methodologies for monitoring, verifying, and reporting on the climate impacts of its own climate-smart policies at the national or even sub-national government level.

More rigorous data collection and measurement approaches would need to be developed to measure precisely how a new climate-responsive education policy or plan (e.g., a new national net-zero regulations for the sector, a new green standard for new school building construction, etc.) might impact emissions at a systems level.

³⁵ Fitzpatrick & West, 2022; Sheffield, et al., 2017. Gold Standard, 2024.

Box 3. A note on GEDSI-responsive climate finance under Pathway 2

This Pathway (Adapting the Education Sector through Climate-Resilient Education Systems) has the potential to be GEDSI-responsive. For example, policy and planning related to climate-resilient education systems can integrate the needs and actions of marginalised groups while any activities related to data and reporting should be sure to disaggregate by sex, disability, and age. This would ensure that sub-populations may be targeted effectively and different trends can be understood.

Activities related to strengthening a climate-ready education sector workforce should be designed to be accessible to all, while activities related to strengthening channels for communicating and disseminating climate-relevant information should take into account the different communications channels and preferences of different populations. For example, early warning systems need to be designed in a way that is accessible to people with disabilities, which could include tailored communication strategies and assistive technologies.

3.3 Pathway 3: Achieving climate outcomes through climate-relevant teaching and learning

3.3.1. Overview

Pathway 3 encompasses investments in activities that enhance the climate-relevance of teaching and learning and, ultimately, levels of climate literacy, pro-environmental behaviours and mindsets, along with a “breadth of green skills,”³⁶ including those for green jobs (see Figure 3 and explore more in [Annex 1](#), Pathway 3). This pathway is well aligned with the adaptation strategies often found in NAPs and is being increasingly integrated into NDCs. Multilateral climate and development funds are also beginning to finance Pathway 3 activities, especially efforts to integrate climate change education into textbooks and to ‘green’ national curriculum frameworks. This suggests that co-financing opportunities may be growing.

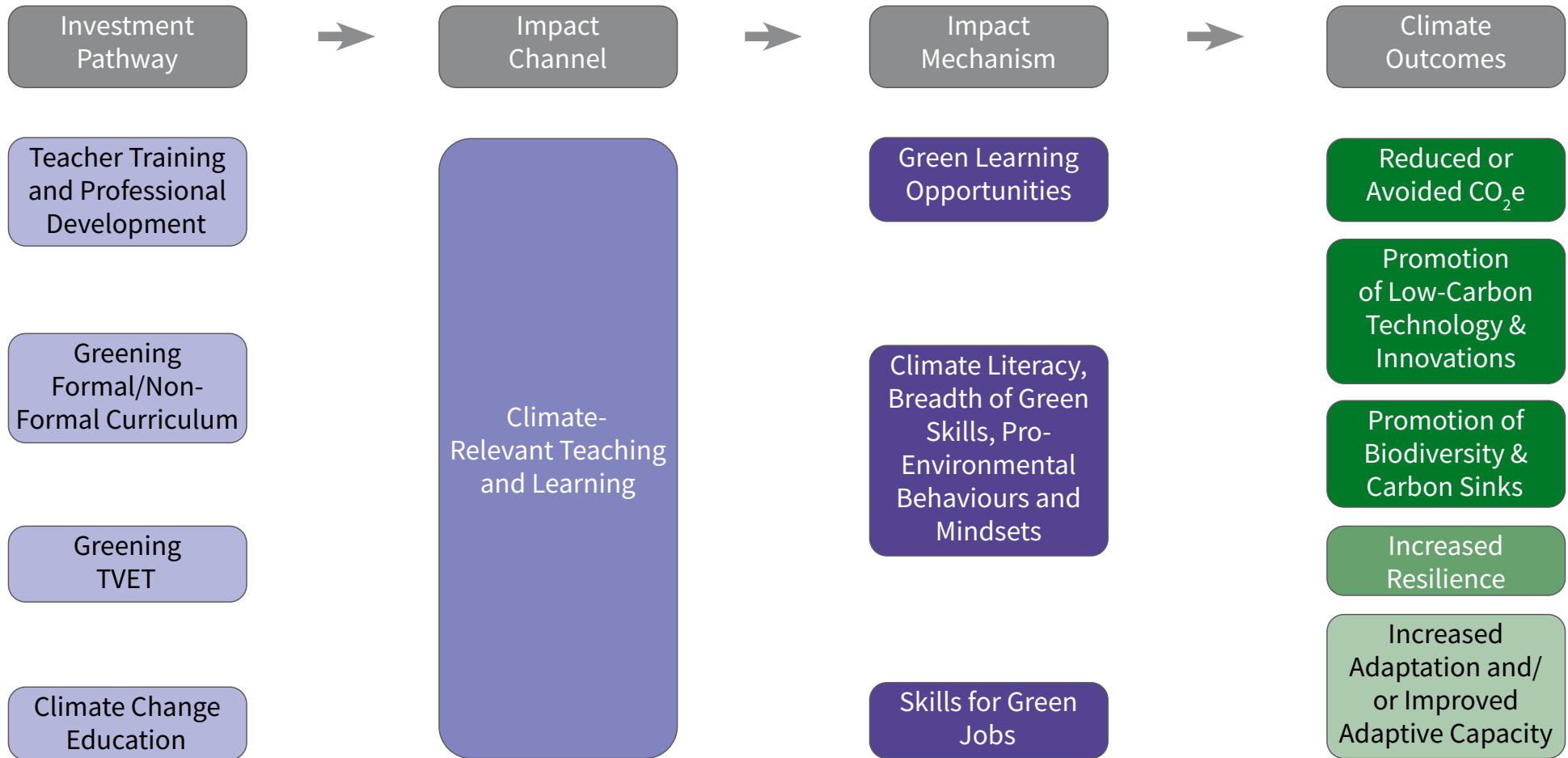
3.3.2. Examples

This pathway includes activities such as:

- Integrating climate change into the formal curriculum and/or into teacher education qualifications frameworks;
- Non-formal programming on climate change education;
- Teacher training on subject-specific instruction through a climate lens;
- The development of career guidance, tools, and training courses on green jobs;
- Efforts to green technical and vocational education and training (TVET); and,
- Other teaching and learning activities that create lifelong opportunities for quality climate-infused education.

³⁶ Kwauk and Casey, 2022.

Figure 3. Snapshot of Pathway 3



Note: See **Annex 1** for more detail.

Activities in Pathway 3 are rooted in building climate literacy and green skills. These range from the specialised and technical skills needed for a diversity of green jobs to the transferrable and socio-emotional skills essential for living a sustainable life and the transformative skills critical for supporting low-carbon, socially inclusive development and systems change.³⁷

Pathway 3 rests on the assumption that its activities enable the attitudes, behaviours, and mindsets necessary for all other climate actions to happen – although more data and evidence are needed to support this claim. For example, knowledge about climate change risks and impacts is perceived to be the cornerstone for meeting certain national ambitions, such as strengthening the adaptive capacity and climate resilience of the general population and specific climate-vulnerable sub-populations like women and girls. The integration of green skills into TVET and post-secondary education and training programmes is essential for advancing national strategies, including NDCs and NAPs. Integration into TVET curricula would strengthen the technical capacities of sector-specific workforces critical to advancing decarbonisation and adaptation targets.

3.3.3. Data and evidence

While the different types of education entry points for this pathway are clear, what is often less clear is how to effectively deploy these investments in different contexts and at scale. Key questions that are currently driving academic inquiry related to climate-relevant teaching and learning are:

- *What* should learners learn (content and learning outcomes)?
- *When* should they learn these things (age-appropriate content and learning progressions)?
- *How* should they learn these things (pedagogies and inter- and trans-disciplinarity)?
- *Where* should they learn (classrooms, communities, in nature, etc.)?

