CHOOSING OUR FUTURE:

Education for Climate Action

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Highlights

Key-takeaways

1. **Education is a powerful but under-used instrument for climate action. Channeling more climate funding to education could significantly boost climate mitigation and adaptation.** This report shows how to do this.
    - Education is the single strongest predictor of climate change awareness. It can play a catalytic role in climate change mitigation and adaptation by reshaping mindsets, behaviors, skills, and innovation.
    - And yet, education is massively overlooked in climate financing – a mere 1.5 percent of climate finance went to the education sector in 2021.[1]
2. **Schooling and learning, especially for the poorest, are at significant risk because of climate change. Education systems need to adapt for a changing climate**. This report shows how countries can do this.
    - Countries lost on average 11 days of instruction per year (or 6 percent of an academic year) in affected schools due to climate-related school closures. But impacts were highly unequal - low-income countries lost about 18 days per year (or 10 percent of an academic year) in affected schools, while high-income countries lost only 2.4 days. Unless made up, this lost schooling will translate into big learning deficits for children in low-income countries. For instance, it takes about 18 days to teach a student how to add two-digit numbers to one- or two-digit numbers, with carrying (assuming well-designed and structured pedagogy).[2]
    - Even when schools are open, students are losing learning due to climate change. An average student in the poorest 50 percent of Brazilian municipalities could lose up to 0.5 years of learning overall due to rising temperatures.
    - Governments can act now to adapt schools for climate change in cost-effective ways. A low-cost adaptation package for education systems would cost around US$18.51 per student. More effective but expensive adaptation packages would cost between US$45.68 – US$101.97 per student. All these adaptation packages include solutions for temperature control, infrastructure resilience, remote learning during school closures, and teacher training. The first two components will help reduce the likelihood of climate-related school closures and all four components will help minimize climate-related learning losses. Costs would be lower for systems that already have some elements in place. For reference, low-income countries spend an average to US$51.80 per student per year, while high-income countries spend US$8,400 per student per year.[3]

The story in numbers

3. **Climate action remains slow**. Nearly 79 percent of youth across eight low- and middle-income countries believe their country is in a climate emergency.

4. **This is in part due to missing or misleading information**, in three ways:
    - **Information gaps on climate awareness**, especially among older people. Household behaviors are responsible for 72 percent of global greenhouse gas emissions.[4] And yet, climate change awareness is still at only about 65 percent in low- and middle-income countries.[5]
    - **Information gaps on how to act for climate** mitigation and adaptation. Information gaps on adaptation are particularly problematic for young people in low- and middle-income countries. This is because the most severe impacts of climate change will occur in these countries, which are home to 85 percent of the world's children but have contributed very little to carbon emissions.[6] For example, the ten highest-risk countries in terms of climate change collectively emit only 0.5 percent of global emissions.[7]
    - **Misinformation**. Nearly 47 percent of secondary teachers in Bangladesh and 41 percent in Uganda believe that climate change coverage in media is exaggerated.

5. **Climate action is also slow due to missing skills**. Global green transitions would require skilled workers for an estimated 100 million new jobs, up-skilled workers for most existing jobs, and re-skilled workers for another 78 million jobs which will disappear.[8] However, these skills are missing.

6. **Young people are desperate to act but feel ill-equipped to do so**. While approximately 88 percent of Bangladeshi secondary students want to do something about climate change, only 32 percent could correctly answer a basic question about greenhouse gases.

7. **Education, especially in schools, can address information gaps and propel pro-climate behaviors at scale**.
    - In a global analysis, education is the strongest predictor of climate change awareness.[9] An additional year of education increases climate awareness by 8.6 percent, based on data from 96 countries. These impacts are stronger where education quality is higher.[10]
    - Education is especially critical for behavior change related to climate change adaptation in low- and middle-income countries. Those with more education exhibit greater disaster preparedness and response, experience reduced adverse effects and recover more quickly from disasters.[11]

8. **Education can help with climate action today, not just tomorrow**. In India, climate-related outreach to children not only increased their pro-climate behavior but also increased the pro-climate behavior of parents by nearly 13 percent. Parents are much more receptive to climate-messaging when it's done with their children or through their children.[12]

9. **Education, especially at the upper secondary and tertiary levels, can generate green skills at scale to massively propel green transitions.** These skills are increasingly critical. Around 65 percent of youth from eight low- and middle-income countries believe that without green skills, their future employability is at risk.

10. **School education can be much better harnessed for climate action** for three primary reasons.
    - **Low foundational skills**. Globally 70 percent of ten-year-olds are estimated to not meet minimum proficiency in literacy.[13]
    - **Lack of climate education within already overloaded curricula**. Nearly 65 percent of youth across eight low- and middle-income countries believe they did not learn enough about climate change in schools.

- **Teachers are tackling climate topics in the classroom, but do not have the training to do this accurately or effectively**. Nearly 87 percent of teachers across six low-and middle-income countries reported including climate topics in their lessons. However, nearly 71 percent answered at least one basic climate related question incorrectly.

11. **Policymakers can help schools do much more for climate by focusing on foundations, incorporating practical and relevant climate curriculum, and building teacher capacity.**
    - Two key principles for this are: (i) introduce climate topics early but without crowding out foundational learning. Instead, use climate topics to teach foundational skills; (ii) teacher consultations are essential to adjust the existing curriculum to include climate.
    - Teachers are sharply divided on how exactly climate curriculum should be introduced. Across eight low- and middle-income countries, around 45 percent of teachers believe climate should be a separate subject and the rest believe it should be mainstreamed in existing subjects.

12. **Tertiary education remains under-used for green skilling. This is in part because of prevailing misconceptions about the nature of green skills.** Nearly 54 percent of youth across eight low- and middle-income countries mistakenly believe green skills are only attainable through a master's degree. Around 73 percent mistakenly believe that it would be impossible to get a green job if they do not have STEM skills.

13. **Four facts about green skills** that policymakers and students need to understand are:
    - **Green skills are broad. They include technical, STEM, and sector-specific skills. But also non-technical skills, socio-emotional, and cross-sectoral skills.** In Egypt, India, and Kenya, less than half of the online postings for green jobs needed a STEM skill.
    - **Any job and any sector can become greener with the right set of skills.** In Brazil, on average 25 percent of the skills demanded for jobs in the food and beverage service industries are green, as are 17 percent of the skills demanded for jobs in creative industries.
    - **These skills are not just for 'new' jobs but also for augmentation of existing jobs.** Green transitions will need some new skills for new jobs. But more importantly they will need additional skills for existing jobs. Nearly 76 percent of businesses in Indonesia report that changes in existing jobs are the biggest adjustments needed to green their business.[14]
    - **The demand for these skills can be unpredictable and inequitable.** In high-income contexts, there were 62 women for every 100 men in green jobs.[15]

14. **Education can propel climate action. But at the same time, climate change is impeding education.** Climate change is increasing the frequency and intensity of extreme weather events such as cyclones, floods, droughts, heatwaves, and wildfires as well as the probability of co-occurring events. These extreme weather events are increasingly disrupting schooling and precipitating learning losses and dropouts.