Underlying these gaps is the fact that while it is intuitively obvious that Pathway 3 investments in climate-relevant teaching and learning are critical to the achievement of climate outcomes, the evidence is comparatively weaker. This is due to challenges explored in the following section – primarily, the underdevelopment of methodologies linking learning outcomes with behavioural outcomes, and behavioural outcomes with climate mitigation, adaptation and resilience outcomes. In addition, the majority of research and evaluation on climate change education stems from the Global North, limiting our understanding of how climate-relevant teaching and learning may help to support mitigation and adaptation outcomes in LMIC contexts, in low-emitting contexts, and/or in contexts facing extreme climate vulnerability (see Table 6 and explore Annex 3, Pathway 3, for full citations to the reviewed literature).

Also, while there is ample data on the importance of climate-relevant teaching and learning for the development of a skilled green workforce for green jobs, there is less data on the impact of green education and training interventions on adequately supplying such a workforce. Some green skills training programmes track numbers of learners and trainees that transition to green jobs, internships, or apprenticeships (sometimes disaggregated by gender); however there is little data and evidence that tells us whether these trainees stay and advance in these jobs (and therefore achieve resilient livelihoods – an important adaptation outcome) and whether trainees go on to adopt green innovations and/or affect emissions and/or the resilience of others. There is

³⁷ Kwauk and Casey, 2022; Transformative Skills Collaborative, 2025.

also little data on what inputs are needed in TVET systems to know whether the training system has been designed effectively and efficiently to achieve the desired green learning outcomes.³⁸

Table 6. Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 3

Education investment	State of the evidence	Data gaps
<p>Green learning</p>	<p>Evidence base is largely a mix of studies with limited and inconclusive evidence that climate-related literacies and pro-environmental behavioural change have measurable impact on adaptation or mitigation outcomes. While knowledge is important, it does not necessarily lead to mitigation or adaptation outcomes. Sophisticated and innovative modelling techniques are emerging to better estimate the mitigation potential of climate change education to reduce carbon emissions.</p>	<p>More methodological development and data collection is needed to understand the mediating factors (e.g. environmental attitudes, environmental concern, political identity, etc.) that help to translate climate knowledge into empowered climate action.</p> <p>More mainstreaming of behavioural change measures and metrics is needed in programme evaluations of green learning opportunities, especially longitudinal measures and design.</p> <p>More methodological development is needed to help mainstream the (climate) impact evaluations of green learning opportunities.</p> <p>More methodological development (especially in predictive modelling techniques) is needed to link estimations of GHG emission reductions with behavioural outcomes from green learning opportunities.</p> <p>More methodological development is needed to track the cascading/spillover effects of green learning at the household and community levels. This would enable a better understanding of the scale and speed of the influence of green learning on mitigation and adaptation outcomes, especially in LMICs and low-emitting country contexts.</p>

³⁸ McCoy, et al., 2012; Owusu-Agyeman & Aryeh-Adjei, 2024.

Education investment	State of the evidence	Data gaps
Green learning		<p>More methodological development is needed for defining and measuring a range of green skills (e.g., technical green skills like energy auditing, climate-risk management, or disaster risk planning; generic green skills like climate-relevant problem solving, systems thinking, etc.; transformative green skills like coalition building, policy advocacy, collective action, etc.). Evidence is also needed on the climate mitigation, adaptation, and resilience impacts of teaching and learning these skills.</p>
Green skills for green jobs	<p>Limited evidence exists of the impacts of green skills/green jobs development programmes on green employment outcomes. There is also very limited evidence on the linkages between an increased green-skilled workforce and the achievement of climate mitigation and adaptation outcomes.</p>	<p>More development is needed of standardised green skills and green job taxonomies and classification systems. This would help harmonise approaches to data collection and modelling across sectors and across countries/regions.</p> <p>More methodological development is needed of indicators (including demand and supply side indicators) and data systems used to track the acquisition of green skills (e.g., green skills certifications and micro-credentials). Methodologies also need to be developed on the subsequent transition to green jobs (gender-disaggregated), and the growth of green occupations/industries. This would enable an understanding of whether and how green skills development programmes are/are not supporting the growth of the green economy.</p>

Education investment	State of the evidence	Data gaps
Green skills for green jobs		More methodological development is needed to identify the key indicators of the impacts of green skills programming on climate mitigation and adaptation goals, including what green skills (cognitive and behavioural) should be measured as proof of green skills acquisition; when, how, and what to measure to track impact on green employment outcomes (disaggregated by gender and other characteristics of vulnerability); and how to determine or model the adaptation or mitigation impact that results from the growth of a green-skilled workforce. This could build on the ILO's Green Jobs and Skills Monitoring Framework for evaluating and reporting G7 members' ODA.

Note: See [Annex 3, Pathway 3](#), for full citations to the reviewed literature

3.3.4. Areas for further exploration

Pathway 3 is ripe for the further exploration and development of indicators, data collection methodologies, and modelling methodologies that can strengthen the case for financing. Proof is needed that Pathway 3 activities should be co-financed as a high-priority climate strategy, equal in value to carbon sequestration technologies or sea walls (see Table 7 for sample indicators of climate impacts for Pathway 3 activities). To better understand the potential in this area, the education sector could benefit from more applied research in different geographies and with attention to the most climate-vulnerable populations, including girls and children with disabilities. More diverse research settings would help advocates better identify contextually relevant practices that might help ensure that investments are effective and will achieve expected mitigation and adaptation outcomes.

Table 7. Sample indicators of climate impacts for Pathway 3 activities

Sample indicators	
Number of geographic locations of schools and programmes offering climate change education (including DRR, EE, and ESD), disaggregated by grade level and gender of beneficiaries	Number of people supported to better adapt to the effects of climate change, disaggregated by gender and other identifiers of vulnerability
Number and geographic locations of green learning opportunities, disaggregated by contributions to climate mitigation and/or adaptation (non-formal and tertiary education)	Number of people with improved (climate) resilience, disaggregated by gender and other identifiers of vulnerability

Sample indicators	
Number of climate-literate people and/or people with green skills, disaggregated by gender and other identifiers of vulnerability	Changes in emissions behaviours (e.g., transportation choices, food choices, consumption, etc.)
International standardised assessment scores (PISA 2029+)	Modelled tCO ₂ e
National-level assessments of climate-relevant learning, socio-emotional, and behavioural outcomes	Greenhouse gas emissions reduced or avoided (tCO ₂ e)
Programme-level assessments of climate-relevant learning, socio-emotional, and behavioural outcomes	Number of learners transitioning to green jobs, internships, or apprenticeships, disaggregated by gender and other identifiers of vulnerability
Changes in information-seeking and preparedness behaviours (e.g., weather forecasts, risk reduction strategies, awareness of climate hazards, etc.)	Climate action-specific data (e.g., number of trees planted, weight of waste diverted, number of people trained, etc.)
Modelled resilience and adaptive capacity	

Note: See [Annex 1](#), Pathway 3, for how these indicators map onto different Pathway 3 activities and their associated climate outcomes, as well as the status of their methodological development

It is worth noting that evidence of the climate impact of Pathway 3 investments, especially at the primary and secondary school level, has often been regarded by climate stakeholders as too far removed in an already hard-to-observe causality chain to warrant prioritisation by climate funders. Critics cite the time delay between when an individual receives climate change education in school (i.e., in childhood and youth) and when the individual has sufficient agency and resources to make decisions and exhibit behaviours that have a meaningful impact on climate (i.e., in adulthood). Recently, these critiques have been countered by growing evidence of the intergenerational transfer of climate change knowledge and climate concern from children to their caregivers, who have greater say and influence over household behaviours and decisions.³⁹

For TVET activities, too, some climate funders scrutinise the causality chain between green skills training and green jobs that have measurable climate impact. For instance, a programme targeting young women and training them to perform solar panel installation would find it difficult to generate carbon credits based on the number of solar panels installed, megawatts of clean energy produced, or tons of CO₂ equivalent avoided as a result of the number of women trained in the programme. The reason is that the training they receive is not the direct cause of the CO₂ avoided; rather, the cause is the installation of the solar panel. If the training programme partnered with the company that hires the young women to install the solar panels, this could increase the premium of the carbon credits generated by the solar panel installation company. This is because the company would be able to show that their employment of the trained women empowered women with both employment and valuable green skills; thus the ‘credit’ would go to the company and not the training institution.