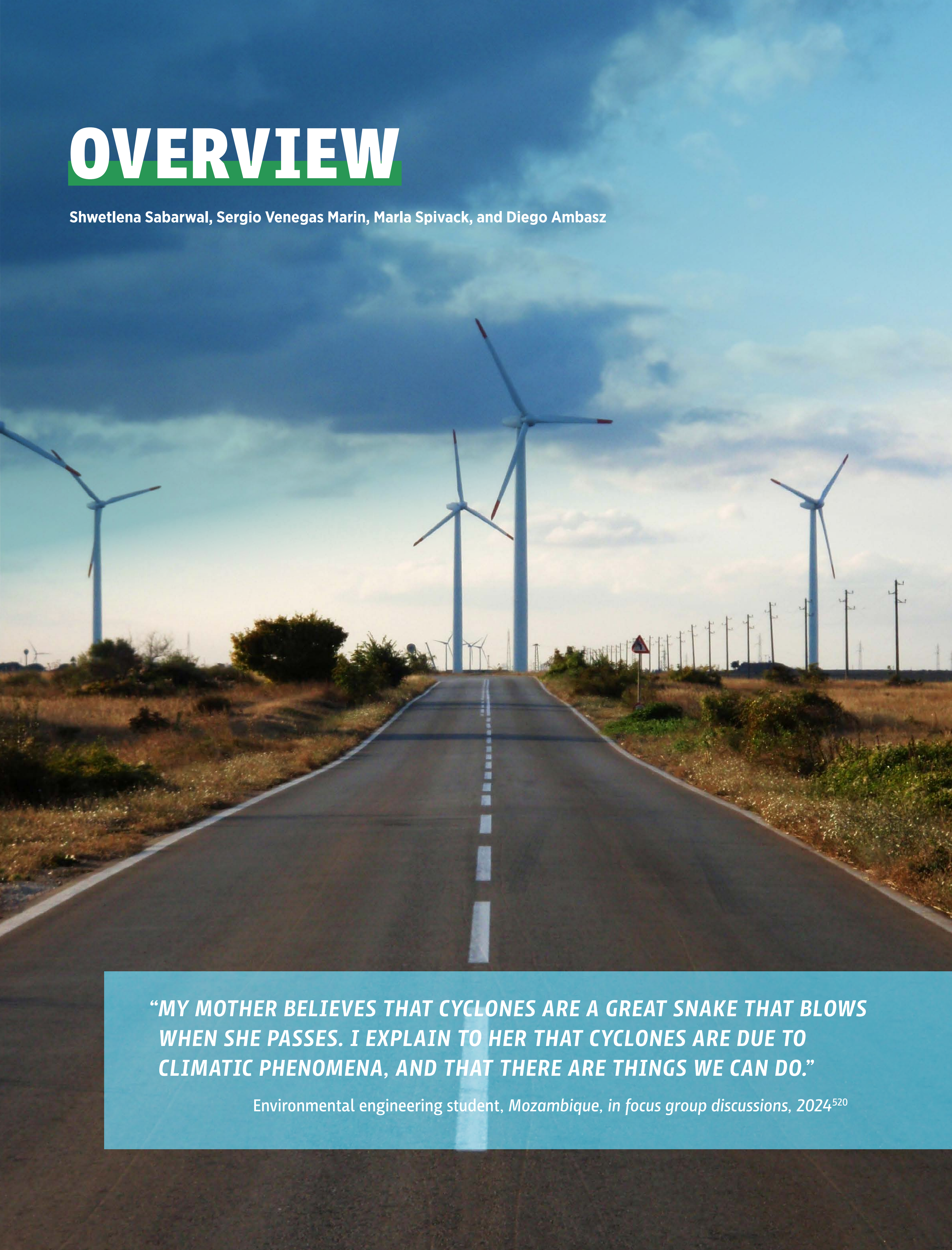
15. **Climate change is causing massive school closures.** These disruptions remain invisible because they are not being tracked. There is no official data on the frequency and severity of school closures due to extreme climate events. Consequently, this crisis is going largely unnoticed. Novel analysis for this report shows that:
    - **Over the past 20 years, schools were closed in at least 75 percent of the climate-related extreme weather events impacting 5 million people or more**.[16] Most worryingly, the frequency and severity of school closures continues to grow due to climate change.
    - **Between January 2022 and June 2024, an estimated 404 million students faced school closures due to extreme weather events.** This was the result of at least 81 countries shutting down schools temporarily due to floods, storms, and heatwaves.

- **These school closures can cause big learning losses.** Between January 2022 and June 2024, countries that closed schools to respond to climate shocks lost on average 28 days of instruction in affected schools. However, the average masks significant disparities. Affected schools in low-income countries during the same period lost about 45 days, while those in high-income countries lost only 6 days.
- **In some contexts, climate-related school closures are frequent or of long duration.** Between January 2022 and June 2024, students in Philippines experienced 23 episodes of school closures. In Pakistan, they lost 97 days of school (nearly 54 percent of a typical academic year).

16. **Rising temperatures are also negatively impacting student learning.** An average student in the poorest 50 percent of Brazilian municipalities could lose up to 0.5 years of learning overall due to rising temperatures.

17. **However, policymakers are not prioritizing this issue.** A novel survey for this note, covering 103 education policymakers across 33 low- and middle-income countries, reveals that only about half (51 percent) believe that hotter temperatures inhibit learning. Further, 62 percent said the protection of learning from climate change is among the bottom three priorities in their country (out of a set of ten priorities).

18. **Education systems need to be adapted for greater resilience through education management, adjustments to infrastructure, prioritizing learning continuity and mobilizing students and teachers as change agents.** This effort will need financing. A low-cost adaptation package, which includes measures for temperature control, infrastructure resilience, remote learning during climate-related school closures, and teacher training can cost about US$18.51 per student. Given that low-income countries spend an average of US$51.80 per student, this would increase per-student costs in these countries by approximately 35.7 percent.



OVERVIEW

Shwetlena Sabarwal, Sergio Venegas Marin, Marla Spivack, and Diego Ambasz

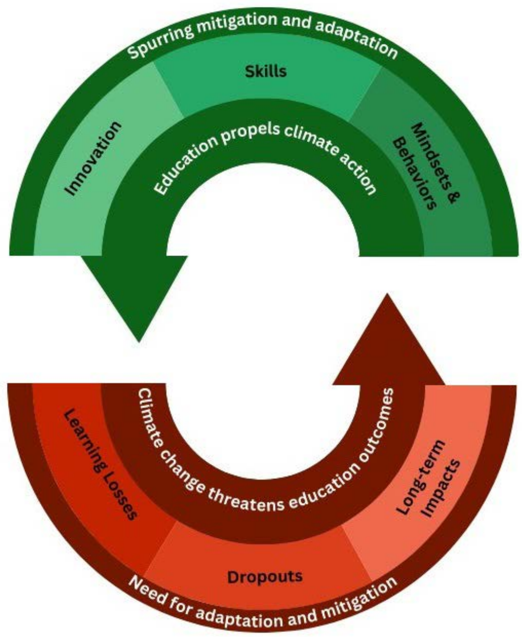
"MY MOTHER BELIEVES THAT CYCLONES ARE A GREAT SNAKE THAT BLOWS WHEN SHE PASSES. I EXPLAIN TO HER THAT CYCLONES ARE DUE TO CLIMATIC PHENOMENA, AND THAT THERE ARE THINGS WE CAN DO."