For Pathway 3 activities, data and evidence challenges are bound to be experienced in accessing some sources of climate finance. Nevertheless, other sources are primed for co-financing

³⁹ [Lawson et al., 2019](#); [Sabarwal et al., 2024](#).

education and training programmes targeting green skills for green jobs. For these, the strategic and practical significance of ‘green-skilling’ the present and future workforce (especially in countries actively pursuing transitions to greener, climate-resilient economies) may be highly relevant. More effort is needed to discern such opportunities, including what data and evidence is required in order to be eligible.

The strength of the evidence for Pathway 3 investments is also limited by perennial challenges inherent in the education sector with regard to measuring skills gained and other learning outcomes. Similar challenges are experienced by the broader climate community in measuring outcomes like adaptive capacity and resilience. Key questions here are: What should we measure, how, and when?

What we measure as a sector is closely tied to what we teach in the context of climate-relevant teaching and learning. Currently, much academic and grey literature points to the importance of a range of environmental, sustainability, and climate-related knowledge, skills, and attitudes for pro-environmental behaviour and climate action.⁴⁰ However, the sector needs a better contextual understanding of which (sets of) skills and competencies are critical – or perhaps even foundational – why, when, and under what mediating circumstances, and among whom. Furthermore, the sector needs to contend with the role of mediating factors in the translation of knowledge and skills into empowered climate action and, importantly, how to take this into account when measuring and reporting impact. For instance, enhancing an individual or sub-population’s ability to anticipate and absorb climate shocks is as much about knowledge and skills as it is about access to resources and systems of support. Similarly, evidence is needed on the best way to build green STEM skills among girls and women for enhanced access to high-skilled, high-wage green economy jobs – and whether young women trained in these skills actually get these jobs. This raises important methodological questions when it comes to how long to wait after the conclusion of a Pathway 3 activity to measure its associated climate impacts. We also need to know which climate financing mechanisms might tolerate such a temporal gap between investment and outcome.

How we measure the climate impact of Pathway 3 activities also needs to take into account the complexities of measuring meaningful impact on mitigation and adaptation outcomes. When it comes to measuring the ‘right’ skills, whether yet to be defined or by proxy, there is an established and growing pool of measurement instruments from the field of environmental education that programme implementers and evaluators can adopt while discussion continues about the ‘right’ skills to be measuring. There is also an emerging pool of validated tools to measure climate literacy, climate action competence, eco-anxiety, and other climate-relevant constructs from environmental psychology, behavioural economics, and climate change education. The education sector should continue to trial and test these tools, while also exploring a range of other potential proxies that might be used to measure impact. In 2029, PISA’s new assessment on climate literacy will also provide the sector with important new data at a global level that can help us better estimate climate literacy among 15-year-old students. This assessment will help us understand the role of gender and other critical demographic identifiers in shaping climate literacy.

⁴⁰ See for example [Bechtoldt & Schermelleh-Engel, 2025](#); [Bianchi, Pisiotis & Cabrera Giraldez, 2022](#); [Brundiers, et al., 2020](#); [Didham & Ofei-Manu, 2020](#); [Frank, Eakin & Lopez-Carr, 2011](#); [Liu, Teng & Han, 2020](#); [Transformative Skills Collaborative, 2025](#); [White, et al., 2024](#).

How we measure programme-level outcomes of Pathway 3 activities also presents a challenge, especially in a context where activities related to climate-education are likely to be held up to greater scrutiny than activities with more clearly observable and measurable impact on emissions. However, just because the task is difficult does not mean that the education sector should abandon it. There are several promising areas of work that the sector could support and invest in. For example, at a systems level, new indicators and databases might need to be developed, such as monitoring the number and geographic location of green learning opportunities; i.e., education or training programmes aimed at developing green skills.⁴¹ This would indicate numbers of people supported to better adapt to the impacts of climate change. At a programme level, new behaviours may need to enter the lexicon for monitoring and evaluating climate-relevant outcomes, such as civic engagement and support for climate policies. New methodologies may also need to be developed, including modelling methodologies for estimating emissions reductions and/or adaptive capacity as a result of climate-relevant teaching and learning activities.

The development of new modelling methodologies holds particular potential for quantifying the climate impact of climate-relevant education, and could open opportunities for the education sector to access the voluntary carbon market (VCM). Currently, there is growing demand for high-integrity carbon credits and for alternative products like ‘climate contributions’.⁴² This area of interest naturally opens up opportunities for the development of new methodologies that measure and report climate impact.⁴³ Such alternative markets are particularly attractive for activities in education that have wide-ranging climate and development impact but are hard to quantify. There are buyers who understand that ‘carbon isn’t everything’ and are willing to purchase an alternative to traditional carbon offsetting.⁴⁴ In this context, even with less rigorous methods for quantifying and verifying emissions reduced or avoided – even estimating the *potential* emissions reduced – education activities in Pathway 3 may still have a viable market of buyers. In fact, the education sector should also explore buyers who are willing to purchase carbon credits that have not yet been issued but are expected to be generated in the future. Such ‘future selling’ or ‘carbon forward’ arrangements might be just the kind of mechanism that enables more education projects to gain quicker access to the VCM. Of course, these mechanisms need further rigorous testing and development.

In short, Pathway 3 activities have wide-ranging potential to be co-financed with international climate finance but need more innovative methodologies to generate the type of data and evidence that will help the sector overcome inherent challenges in measuring impact. The good news is that there appears to be growing interest among climate funders to finance Pathway 3-type activities, as indicated by the attention to curricular activities that form part of the new Building the Climate Resilience of Children and Communities through the Education Sector (BRACE) initiative launched by the Green Climate Fund, the Global Partnership for Education, and Save the Children. There are also strong market signals that buyers of carbon credits may also be interested in projects that have climate impact beyond carbon. Certification bodies like Gold Standard, Plan Vivo, and VERRA would need to approve a validated methodology for quantifying emissions removed or avoided as a result of the activity, or some other indicator of climate impact would need to be provided. For this pathway to climate finance, education

41 Kwauk, Siba, and Demirkaya, 2023.

42 Plan Vivo, 2024.

43 See, for example, Arora-Jonsson & Gurung, 2023; Phillips & Jenkins, 2023

44 Interview, 18 June 2025. See also Schwab Foundation for Social Entrepreneurship (2025) for emerging discussions on designing impact markets that incentivise social impact.

stakeholders would need to stress test emerging methodologies with technical advisories of certification boards.

Box 4. A note on GEDSI-responsive climate finance under Pathway 3

There is high potential for Pathway 3 (Achieving Climate Outcomes through Climate-Relevant Teaching and Learning) to drive GEDSI-responsive climate finance. As discussed, this pathway includes finance related to green skills (including STEM skills) and green jobs for women, who have been found to be at risk of losing out on green jobs, as well as other marginalised groups. Climate-relevant teaching and learning can target specific climate-vulnerable sub-populations, and should be designed pedagogically in a way that is accessible and inclusive. The content of climate-relevant teaching and learning should also be GEDSI-responsive, integrating attention to the gendered impacts of climate change, issues of climate justice experienced by marginalised populations, and climate solutions that transform underlying systems of inequity and exclusion.

3.4. Potential Pathway 4A: Enabling climate outcomes through improved access to education for climate-vulnerable populations

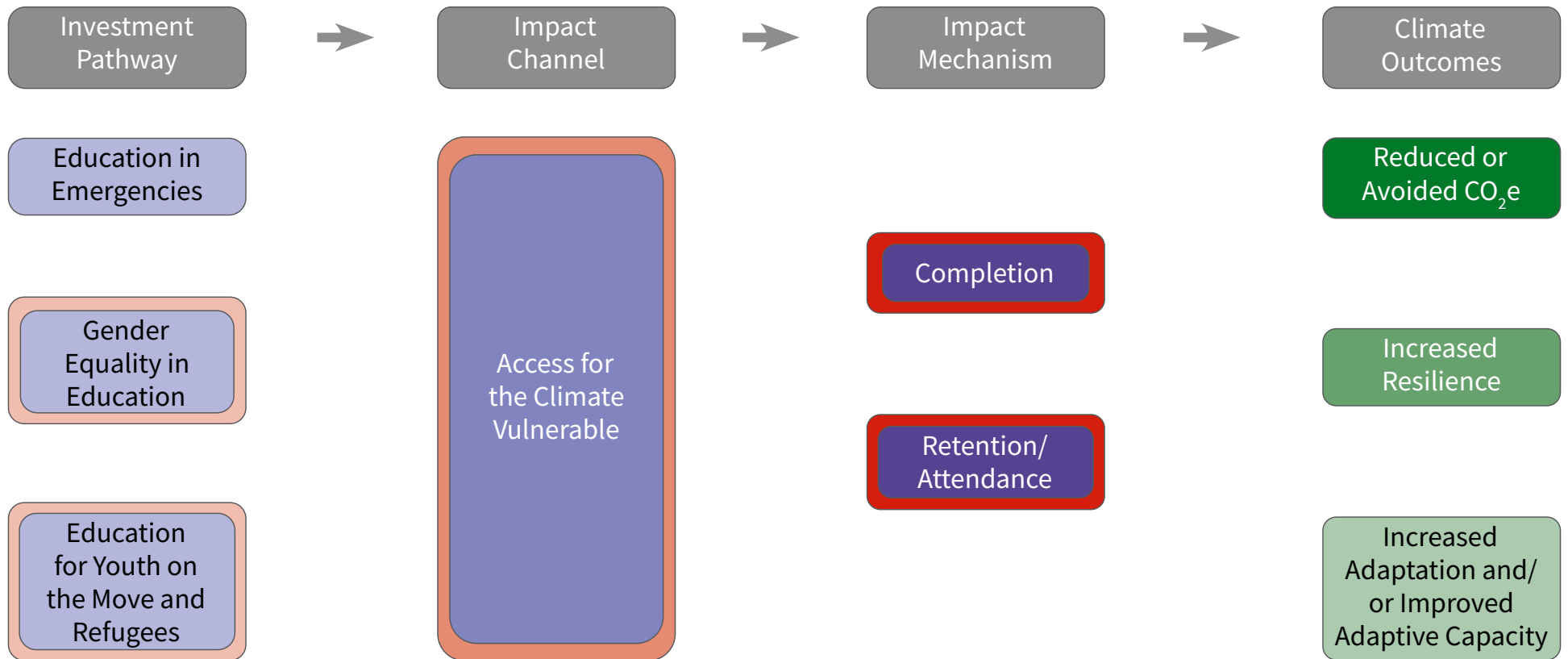
3.4.1. Overview

Potential Pathway 4 takes us into a cluster of activities that straddle a fine line between climate strategy and development strategy. The pathway is visualised in Annex 1 in both purple and red, depending on the underlying intention of the project design (see Figure 4, and explore more in [Annex 1](#), Pathway 4). Purple indicates activities that have been intentionally designed with climate objectives in mind. Red indicates activities that have not been intentionally designed with climate objectives in mind but achieve important international development goals and thus have the potential for climate co-benefits.

The defining element of this pathway is the targeted population: those who are most climate vulnerable and climate impacted and thus most likely to face barriers to education. This includes girls and young women, displaced and refugee children and youth, children with disabilities, Indigenous children, and children in small island developing states (SIDS). In essence, these are some of the most marginalised and climate-vulnerable populations, bearing a disproportionate burden of climate impacts owing to existing vulnerabilities and inequities. As such, Pathway 4 investments are typically focused on increasing and improving their access to education.

Pathway 4A (and its related Pathway 4B, discussed in the following section) is labelled as a ‘potential’ pathway to climate outcomes because it begins to move into the more indirect channels of impact. So, although enhanced adaptive capacity and climate resilience (and, in some cases, reduced carbon emissions) are the anticipated climate impacts of this pathway, the channels of impact are often indirect, if not unclear.

Figure 4. Snapshot of Pathway 4A



Note: See **Annex 1** for more detail.

3.4.2. Examples

Pathway 4A investments include education activities that target populations that are particularly vulnerable to the impacts of climate change, like girls and women and ‘youth on the move’ (youth migrants, refugees, asylum seekers, and internally displaced children). These groups experience heightened climate-related barriers to accessing education. Pathway 4A includes activities such as:

- Girls’ education programmes seeking to improve access to school and/or to non-formal education opportunities for the most marginalised out of school girls;
- ‘Back-to-school’ campaigns targeting climate refugee children; and,
- Setting up temporary learning spaces for children in communities recovering from an extreme weather-related disaster.

The assumption is that by enhancing access to school for these populations, Pathway 4A investments build their adaptive capacity or climate resilience. Notably, for activities under this pathway to be eligible for some forms of climate finance, it is not enough to say that the targeted population is vulnerable to the impacts of climate change. The activity must explicitly demonstrate that climate change creates barriers to access and, therefore, drives the need for investment. Similarly, for some climate financing instruments, it would not be enough to say that the education investment targets girls’ access to school; the activity would have to demonstrate that the girls targeted are the most marginalised out-of-school girls who would not otherwise have had the opportunity to go to school. A climate vulnerability assessment would have to support this claim.

As such, Pathway 4A activities may find more straightforward opportunities for climate adaptation financing through development funds such as MDBs and bilaterals. To access these funds, programme designers would need to calculate the proportion of total project funds that may be marked as climate finance, which depends on the degree to which climate adaptation is targeted as a primary objective of the overall project design.

3.4.3. Data and evidence

The literature supporting this pathway has been largely concerned with data on years of schooling, suggesting that there are mitigation and adaptation benefits from being in school over longer periods of time. Coincidentally, much of the evidence behind this pathway’s core Theory of Change overlaps with the evidence behind Pathway 4B, which is highly correlational, not causal. A lack of data disaggregated by gender and other markers of vulnerability and a lack of studies on these most climate-vulnerable populations also means that the pool of evidence for Pathway 4A is very limited.