Environmental engineering student, *Mozambique, in focus group discussions, 2024*[520]

Education holds the key to faster and better climate action (action that supports climate change mitigation and adaptation). This is partly because people in the eye of the crisis have insufficient knowledge and skills to address it. Education can help alleviate these constraints in two crucial ways. First, education can galvanize behavior change at scale - not just for tomorrow, but also for today. Second, education can unlock skills and innovation to shift economies onto greener trajectories for growth.

At the same time, education needs to be protected from climate change. Extreme climate events and temperatures are already eroding hard-won progress on schooling and learning. Climate change is causing an increase in dropouts and learning losses, which will turn into long-run inter-generational earnings losses. Climate-related erosion of education outcomes will get worse as climate change worsens, putting into jeopardy education's powerful potential for spurring poverty alleviation and economic growth.

Figure 0.1: Education propels climate action, while climate change threatens education outcomes



Governments can harness education and learning to propel climate action. This is a very attainable goal that is aligned with broader education objectives. To do this, governments need to act on three domains:

- **First, harness school education for pro-climate behavior-change** by investing in foundational skills and STEM education, delivering well-designed climate education, and building teacher capacity.
- **Second, harness tertiary education for green skilling and innovation** by fostering student adaptability through strong foundations, flexible pathways, and information flows.
- **Third, protect education systems** by making them more adaptable and resilient to a changing climate.

This report outlines data, evidence, examples, and a policy agenda on how to harness education and learning to propel climate action. Chapter 1 focuses on school education to generate climate change awareness and behavior change at scale. Chapter 2 focuses on tertiary education for green skilling. Chapter 3 discusses how to protect and adapt education systems in the face of climate change.

Climate action is slow partly because people don't have sufficient knowledge or skills

Despite a dire climate crisis, action remains slow. Across the board, there is only marginal 'greening' of how economies function, how firms operate, and how individuals live and work. In 2015, 195 countries adopted a legally binding treaty to limit global warming to between 1.5-2°C, compared to pre-industrial levels.[17] A stocktaking in 2023 reveals that global efforts to meet these targets are failing. Across the 42 climate indicators only one is on track to reach its 2030 target. Of the other 41 indicators, six are "off track"; 24 are "well off track"; six are headed in the wrong direction entirely; and five have insufficient data to track progress.[18] This is a dismal progress report, despite decades of frightening warnings, projections, and wake-up calls.

Why has climate action been so slow? The lack of information, knowledge and skills have played a role. These gaps mean that people are not at the center of climate mitigation and action. Global climate efforts have put tremendous emphasis on what policies can lower emissions, but not on how to build support for these policies, how to implement these policies and help them succeed. At the same time, low- and middle-income countries urgently need large-scale efforts to help them adapt to the impacts of climate change. Efforts that will undoubtedly require improved awareness, knowledge, skills, and behaviors among people.

Household behaviors are responsible for 72 percent of global greenhouse gas emissions.[19] Three types of information/ knowledge gaps that may be partly responsible for impeding pro-climate behavior change. First, information gaps on climate change awareness, especially among older people. Climate change awareness is still at only about 65 percent in low- and middle-income countries.[20] Second, information gaps on what to do for climate change mitigation and adaptation. Nearly 65 percent of young people across eight low- and middle-income countries believe their future livelihoods are at stake if they don't develop green skills. And yet, 60 percent believe they did not learn enough about climate change in school. Third, there is a lot of climate-related misinformation, especially online, eroding public trust in scientific information. Nearly 47 percent of secondary teachers in Bangladesh and 41 percent in Uganda mistakenly believe that climate change coverage in media is exaggerated.[21]

Across the 42 climate indicators **only one is on track to reach its 2030 target.**

Economies also lack the skills to power a transition to low-carbon economies. Globally, moving economies to more sustainable development trajectories would require skilled workers for an estimated 100 million new jobs, and up-skilled workers for most existing jobs. They would also require re-skilled workers for another 78 million jobs which will disappear.[22] But these skills are currently in short supply. In 2024, 68 percent of the world's energy-focused educational degrees were oriented towards fossil fuels, only 32 percent focused on renewable energy, failing to fulfill the increasing need for a workforce in clean energy.[23] In India, 60 percent of respondents in the energy sector report shortages of skilled workers for adaptation and mitigation activities.[24] These skills shortages are creating significant barriers to green transitions.

These knowledge and skills constraints are particularly frustrating because young people are desperate to act. They just feel ill-equipped to do so. Across 37 countries, around 78 percent of 15-year-olds claim that looking after the environment is important to them. But only 57 percent felt that they could actually do something about it.[25] In Korea this share was only 20 percent. Novel data for this report shows just how big the untapped opportunity for youth-led climate action is. Among secondary students in Bangladesh, nearly 93 percent believe climate change is happening, nearly 40 percent feel that they are being personally affected by climate change, and yet only 32 percent could answer a basic question about greenhouse gases.[26] In a youth survey in Bangladesh, Kenya, and Mexico, about 81 percent of youth felt that if they did not learn about green skills and how to apply them, then their future livelihoods were at stake.

Education can unlock large-scale behavior change, not just tomorrow but today

Globally, educational attainment is the single strongest predictor of climate change awareness.[27] An additional year of education increases climate awareness by 8.6 percent (measured by knowledge and skills on environmental issues) based on analysis across 96 countries with nearly a million students over four years.[28] In Brazil, 84 percent of those with a secondary education or higher say climate change is a major threat, compared with 62 percent of those with less education – a 22-point difference.[29] The same pattern reoccurs in country after country. Across 16 advanced economies, those with more education are more willing to adjust their lifestyles in response to the impact of climate change.[30]

Education directly promotes pro-climate behavior. In Europe, an additional year of education increased pro-climate behaviors by 5.8 percentage points.[31] Students who attended a one-year university course on such topics reduced their individual carbon emissions by 2.86 tons of CO_2 per year.[32] Even as early as elementary school, exposure to environment-related, curriculum-based education can reduce energy consumption by more than 15 percent in their homes, and 30 percent in their schools.[33]

Education also makes individuals more adaptive to the impacts of climate change via access to higher employability and incomes. Globally, every year of learning generates about a 10 percent increase in earnings annually.[34] It can also increase adaptability directly. Across Brazil, Cuba, Dominican Republic, El Salvador, Haiti, Mali, Senegal, and Thailand, people with higher levels of education exhibit greater disaster preparedness and response.[35] Engendering behavior change for climate change adaptation is particularly critical for low- and middle-income countries which face the highest vulnerability to climate shocks.