Notably, however, over the past decade there has been increasing attention in the scholarly literature and global policy advocacy on the potential climate mitigation and climate adaptation benefits of investing in girls’ education (or gender equality in education more broadly) as a climate strategy.⁴⁵ There has also been growing attention to the need to extend green skilling opportunities to ‘youth on the move’ (e.g., refugees, displaced youth, asylum-seekers, etc.), spurring a relatively new area of research inquiry.⁴⁶ As such, methodological development, data,

⁴⁵ See, for example, [FCDO, 2022](#); [Hawken, 2017](#); [Malala Fund, 2021](#); [Namasivayan, et al. 2022](#); [Pankhurst, 2022](#); [Patterson, et al., 2021](#); [Sims, 2021](#).

⁴⁶ See, for example, [ILO, World Bank & UNICEF, 2024](#)

and evidence may already be growing. See Table 8 and explore Annex 3, Pathway 4A, for full citations to the reviewed literature.

Table 8. Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 4A

Education investment	State of the evidence	Data gaps
Gender equality in education	<p>There is emerging evidence from LMICs on the relationship between girls' education and enhanced adaptive capacity and resilience. In this area, the achievement of SDGs such as gender equality, empowerment, agency, and decision-making power are key mediating factors.</p> <p>There is strong correlational evidence between increased levels of girls' education and lower rates of fertility. When combined with voluntary family planning investments, this outcome can contribute to mitigation outcomes as well.</p>	<p>There is a need for more methodological development to understand the mechanisms of impact through which gender equality in education achieves climate mitigation and adaptation outcomes.</p> <p>Methodological development and associated data is also needed to understand whether the relationship between girls' education and climate outcomes is underestimated, since current methodologies do not attend to the quality of learning but rather to years of schooling for girls.</p>
Improved access for climate-vulnerable populations	<p>Very limited data on the climate adaptation and resilience impacts of investing in the education of other climate-vulnerable populations such as refugees and children with disabilities.</p>	<p>Need more studies investigating the climate impact of investing in the education of climate-vulnerable and climate-impacted populations and/or studies that disaggregate data by different markers of vulnerability and exclusion.</p>

Note: See [Annex 3](#), Pathway 4A, for full citations to the reviewed literature

3.4.4. Areas for further exploration

Activities in Pathway 4A have the potential for climate impact because the impact channel (access to formal education) triggers a chain of events (including, presumably, learning while in school). These are well established in the literature (see Pathway 4B) but are nonetheless indirectly linked to increased adaptive capacity and resilience to climate-related shocks and stressors. The two main mechanisms creating the potential for adaptation outcomes is *school completion* (measured as years of schooling) and *school attendance* and retention (here, a proxy for learning, and the potential to move to Pathway 4B if this learning is climate-unaware or to Pathway 3 if it is climate-responsive).⁴⁷

⁴⁷ While efforts to support continuity of learning are also efforts to sustain access to education amidst disruption, these efforts and their impact on adaptation and resilience outcomes are discussed in Pathway 2 as an investment in climate-resilient education systems rather than here in Pathway 4A as an investment in access.

For the former (school completion), the assumption is that if populations affected by a climate-related disaster or particularly vulnerable to the impacts of climate change can complete school, the protective and empowering effects of education will enable the achievement of critical sustainable development goals, such as improved gender equality, poverty reduction, and enhanced resilient livelihoods. These in turn would enable students to better adapt to the effects of climate change. However, this evidence is highly correlational and it is difficult to parse out mechanisms of impact or additionality. At a minimum, education stakeholders should use this rationale to advocate the sustained prioritisation of education access for climate-vulnerable populations and climate-affected populations within rapidly dwindling development financing.

The fact that there are opportunities for climate financing for Pathway 4A activities is largely due to the pioneering work of SoGreen (now Katla Carbon) and Project Drawdown (**detailed in paper two**). Specifically, secondary school completion among girls has a potential mitigation impact that may be quantified as carbon credits and sold on the VCM. The evidence for this pathway is well documented in the literature, which illustrates a strong relationship between female levels of education (measured in years of schooling, specifically secondary school completion), delayed age of marriage, and delayed age of first child birth. This is especially the case in low- and middle-income countries where early and forced child marriage rates are high and where gender inequality in education outcomes are also high.⁴⁸ This relationship is often modelled together with improved access to voluntary family planning. The strength of the evidence pathway could be improved if access to and completion of secondary school is accompanied by access to comprehensive sexuality education and/or clear measures of girls' improved sexual and reproductive health and rights, as well as additional measurements of girls' development of green skills.⁴⁹

Table 9 shows example indicators that may be used to measure climate impacts for Pathway 4A activities.

Table 9. Sample indicators of climate impacts for Pathway 4a activities

Sample indicators	
Programme-level enrollment and completion data, especially for the most marginalised girls and/or climate-vulnerable populations	Modelled tCO ₂ e
Modelled resilience and adaptive capacity	Greenhouse gas emissions reduced or avoided (tCO ₂ e)
Number of people supported to better adapt to the effects of climate change, disaggregated by gender and other identifiers of vulnerability	Number of days of learning disrupted owing to climate-related events or barriers, disaggregated by type of climate hazard
Increased bodily autonomy and choice with regard to family size	Number of climate-vulnerable learners, disaggregated by gender and other identifiers of vulnerability, returned to school or temporary spaces of learning

Note: See Annex 1, Pathway 4A, for how these indicators map onto Pathway 4A activities and their associated climate outcomes, as well as the status of their methodological development; learning-related indicators

⁴⁸ Doğan & Kirikkaleli, 2021; Lutz, Mutarak & Striessnig, 2014; Mutarak & Lutz, 2014; Namasivayan, Graves, Kwauk, et al., 2022; O'Neill, Jiang, KC, et al., 2020.

⁴⁹ Kwauk & Casey, 2022. Also, understanding the impact of improved gender equality attitudes and behaviours among boys and young men would be an added bonus, especially as they pertain to equalising gendered relations of power necessary for girls and young women to avail themselves of their reproductive rights.

For the second impact mechanism (school retention and attendance), the pathway to adaptation impacts is also aligned with Potential Pathway 4B, which concerns the promotion of foundational knowledge and skills. That is, activities starting within Pathway 4A have the potential to ‘move’. For example, if a post-climate disaster online learning programme targeting climate-displaced children has been intentionally designed to deliver climate-relevant teaching and learning, then the impact channel of this activity would shift from being one of access (Pathway 4A) to being one of climate-relevant teaching and learning (Pathway 3). If climate adaptation and resilience is not part of the learning continuity programme design or objectives, it would remain a Pathway 4A activity (or potentially move into Pathway 4B) with the *potential* for climate impact – although this impact would be difficult to prove.

In the context of climate financing provided by traditional development funders seeking to increase their investments in climate action, programmes like a girls’ education initiative or a remedial education programme for refugee children could be eligible for climate finance if the project rationale clearly identifies the climate vulnerability(ies) of the targeted population and points to these vulnerabilities as a reason for their being targeted by the project. In other words, the project rationale must explicitly illustrate how the climate impacts and risks borne by this population create barriers to education and therefore drives the need for a change in the enabling environment through specific interventions. Simply targeting a climate-vulnerable population as the project beneficiary would probably be insufficient justification to qualify the project for climate financing – at least not among most development funders seeking to classify some of their investments as climate finance.

Similarly, for the VCM, because of the principle of additionality, the onus is on the project to prove that the targeted population would not otherwise have had access to school. For a girls’ education programme to pass this test of additionality, projects would need to use a climate-vulnerability assessment to help identify (and prove) the population of girls gaining access to school that would not otherwise have had access.⁵⁰ As such, another area for further exploration is identifying what the different levels of tolerance are among different types of climate funders and climate financing mechanisms for the vastly different types of data and evidence currently available or emerging, from correlational to innovative modelling.

Box 5. A note on GEDSI-responsive climate finance under Pathway 4A

Pathway 4A (Access) is GEDSI-responsive by nature. This climate finance pathway targets sub-populations that are particularly vulnerable to the impacts of climate change, like girls and women and ‘youth on the move’. Activities in this pathway address the disproportionate impacts of climate change on these sub-populations and use climate finance to promote equity and inclusion in the education sector.

⁵⁰ In the context of any investment seeking to be co-financed with climate funds, a climate vulnerability assessment should be viewed as standard practice.

3.5. Potential Pathway 4B: Enabling climate outcomes through foundational learning for all

3.5.1. Overview

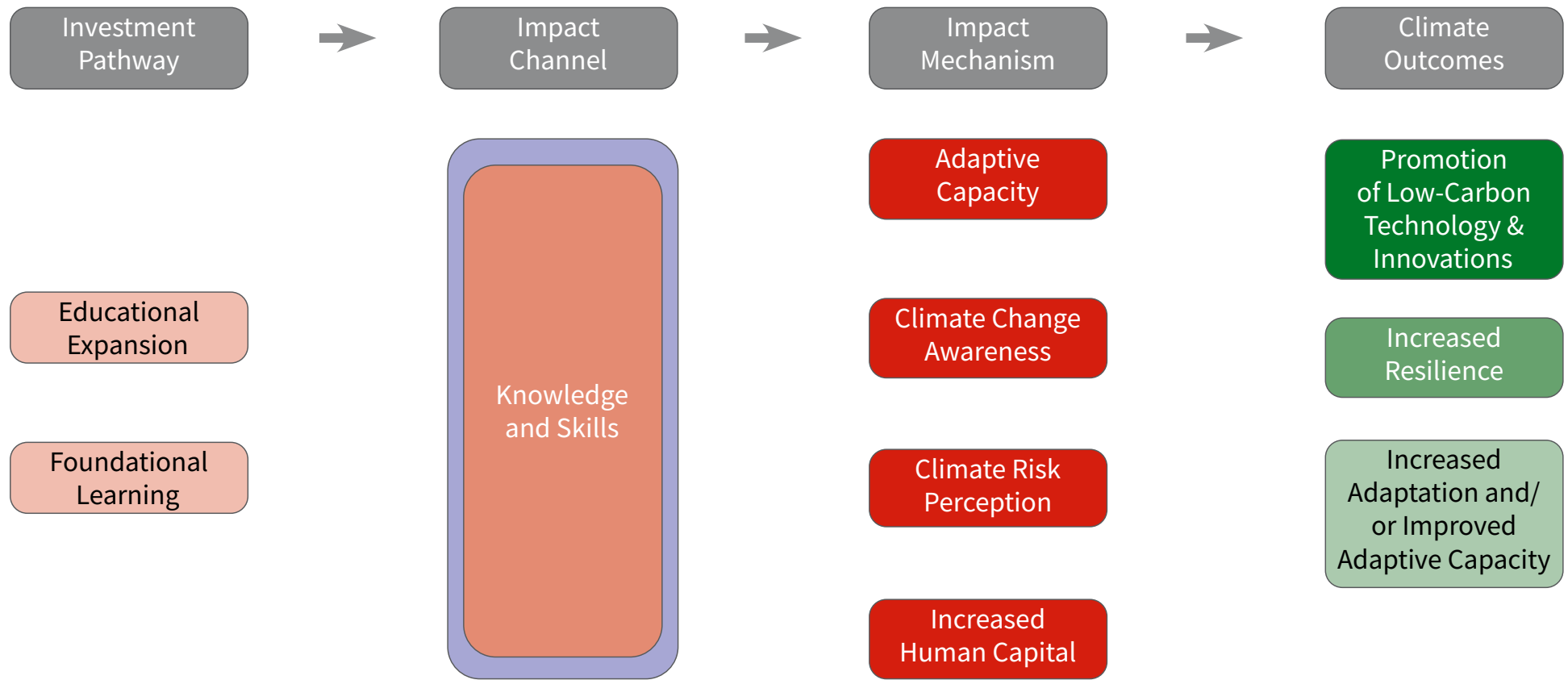
Potential Pathway 4B is perhaps the most tenuous pathway to climate finance for the education sector as it is characterised by the most indirect channels of impact between education and climate outcomes. It concerns the expansion of educational access and foundational learning for all (see Figure 5 and explore more in [Annex 1](#), Pathway 5). While there is limited literature on correlations between foundational literacy, numeracy, and socio-emotional skills, on the one hand, and climate outcomes, on the other, the underlying rationale for Pathway 4B stems from a rather robust evidence base linking greater educational attainment with greater adaptive capacity and climate resilience. In fact, the literature on this aspect of education constitutes some of the most cited evidence in global advocacy calling for greater attention to education as a climate solution.

3.5.2. Examples

This pathway captures education in its most general and basic forms: more schooling and more (foundational) learning. It includes traditional investments in education targeting educational expansion and the development of foundational knowledge and skills: basic literacy, numeracy, and socio-emotional skills. These are the building blocks of lifelong learning. This potential pathway acknowledges the policy priorities of the global education sector still actively addressing a global learning crisis.

While Pathway 4A targets education investments that remove barriers to educational opportunities, especially among historically marginalised and climate- vulnerable populations, Pathway 4B focuses on education investments in overall attainment and foundational learning for all.

Figure 5. Snapshot of Pathway 4B



Note: See **Annex 1** for more detail.

3.5.3. Data and evidence

Investments in this pathway have the *potential* for climate impact mostly because the evidence base provides an indirect pathway to climate adaptation, resilience, and even mitigation outcomes (see Table 10 and explore Annex 3, Pathway 4B, for full citations to the reviewed literature). Often, the evidence suggests that the influence of foundational skills is highly mediated by other demographic factors and programmatic interventions, such as access to social capital, land, and information about climate change.⁵¹ (From a programmatic perspective, evidence about increased access to climate information might shift investments in this pathway to Pathway 3.) Correlational studies, often conducted in the context of investigating the adaptive capacity of smallholder farmers, provide much of the evidence base on the relationship between foundational literacy and numeracy and climate adaptation outcomes.⁵² Among the heavily cited evidence are studies indicating strong correlations between higher levels of education (often measured in years of schooling – a proxy for the achievement of foundational learning outcomes) and greater levels of adaptive capacity at the population level. Well-cited studies also show correlations between high levels of educational attainment and a higher propensity to engage in more pro-environmental behaviours, or to adopt adaptive responses and technologies at the individual level.⁵³ This evidence tends to come from climate-focused modelling that considers education levels as a demographic variable, and from national experiments looking at the impact of a compulsory education law in a particular country that effectively increases the years of schooling received by the average person.⁵⁴

The relationship between more foundational knowledge and skills and climate adaptation outcomes is often explained in the literature as a result of the empowering effect of education in the context of achieving key SDGs (e.g., reduction in poverty, increase in gender equality, etc.). Another explanation focuses on enhanced cognitive skills; more schooling means greater exposure to environmental concepts, which increases climate change awareness and/or climate risk perception, which then increases the adoption of adaptive technologies and adaptation-seeking behaviours and improved resilience.⁵⁵ However, the idea that these mechanisms lead to changes in information-seeking behaviour that enhance resilience and adaptive capacity, or lead to changes in emissions-causing behaviours and promote the adoption of low-carbon technologies and innovations, remains largely intuitive and correlational at best.⁵⁶

51 For example [Cho, et al., 2024](#). See Annex 3, Pathway 4B for additional literature.

52 For example [Mfitumukiza, Barasa and Catherine, 2017](#). See Annex 3, Pathway 4B for additional literature.

53 For example [Hoffmann and Muttarak, 2017](#). See Annex 3, Pathway 4B for additional literature.

54 For example [Striessnig, Lutz & Patt, 2013](#), and [Powdthavee, 2022](#). See Annex 3, Pathway 4B for additional literature.