Education can propel behavior change today, not just tomorrow. This is because children can improve climate mindsets of their parents and communities. In Indonesia, an increase in disaster risk knowledge among students led to a significant increase in parents' attitude and knowledge sharing.[36] In U.S., providing middle-school children with climate education led to higher levels of climate change concern among parents. Effects were strongest among parents who displayed the lowest levels of climate concern before the intervention.[37] In the UK, recycling rates increased by 8.6 percent when students shared lessons in waste education with their parents.[38]

Figure 0.2: Those with more education show greater concern about climate change

Statistically significant differences shown. Source: Pew Research Center, 2018j1

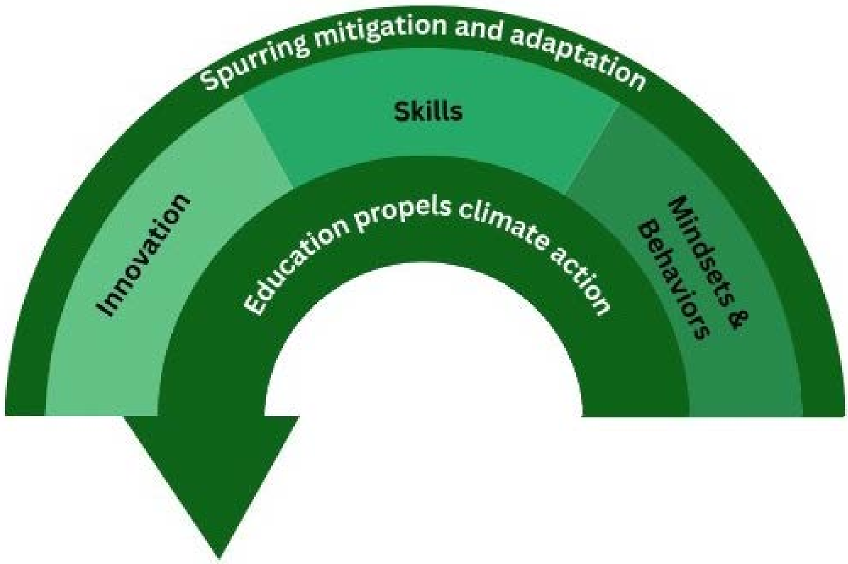
Education can propel behavior change for societies, not just individuals. There are many examples of education galvanizing political change.[39] And the climate movement requires these changes, be it around scaling-back energy subsidies or promoting low-carbon infrastructure or taxing private planes. In Europe, an additional year of education leads to an increase in green voting. Such voting gains, equivalent to a 35 percent increase, can be hugely consequential in promoting pro-climate policies at the national level.[40]

Education can empower people with skills to propel greener economies

Education is the only way to develop the skills required for green transitions, especially green transitions that are also just. Shifting towards more environmentally sustainable economic growth will require skilled workers. This global green transition would require skilled workers for an estimated 100 million new jobs, up-skilled workers for most existing jobs that will be transformed, and re-skilled workers for another 78 million jobs that will disappear.[41] In a global survey of business leaders, nearly 80 percent agree that green skills will be the most important driver of the green transition.[42] Future workers are most likely to access these skills mostly through education and training systems.

Climate action also requires innovation as well as research and development that rely on universities. Globally, promising climate research happens in universities through grants, graduate training (Master's and PhD students), and partnerships with the private sector. This agenda is especially critical for low- and middle-income countries to help foster climate solutions that are relevant for their specific contexts.

Figure 0.3 Education propels climate action



BOX 1: NEW DATA FOR THIS REPORT

This report relies on extensive literature reviews, supplemented with novel data, as follows (all low- and middle-income countries):

Quantitative Data

1. Compilation of media reports on climate-related school closures between January 2022 to June 2024 from 81 countries
2. Youth survey (ages 17-35 years) on climate and education from eight countries (Angola, Bangladesh, China, Columbia, India, Kazakhstan, Senegal, and Tanzania)
3. Secondary student survey on climate mindsets from Bangladesh and Uganda
4. Teacher survey on mainstreaming climate curriculum from six countries (Bangladesh, Chad, Jordan, Nigeria, Pakistan, and Uganda)
5. Policymaker survey on education and climate change from 33 countries
6. Online job portal data from five countries (Brazil, Egypt, Kenya, India, and Philippines)

Qualitative Data

7. Analysis of climate and education policies across 14 countries
8. Interviews with youth climate activists from 16 countries
9. Focus group discussions with tertiary education students and teachers in five countries (Bangladesh, Colombia, Kenya, Mexico, and Mozambique)
10. Online global youth leaders survey

But education remains massively under-used for climate action

Within global climate efforts, the education sector remains overlooked. While climate-related official development assistance increased from 21.7 percent in 2013 to 33.4 percent in 2020, education made up less than 1.3 percent of this change.[43] In terms of government action plans for climate, also known as Nationally Determined Contribution (NDCs), less than 1 in 3 mention climate education, and less than 1 in 4 mention green skills. Even in World Bank Country Climate Development Reports (CCDRs), across 46 countries, education is mentioned 20 times on average, compared to an average 172 mentions for energy or 72 for infrastructure.[44] This gap increases when we exclude CCDRs for Sub-Saharan Africa – 16 average mentions of education versus 215 for energy. The same is true for research. Out of 15 review articles on the economic impacts of climate change published since 2010, only three mention the impacts of climate change on education.[45]

Schools can do much more for pro-climate behavior change. Across low- and middle-income countries most students, parents, teachers, and even policymakers want schools to better prepare students for climate action. However, this is currently not happening. The biggest obstacles to this goal are:

- **Low foundational skills**: Worldwide hundreds of millions of children reach young adulthood without even basic literacy and numeracy. Globally, 70 percent of ten-year-olds cannot read for meaning by age ten.[46]
- **Lack of climate education within already overloaded curricula**: Across 100 countries, nearly 47 percent of frameworks have no mention of climate change.[47] In a youth survey across eight low- and middle-income countries, nearly 65 percent feel they did not learn enough about climate in school. But adding climate topics to an already overloaded school curricula is not easy. If done without careful consideration, it could backfire by further crowding-out the much-needed focus on foundational skills.
- **Lack of teacher capacity**: Finally, most teachers currently do not have the capacity to teach on climate. Across six low- and middle-income countries, 87 percent of teachers claim to include climate themes in their lessons, and yet 71 percent answered at least one basic climate related question incorrectly.[48]

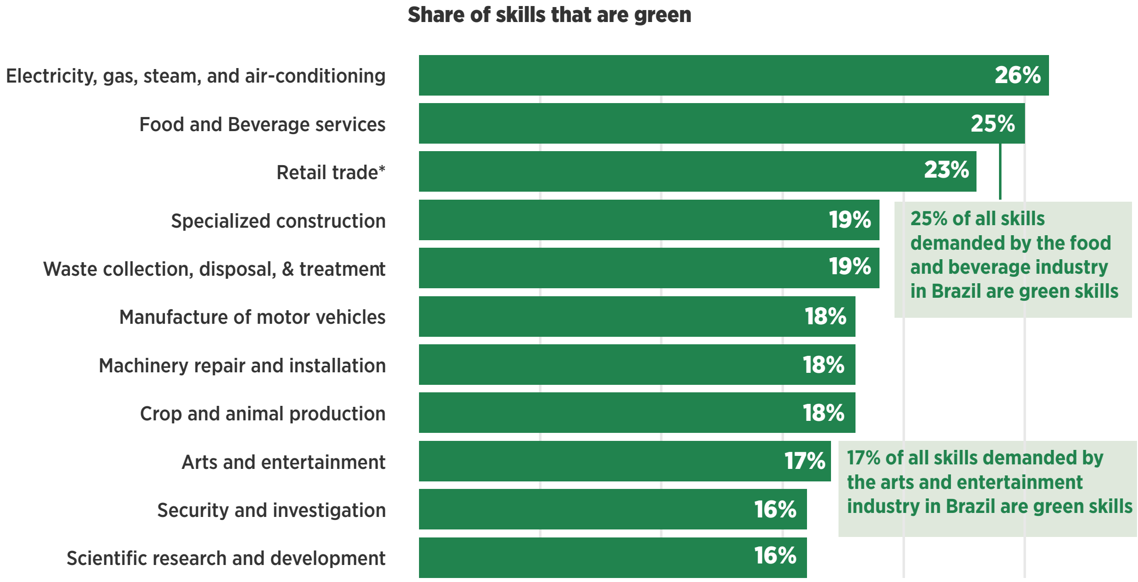
Education can do much more on green skilling and innovation. One big issue is that although green skills are central to the green transitions that most countries have pledged, their characteristics are not well understood. There is a misperception that green skills are highly technical, highly specific to a few sectors (energy, construction, transport, etc.), and only achievable through demanding degrees. This is not true.