55 [Striessnig, Lutz & Patt, 2013](#); [Muttarak & Lutz, 2014](#).

56 See, for example, [Beckage, Gross, Lacasse, et al., 2018](#); [Hoffman & Muttarak, 2017](#); [Marshall, et al., 2013](#).

Table 10. Snapshot of the evidence base and data gaps for a sample of education investments under Pathway 4B

Education investment	State of the evidence	Data gaps
Increased levels of education	There is well-established correlational evidence on the relationship between years of schooling and adaptive capacity. Evidence supports causal inference from natural experiments on the impact of compulsory education laws on both adaptation and mitigation outcomes.	<p>More methodological development is needed to measure the mediating influence of things like anticipatory capacity, risk perception, abstract reasoning, social capital etc., to better understand what aspects of foundational learning increase adaptive capacity and resilience.</p> <p>More data collection and analysis is needed on the relationship between more years of schooling and exposure to environmental/climate change knowledge and awareness, in order to understand when investments in Pathway 4B become investments in Pathway 3.</p> <p>More methodological development (especially modelling) is needed in diverse geographic contexts with diverse economic development journeys, in order to understand the relationship between increased levels of education, urbanisation, and economic growth. This would help to determine the point at which investments in Pathway 4B become investments in Pathway 3. In other words, sound modelling could reveal what proportion of the effect is attributable to foundational/non-green skills and what proportion is due to green learning.</p>
Increased literacy and numeracy	Well-established correlational evidence of the relationship between literacy and numeracy and adaptive capacity, especially among smallholder farmers.	<p>More studies are needed that use measures of foundational skills – basic literacy and numeracy and socio-emotional skills) – to more robustly capture the influence of foundational learning on adaptive capacity (rather than using formal education attained as a proxy).</p> <p>More data and methodological development is needed to explore the relationship between foundational skills and the carbon footprint of societies.</p>

Note: See [Annex 3](#), Pathway 4B, for full citations to the reviewed literature

3.5.4. Areas for further exploration

More studies are needed to better understand how foundational knowledge and skills enhance adaptive capacity, environmental and climate awareness, and climate risk perception. Many of the existing studies appear to treat education as a quantitative variable; that is, they measure the effects of years in school – or more often, the effect of one additional year in school. Many of these studies assume that an additional year of schooling leads to increased environmental awareness. However, the evidence for Pathway 3 suggests that the link between environmental awareness and pro-environmental behaviours or resilience-seeking behaviours is not guaranteed, since it is mediated by many other factors; therefore, it must be intentionally cultivated. Indeed, the literature suggests that things like climate risk perception and climate awareness are generally correlated with proximity to and experience with climate disasters and/or warming temperatures. Such factors can interact with foundational skills in ways that inform climate risk perception.

Table 11 shows example indicators measuring climate impacts for Pathway 4B activities.

Table 11. Sample indicators of climate impacts for Pathway 4b activities

Sample indicators	
Number of people supported to better adapt to the effects of climate change, disaggregated by gender and other identifiers of vulnerability	Changes in information-seeking behaviours (e.g., weather forecasts, risk reduction strategies, awareness of climate hazards, etc.)
Number of people with improved (climate) resilience, disaggregated by gender and other identifiers of vulnerability	Changes in emissions behaviours (e.g., transportation choices, food choices, consumption, etc.)

Note: See Annex 1, Pathway 4B, for how these indicators map onto the Pathway 4B activities and their associated climate outcomes, as well as the status of their methodological development

For climate funders like the Green Climate Fund or carbon credit standards that require proof of additionality – that is, proof that the climate benefits of foundational learning would not have occurred under ‘education as usual’ – investing in this pathway may pose epistemological challenges. This is because the concept of additionality is counterintuitive to the nature of foundational learning; foundational learning is supposed to be foundational. Unless of course, approaches to foundational learning begin to take on climate literacy as a foundational literacy,⁵⁷ this pathway may require strategic advocacy to be taken seriously by some climate funders as a climate investment.

In response, some have argued that a more compelling argument for the sustained prioritisation of foundational learning is to note the consequences of an *absence* of foundational learning (as seen in the global learning crisis). It is argued that such an absence reduces adaptive capacity and resilience, and that discussion on this aspect could be included in project rationales in order to secure climate funding. However, for development funders seeking to invest in climate strategies, such an argument may not be sufficient and may not warrant a proportion of climate financing under current eligibility requirements. The argument may, however, be compelling

⁵⁷ See, for example, Kwauk, 2024.

where a programme offers foundational learning to a particularly climate-vulnerable population; however, in such a case, the activity would fall under Potential Pathway 4A. Others have suggested that foundational learning could be taught through a climate lens or with climate-infused teaching and learning materials.⁵⁸ Doing so would help move this activity from Potential Pathway 4B into Pathway 3 with more direct linkages to climate impact.

One additional area perhaps ripe for further inquiry is to reconcile two apparently disparate bodies of evidence; that more education leads to decreased emissions and that more education leads to increased emissions – especially if the education is ‘more of the same’ that enabled the current state of overconsumption, affluence, and unfettered economic growth.⁵⁹ Studies supporting Pathway 4B suggest that more education leads to improved environmental awareness and thus decreased emissions, and also that it leads to more support for (and skilled labour for) environmentally friendly technologies that help decrease emissions. The literature on interactions between human capital, urbanisation, and ecological and carbon footprints also suggests that increased levels of human capital are associated with more sustainable urbanisation.⁶⁰ However, whether this is a matter of years in school and a certain threshold of foundational learning attained, or a matter of the quality of education and climate learning attained, is not yet fully understood.

Given the indirect nature of foundational learning’s impact on climate adaptation and resilience, this potential pathway has a long but not impossible road from development finance to climate finance. Efforts to identify co-financing opportunities under this pathway might be best spent trying to ensure development finance levels to foundational learning do not shrink amidst other priorities.

Box 6. A note on GEDSI-responsive climate finance under Pathway 4B

Pathway 4B (Foundational Learning) has potential as an entry point for GEDSI-responsive climate finance. Generally, women and girls experience greater gains than men in adaptive capacity and climate resilience with higher levels of education – and presumably higher levels of foundational knowledge and skills as a result.⁶¹ Women have also been found to exhibit higher climate change awareness and risk perception than men, although this can vary based on different factors and contexts.⁶² To ensure such impacts are realised, projects related to foundational knowledge and skills should target climate-vulnerable sub-populations and should be designed to be accessible to all learners, including children with disabilities.

⁵⁸ See, for example, Kwauk, 2024; Sabarwal et al., 2014.

⁵⁹ O’Neill, et al., 2020; Wiedmann, et al., 2020.

⁶⁰ Ahmed & Wang, 2019; Ahmed, et al., 2020; Zafar, et al., 2020.

⁶¹ Muttarak & Lutz, 2014.

⁶² Ballew, et al., 2018; Khan, Chattopadhyay & Ali, 2022; Sammie, et al., 2020.