Novel analysis for this report shows four facts about green skills. First, these skills are broad and also include non-technical skills, socio-emotional skills, cross-sectoral skills, and skills that are achievable through short courses. Second, these skills can be flexibly applied and include a core of transferable cognitive and social-emotional skills. Third, these skills are not just for 'new' jobs: they are augmented skills for existing jobs. Any job and any sector can become greener through the right set of skill-augmentation. Fourth, these skills are evolving in a way that is unpredictable and inequitable.

However, young people, educators, and policymakers do not appreciate the true scope and promise of green skilling opportunities. Other constraints include inaccessible, outdated, unresponsive, and rigid tertiary education systems that are failing to respond to the urgent promise of green transitions.

Figure 0.4: Green skills are demanded in a wide range of sectors across developing countries

AS ONE EXAMPLE, INDUSTRIES IN BRAZIL WITH THE HIGHEST SHARE OF SKILLS DEMAND BEING GREEN (IN ONLINE JOB POSTINGS)



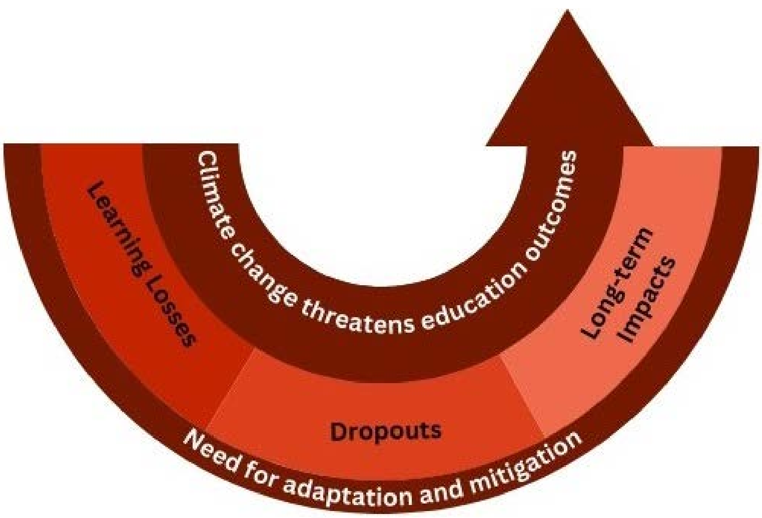
** except of motor vehicles and motorcycles*

Source: Lightcast™ (2024)
Note: Data are taken from online job postings data in Brazil between September 2022 and August 2023.

Education is also under threat by climate change

Climate change is causing massive school closures. A 10-year-old in 2024 will experience twice as many wildfires and tropical cyclones, three times more river floods, four times more crop failures, and five times more droughts over her lifetime in a 3°C global warming pathway than a 10-year-old in 1970.[49] This has significant implications for school continuity. Over the past 20 years, at least 75 percent of the extreme weather events impacting 5 million people or more led to school closures. Their duration is prolonged when school infrastructure is vulnerable or when schools are used as evacuation centers. In Pakistan, 92 percent of households affected by flooding in 2022 were still uncertain six months later of when local schools would reopen.[50] And there is evidence that a day of school closures is a day of learning lost.[51] Beyond impacts on learning, these closures also cause dropouts as some students do not return to school after schools re-open.

Figure 0.5 Climate change threatens education outcomes



Rising temperatures are causing learning losses even when schools are open. Across countries, additional school days subject to extreme heat are found to negatively impact learning.[52] While the size of the impact remains uncertain and very context specific, surpassing very high temperature thresholds or experiencing temperatures that represent significant deviations from local trends do precipitate learning losses. In Brazil, an average student in the poorest 50 percent of municipalities could lose up to 0.5 years of learning overall due to rising temperatures.[53] In the United States, test scores decreased by 1 percent for every 0.56°C increase in temperature in the school years leading up to the test. These seemingly small impacts build up over time given the cumulative nature of the learning process, especially in the foundational learning years.

Climate change is also eroding education indirectly through increased diseases, stress, and conflict. A one standard deviation change in climate (temperature and rainfall) can increase the risk of intergroup conflict by 14 percent and interpersonal violence. Conflict, violence, and war have severe consequences on children's educational attainment and achievement.

Reduced education attainment will translate into lower earnings and productivity. School attainment is linked with higher earnings, with estimates suggesting a return of 10 percent for each additional year of schooling. As climate shocks reduce education attainment, future earnings will suffer. Individuals with lower education attainment face economic disadvantages and restricted access to stable employment. These inequalities are transmitted from one generation to the next, perpetuating cycles of poverty and limiting social mobility.[54]

Policy efforts on three fronts can help harness education for climate action

Governments can better harness learning to propel climate action by focusing on three areas. First, harness schools to foster pro-climate behavior change at scale. Second, harness tertiary education for powering green transitions and innovation. Third, adapt education systems so they can be resilient in the face of a changing climate.

Figure 0.6: Policy actions to help learning propel climate action

Make schools more effective for climate action	Support tertiary education for green skilling and innovation	Adapt education systems for climate change
1. Improving foundational and STEM skills 2. Mainstream climate education 3. Build teacher capacity	1. Foster adaptable students through strong foundations, flexible pathways and information flows 2. Foster agile systems by strengthening alignment and inclusiveness	1. Education management for resilience 2. School infrastructure for resilience 3. Ensure learning continuity in the face of climate shocks 4. Leverage students and teachers as change agents
Emphasize education in climate policies + ensure adequate financing		

Governments can make schools more effective for climate action through three actions. Several of these are fully aligned with broader education goals.

- First, improve foundational skills and strengthen STEM education. Climate topics should be used to teach literacy, numeracy, and STEM concepts.
- Second, once foundational skills are secured, mainstream practical, actionable, and contextual climate curriculum. In doing so, consult teachers to avoid overloading the curriculum.
- Third, teachers must be supported at every step of the way, by enhancing teacher knowledge and skills on climate-related topics and providing them with high quality educational resources and targeted support.

Governments can help tertiary education spur green skilling and innovation in a way that is very attainable. Green skilling opportunities are so big and so close that accelerating this agenda does not require a big leap. A lot can be achieved in the short run through smart augmentations at the margin. However, to fully exploit these opportunities, system reforms would also be needed in the medium term. Accordingly, governments can act on two fronts:

- **In the short run, facilitate more information and the availability of market-responsive short courses for green-skilling of both students and workers**. Specifically, tertiary education systems should be: (i) disseminating information about the returns to specific green skills across sectors and (ii) facilitating the availability of short stackable courses for green skilling that are easily accessible by both students and workers.
- **In the medium run, foster adaptable students and systems** through strong foundations, flexible pathways, information flows, and intentional inclusion.

It is also important to understand that simply increasing specific narrowly defined courses in tertiary education will not be enough. Instead, the focus needs to be on creating the right enabling conditions, so that the system facilitates the supply of skills and innovation, instead of just trying to directly predict and provide narrowly defined skills.

Governments can better adapt education systems to a changing climate. For the millions of children that will attend school over the next 50 years, the results of mitigation will simply come too late. Governments can enhance the resilience of their education systems now by focusing on (i) education management for resilience; (ii) school infrastructure for resilience; (iii) ensuring learning continuity in the face of climate shocks; and (iv) leveraging students and teachers as change agents.

At the heart of this effort should be a focus to embed education into climate policy and climate into education policy. And this will require both financing and alignment across different ministries and stakeholders.

How should education ministries prioritize for climate?

Prioritization should be guided by where the country is and what it needs the most. However, a key message of this report is that: (i) harnessing schools for climate action is fully aligned with the core education systems goals around quality education for all and (ii) harnessing tertiary education for green skills is very attainable by making key augmentations in the short run.

Three metrics can be particularly helpful to guide policy prioritization.

First, the learning poverty rate (share of students who cannot read for meaning by age 10)**.** No meaningful climate skilling is possible without foundational skills. On the other hand, securing foundational skills for all can massively increase a country's resilience, adaptability, and action for climate. Therefore, if a country has high learning poverty rates (50 percent or more), one of the best climate investments is improving foundational skills. In this effort, climate material should be used to teach literacy and numeracy (more details in Chapter 2).

Table 0.1: In every region, some countries have learning poverty rates above 50 percent

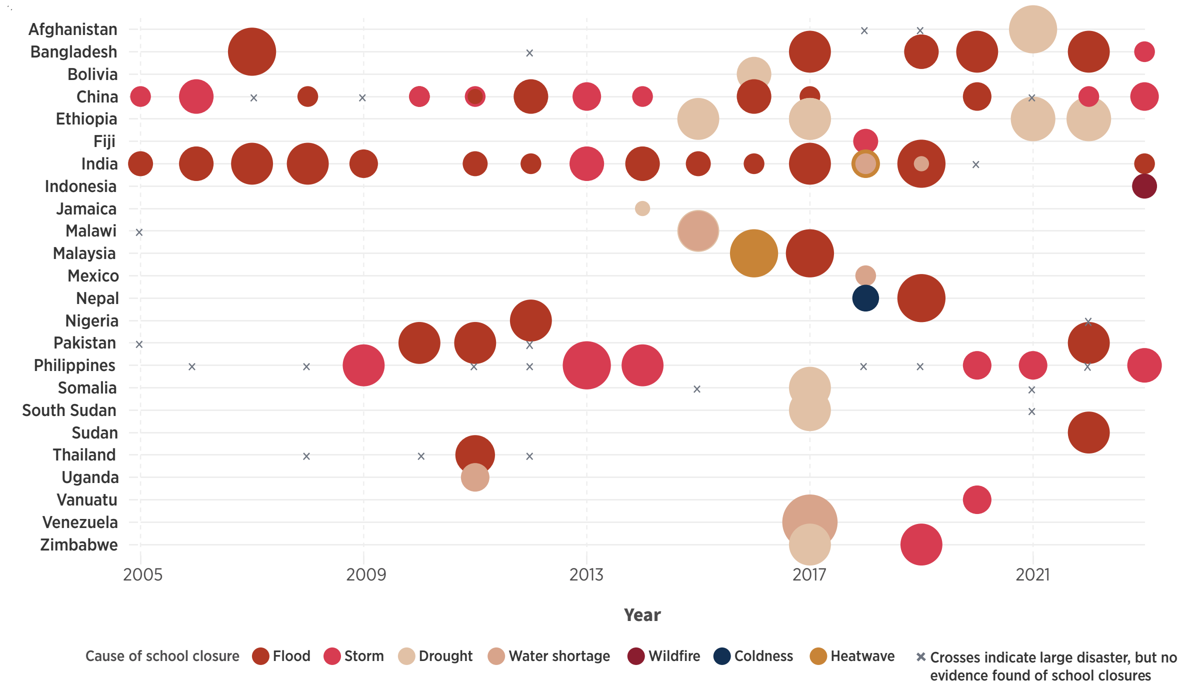
LEARNING POVERTY RATE	LOW (< THAN 25%)	MODERATE (25 -50%)	HIGH (50 - 75%)	VERY HIGH (ABOVE 75%)	TOTAL
REGION	NO. OF COUNTRIES				
East Asia & Pacific	10	2	1	4	17
Europe & Central Asia	36	4	1	0	41
Latin America & Caribbean	1	7	4	7	19
Middle East & North Africa	1	7	6	1	15
Sub-Saharan Africa	0	2	6	16	24
South Asia	1	0	2	2	5

Source: 2019 data using State of the Global Learning Poverty Report, 2022.

Second, number of climate-related school closures per year. This metric is important and relatively straightforward to track (via reports from district education officers, newspaper stories, etc.). Climate-related school closures are increasingly common and generate tremendous learning losses. Countries that experience these school closures frequently should prioritize keeping schools open (to the extent possible) and invest in effective remote learning solutions (more details in Chapter 3).

Third, availability of information to students on returns to education, STEM, and green skilling opportunities. This is a yes/no criteria about whether mechanisms are in place that allow students, especially in upper secondary and tertiary education, to make informed decisions about labor market outcomes**.** Giving students clear information about returns to education in the labor market is one of the most cost-effective strategies for improving learning adjusted years of schooling.[55] These interventions can have positive climate externalities by boosting education attainment, especially after primary. These

Figure 0.7: Most countries experience more climate-related school closures every year



Shown is an index on school closures that combines the duration of school closures and their geographic spread. The larger the bubble the larger either the length of the school closure or the number of people affected, or both. Source: Angrist et. at (2023). Building resilient education systems: Evidence from large-scale randomized trials in five countries. No. w31208. National Bureau of Economic Research. Compiled school closure information based on a several sources.

externalities will be multiplied if information on returns to STEM education and green skills is provided. For green skilling it is critical to address common misconceptions (e.g., green skills are only technical skills and only applicable in green sectors) and give students access to clear labor market signals.

Once these metrics are assessed, countries should prioritize making practical and actionable climate curriculum and green skilling opportunities available in schools and tertiary education. For tertiary education, flexible pathways including for those already in the labor market are incredibly important.

Governments can harness learning to propel climate action and meet development, education, and climate goals together. Tackling climate change requires changes to individual beliefs, behaviors, and skills. Education can be a powerful force to achieve these changes. At the same time, quality schooling enables people to act on the biggest threat to their future – climate change. Children and youth, globally, care deeply about climate. It's time to help them help the planet.

EDUCATION *FOR* PRO-CLIMATE BEHAVIOR CHANGE

Surayya Masood and Shwetlena Sabarwal

SUMMARY

Large-scale behavior change is the key to meaningful and sustained climate action. Yet, progress has been slow, in part, due to lack of information. Although information is not a silver bullet, information gaps could be impeding climate action in three ways – (i) many do not have enough information on climate change; (ii) many are falling prey to climate misinformation, especially online; and (iii) many young people know how dire climate change is, but don't have information on what they can do about it, especially in terms of adaptation. Low- and middle-income countries are in urgent need of large-scale behavior change interventions geared towards adaptation to climate change.