Photo credit: Fatima Yusuf

4

Conclusions and areas for further exploration

The mapping undergirding this paper has demonstrated how a range of education activities are directly linked to climate outcomes and how a few indirect connections could be tightened. While some pathways already have strong or moderate evidence of the link between education investment and climate outcomes, the goal of this paper is to help education stakeholders think more expansively about links between education and climate impact. It is hoped that the discussion on various pathways will broaden the realm of possible climate linkages and inspire more research and development on innovative methodologies in the design and delivery of education activities that target climate objectives. Ultimately, as the education sector develops a more sophisticated understanding of education’s many possible contributions to climate mitigation and adaptation, this understanding will translate into more and new investments in education as a climate solution.

Table 12 summarises the general state of the evidence for each pathway, challenges ahead that must be navigated, and opportunities for the education sector to access international climate finance.

Table 12. The state of the evidence, challenges to navigate, and opportunities for climate finance

Pathway	State of the evidence	Challenges to navigate	Opportunities for international climate finance
1. Climate-Smart School Environment Examples: Low-carbon, energy-efficient school retrofits, planet-friendly school health and nutrition.	Strong to emerging evidence base with well-tested methodologies for measuring mitigation and adaptation outcomes, but often limited to Global North contexts.	Education stakeholders could be more proactive in initiating these activities in collaboration with stakeholders from other relevant sectors.	Pairing climate-smart education infrastructure with climate-relevant teaching and learning could double the climate impact of these infrastructure-focused activities and create opportunities to increase total climate spend/co-financing.

Pathway	State of the evidence	Challenges to navigate	Opportunities for international climate finance
<p>2. Climate-Resilient Operations in Education</p> <p>Examples: Climate-integrated education policy and planning, climate-conscious institutional and technical capacity building.</p>	<p>Acceptable approaches for tracking adaptation impact at aggregate levels, but heavily reliant on documenting implementation; less robust and less developed methodologies for measuring impact at the individual and systems levels.</p>	<p>Need more robust methodologies for measuring adaptation outcomes like adaptive management among education decision-makers, adaptive capacity and resilience at the systems level and at the individual level, etc.</p>	<p>Adaptation financing might be the easiest case to make, but the burden of proof rests on a strong project design and rationale with clear evidence.</p> <p>Keep an eye out for opportunities in the VCM that could open channels to climate financing focused on systems-wide mitigation impact, spurred by systems- strengthening climate policy and regulations.</p>
<p>3. Climate-Relevant Teaching and Learning</p> <p>Example: Teacher training and professional development, greening curriculum, greening TVET</p>	<p>Intuitively this pathway of activities is necessary for climate impact, but more robust evidence is needed, especially on the linkages between learning and behavioural outcomes and their potential climate outcomes.</p> <p>A solid foundation of measurement approaches and data collection tools exists (albeit mostly in the Global North); need to build on these to measure outcomes and to model relationships that are relevant to climate funders.</p>	<p>Need to define what should be measured and how, and then resolve methodological challenges for linking these outcomes to climate outcomes.</p> <p>Need more robust methodologies for achieving greater proximity on measures of behavioural change.</p>	<p>Growing demand for high-integrity carbon credits and alternative products in the VCM is increasing demand for new methodologies and types of climate impact-generating projects, creating room for innovation by the education sector.</p> <p>Investigate public and private climate finance eligibility criteria that could enhance investments in green skills for green jobs; ensure these opportunities focus on a range of green skills as well as investments in upstream linkages to primary and secondary education.</p>

Pathway	State of the evidence	Challenges to navigate	Opportunities for international climate finance
4a. Access Examples: Education in emergencies for climate-vulnerable populations, enhancing girls' access to education.	Although historic evidence exists of the protective and empowering effect of education, the evidence is highly correlational; the mechanisms of impact of increasing access to school, even among climate-vulnerable populations, are less understood, especially in a long chain of causality.	Understanding the mechanisms of climate impact, especially among climate-vulnerable populations, remains a methodological challenge.	Intentionally target climate-vulnerable populations and proactively shift education projects with an access entry point toward becoming climate-relevant teaching and learning activities (i.e., move Pathway 4A activities into Pathway 3).
4b. Foundational Learning Examples: Foundational literacy and numeracy programmes	Robust evidence base illustrating the importance of foundational knowledge and more schooling on adaptive capacity, but less robust evidence on the mechanisms of impact.	May be too far back in the causality chain to move from development finance to climate finance. No clear way to establish the baseline or the counterfactual to prove additionality.	Intentionally design foundational learning activities through a climate lens to move the investment into Pathway 3 and better eligibility for climate finance.

The evidence highlighted in this paper shows that education can be a powerful enabler of both mitigation and adaptation. However, more work needs to be done to develop indicators and data collection and modelling methodologies to better document and measure these climate impacts. As the climate finance landscape evolves and the urgency of the climate crisis grows, this mapping can help the education sector – together with allies in the climate finance community – to prioritise methodologies to test. Only with such exploration will the education sector be able to unlock new financing and co-financing opportunities to receive the funding needed for long-term transformation and the achievement of global climate and development goals.

Looking ahead, several priority areas of action by the education sector might help it to maximise the potential for climate co-financing:

- Develop robust methodologies for measuring, reporting, and verifying the climate outcomes of education activities**, especially where existing data collection is irregular, insufficient, or methodologically weak. To facilitate this, more robust mapping of the available, needed, and/or required data and evidence pathways may be necessary for specific education investment areas and their potential climate outcomes. Such mapping should be done in consultation and collaboration with education and education-adjacent stakeholders (e.g., from other sectors like labour, agriculture, energy, etc.). This would assist all parties to

identify data collection methodologies and management systems that could be harmonised across sectors.

- **Enhance existing data collection systems and modelling approaches to provide credible evidence** of the climate impacts of education interventions, including for projects with more indirect or complex causal pathways. This may mean establishing a counterfactual to help illustrate additionality, whether through advanced modelling methodologies or through carefully considered natural or quasi-experimental approaches.
- **Collaborate with climate funders**, especially to jointly develop and stress-test methodologies and standards that can accelerate education sector access to international climate co-financing. It is clear that a wide range of education activities contribute to climate mitigation and adaptation. Working together with climate finance stakeholders to identify ways to better measure education's climate impacts can help ensure that education projects are recognised and resourced appropriately and proportionately.
- **Collaborate with cross-sectoral partners in agriculture, energy, health, waste management, etc.** This would both build opportunities for educating and training a future climate-ready workforce and facilitate the development of climate-smart and climate-resilient education systems, based on the notion that education systems offer the ideal scale or 'sweet spot' for climate impact.⁶³ These collaborations could be further leveraged by developing relevant teaching and learning connections that create green learning opportunities for learners. Such collaborations can help build climate-relevant knowledge and skills for climate action, and increase participation in green jobs, adaptive capacity and climate resilience.
- **Encourage the education sector to mainstream climate objectives as core** – rather than peripheral or in addition to – components of their interventions. This will be key to unlocking larger and more sustainable streams of climate finance, and is what the education sector should double down on amidst the climate emergency.

Ultimately, by building robust evidence and fostering stronger partnerships between the education and climate finance communities, the education sector not only protects itself from the impacts of climate change but also empowers itself and its beneficiaries to drive the systemic transformations required for a resilient and sustainable future. This paper represents a first step toward that vision and hopes that the broader education community will carry this step forward.

⁶³ Bhowmik, McCaffrey, Ruskey, et al., 2020; Kwauk, 2020.

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Annexures



Annex 1: Education pathways to climate outcomes

[LINK TO MIRO BOARD](#)

Annex 2: Examples activities under Pathways 1–4A

[LINK TO EXCEL FILE](#)

Annex 3: Rapid mapping of evidence of Pathways 1–4B

[LINK TO EXCEL FILE](#)