Worldwide, education is the single strongest predictor of climate change awareness. Across several countries, more education is linked to a higher willingness to adopt pro-climate lifestyles. It is also linked to improved capacity for both climate mitigation and adaptation. In Ethiopia, completing six or more years of education increases the likelihood of a farmer adapting to climate change by 20 percent. An additional year of education is linked to a 28 percent increase in the likelihood of voting for green parties in Europe. Education helps youth act today and also improves climate behaviors among their parents and communities.

Schools can do much more to promote climate action. Globally, 70 percent of students lack basic literacy and numeracy, which are crucial to build-blocks for climate skills. Across six low-and middle-income countries, nearly 87 percent of teachers are using climate topics in their teaching but almost 71 percent got basic climate questions wrong.

To **make school education work for climate**, one reminder and three conditions are important.

One Reminder: While climate-specific curriculum is very helpful, many climate benefits also accrue from the expansion of quality general education, especially foundational skills. Therefore, climate goals dovetail with overall education goals to improve quality education for all.

Three Conditions: (i) Climate curriculum must not crowd out the focus on foundational skills like literacy and numeracy. Instead, for early grades, climate topics should be mainstreamed into literacy and numeracy instruction. (ii) Climate curriculum should be practical, actionable, and contextual. It needs to be mainstreamed carefully and with teacher-consultation to avoid overloading existing curricula. (iii) Teacher capacity needs to be strengthened.

This chapter presents data, evidence, operational examples, and a policy agenda to make this happen.

Has climate change prompted behavior change? Not really.

> "I have heard news that the planet will collapse … and that it can be resolved just by having people change their behavior … but we are not wanting to change … The solution is here, and everyone is seeing it; we just have to change."
>
> *Environmental engineering student, Mozambique. Focus group discussions 2024.*[56]

Large-scale behavior change is the key to a low-carbon future. Household behaviors are responsible for 72 percent of global greenhouse gas emissions.[57] Globally, the residential sector represents around 25 percent of energy consumption.[58] This means that individual behavior change can make a big difference. In fact, estimates suggest that behavioral solutions in different areas including food, transport, energy and materials, and agriculture could help reduce emissions by up to 37 percent by 2050.[59]

Behavior change is needed not just for climate change mitigation, but also for climate change adaptation especially in low- and middle-income countries (LMICs). Poorer countries contribute the least to carbon emissions but face greater risks from climate change and are less able to adapt to them. Around 74 of the world's poorest countries account for less than one tenth of global greenhouse gas emissions. However, compared to the 1980s, these countries experienced approximately eight times more natural disasters in the last decade.[60] Also, poorer countries, that are often in climates that are already hot, are likely to be exposed to more hot days as the planet gets warmer. Climate projections show that a country like Gambia may face up to 280 hot days (above 35°C) annually as compared to around 2 hot days a year for the Netherlands even under the most pessimistic climate scenario.[61] Thus, LMICs are in urgent need of large-scale behavior change interventions geared towards adaptation to climate change.

Individual behavior change, for both mitigation and adaptation, can trigger big systemic changes. This can happen through voting or grassroot activism linked or just incremental changes in social and cultural norms. Changes in individual beliefs and behaviors can trigger a scaling-back of energy subsidies, promoting low-carbon infrastructure, pressure corporations into adopting pro-climate policies etc. Individual behavior change can also do much to normalize, or even popularize, low carbon lifestyles[62] and simple lifestyle adaptations for a changing climate. In fact, some have argued that most of the efforts required for climate change mitigation and adaptation, need at least some element of individual behavioral change.[63] Ultimately, solutions to the climate crisis will need, in one way or another, individual behavior change, at scale.

Yet, despite years of climate warnings, pro-climate behavior change has been slow. This is clear in the poor track record for meeting global and national climate targets. In 2015, 195 countries adopted a legally binding treaty to limit global warming to between 1.5-2°C, compared to pre-industrial levels.[64] A stocktaking in 2023 reveals that global efforts to meet these targets are failing. Across the 42 indicators only one is on track to reach its 2030 target. Of the other 41 indicators, six are "off track"; 24 are "well off track"; six are headed in the wrong direction entirely; and five have insufficient data to track progress.[65] Across the board, there is only marginal 'greening' of how economies function, how firms operate, and how individuals live and work.

Climate action is being impeded, in part, by missing and misleading information

Pro-climate behavior change has been hard partly due to the lack of actionable information and/or active misinformation. Actionable information is a necessary (but not sufficient) condition for behavior change to happen. For pro-climate behavior change, there are three key information gaps – gaps in climate change awareness, misinformation, and information gaps on what to do to mitigate and adapt.

First, there are still significant gaps in climate change awareness, especially in low- and middle-income countries and among the older generation. Climate change awareness is still at only about 65 percent in low- and middle-income countries.[66] Around 40-50 percent of survey respondents in Honduras, Dominican Republic, and Ecuador agreed with the statement, "*climate change is not a problem*".[67] Nearly 58 percent of youth across eight low- and middle-income countries believe that their parents do not understand climate change (novel data for this report).[68]

Second, there is active misinformation.[69] **In Indonesia, more than 25 percent of respondents agree that climate crisis research is controlled by elites. In the same survey, nearly 64 percent use social media as their main source of information on the climate crisis.**[70] **Nearly 47 percent of secondary teachers in Bangladesh and 41 percent in Uganda believe that climate change coverage in media is exaggerated.**[71] These problems also appear in high-income contexts. In the US, only 46 percent of Americans believe that global warming is occurring due to human activity and another 14 percent do not believe there's evidence the Earth is warming at all.[72] In Australia (a world-leading exporter of coal) roughly a third of the population maintains that climate change is not predominantly caused by humans.[73] That people are so vulnerable to climate misinformation signals gaps not only in climate knowledge but also in critical thinking and media literacy. Across sixty-six countries, only one out of ten students could distinguish between fact and opinion[74].

Third, for young people, there is missing guidance on what to do about climate change. Those who know that climate change is dire still don't have enough information on how to help address it both in terms of mitigation and adaptation. In Senegal, 79 percent of young people interviewed are terrified of their future because of climate change, and yet more than half did not know that their country has made a commitment to reduce emissions.[75]

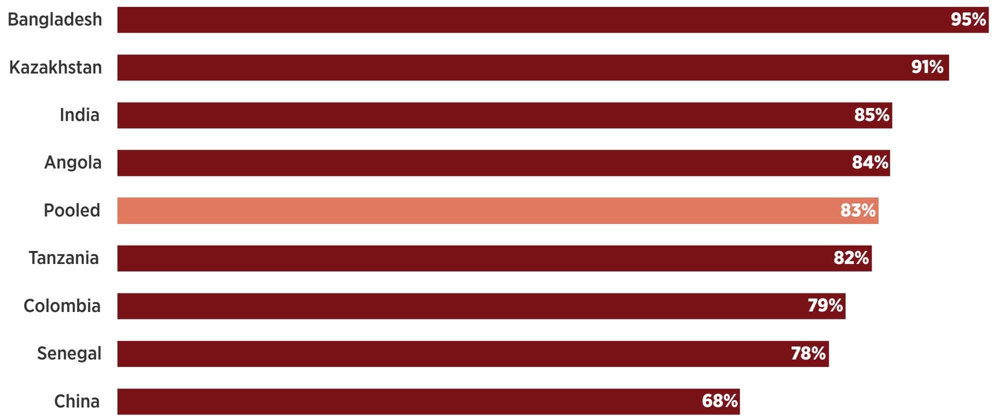
Young people feel anxious and helpless in the face of climate change

> "I'm a bit nervous that the world is getting destroyed."
>
> *Solan, age 9, Johannesburg, South Africa, UNICEF 2014*[76]

Nearly 79 percent of youth across eight low- and middle-income countries believe their country is in a climate emergency. This share was over 90 percent in Bangladesh, India, and Kazakhstan.[77] As climate change worsens, this climate anxiety is likely to also worsen, increasingly taking the form of an "inescapable stressor".[78] So much so that a new term has been coined – *Solastalgia*. This refers to the distress that is produced by environmental change. As opposed to nostalgia, *solastalgia* is a feeling of homesickness when you are still at home and your home environment is changing in ways you find distressing.[79]

Figure 1.1: Global youth are terrified of the future when it comes to climate change

SHARE OF 17-35 YEAR OLD WHO AGREE THAT CLIMATE CHANGE HAS MADE THEM TERRIFIED OF THE FUTURE

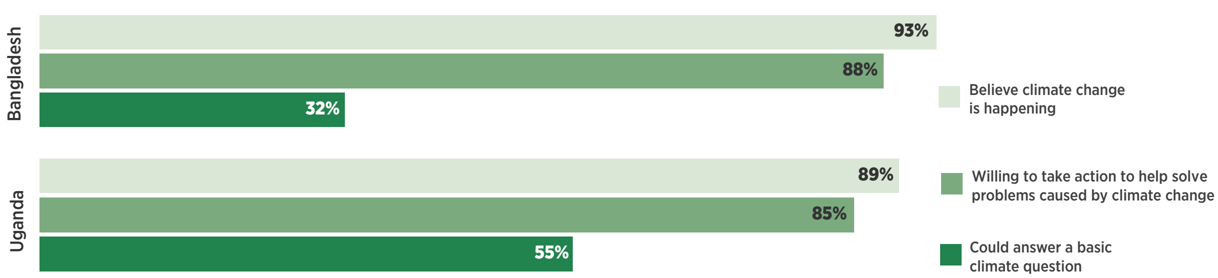


Source: Novel data for this report

Climate anxiety is increasingly morphing into frustration and anger. Almost 60 percent of young people across ten countries claim that their national governments were "betraying" them and future generations through their inaction.[80] Frustration with the perceived slow action of political leaders is leading to a spike in youth-led demonstrations, court cases, and even school strikes.[81] Young climate leaders, such as Greta Thunberg, Isra Hirsi, Xiuhtezctal Martinez and Luisa Neubauer, are gaining prominence and influence. Ultimately, young people see climate as a social justice issue, not just across different countries and groups, but also across different generations.

Young people want to act on climate but feel under-equipped. While 15-year-old students are passionate about climate action, many feel helpless when it comes to taking action. For example, in the case of Hungary, while 84 percent of 15-year-olds state that looking after the global environment is important to them, only 44 percent felt that they could do something to address such problems. This makes sense because there is tremendous scope to improve the climate knowledge and skills of young people. While approximately 93 percent of Bangladeshi secondary students believe climate change is happening, and 88 percent are willing to do something about it, only 32 percent could correctly answer a basic question about greenhouse gases.[82]

Figure 1.2: Young people feel strongly about the climate but feel less able to make a difference



Source: Novel data for this report

Learning and skilling can help people drive climate action – for mitigation and adaptation

> "The change starts with you and me. Each of us … can be a part of the response to climate change. We can educate everyone … and transfer knowledge into action to combat climate change."
>
> *Anonymous youth respondent in an online survey for this report, 2024*

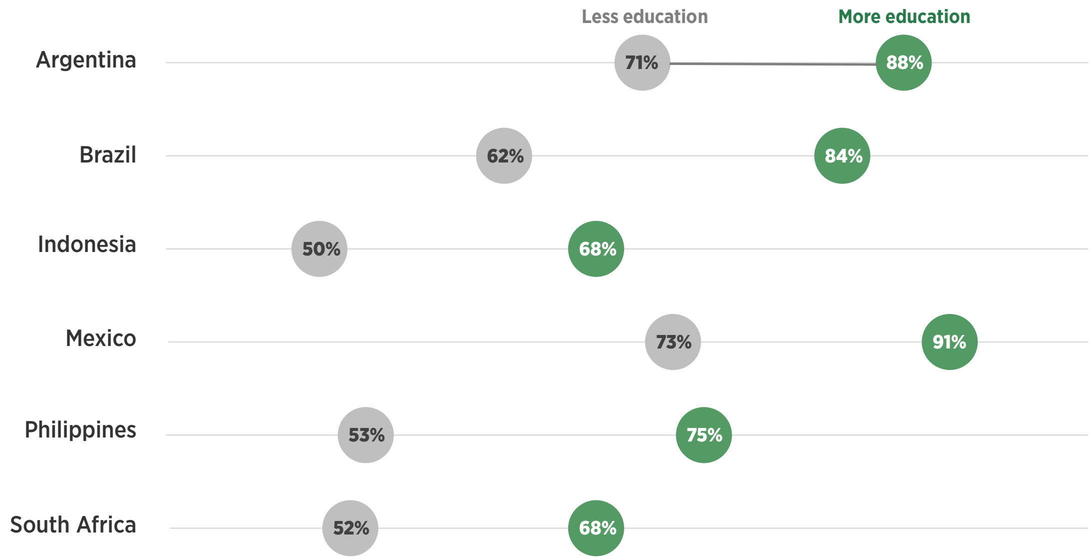
Education is the single strongest predictor of climate change awareness. Across 119 countries, education emerges as the strongest predictor of climate change risk perceptions. This is important because climate change awareness is still at only about 65 percent in low- and middle-income countries.[83] An additional year of education increases climate awareness by 8.6 percent (measured by knowledge and skills on environmental issues) based on analysis across 96 countries with nearly a million students over four years. And this relationship is mediated by the quality of education. Countries with above-median learning improvements see larger impacts on climate awareness compared to those with below-median learning improvements.[84]

People with higher educational attainment were more likely to see climate change as a major threat. In Brazil, 84 percent of those with a secondary education or higher say climate change is a major threat, compared with 62 percent of those with less education – a 22-point difference. The same patterns hold for Kenya and South Africa.[85] But education quality matters. Among Bangladesh secondary students, the likelihood of answering basic questions about climate change correctly was significantly higher among students with higher math proficiency.

Across 119 countries, **education emerges are the strongest predictor of climate change risk perceptions.**

Financing quality education in low- and lower-middle-income countries could lead to significant progress in climate change mitigation and adaptation. It is estimated that financing education in low- and lower-middle-income countries could reduce global emissions by 51.48 gigatons (a gigaton is one billion tons) by 2050.[86] There is tremendous scope to do this. Around 90 percent of the total US$ 463 billion allocated for mitigation and adaptation in 2015-2016 went towards sustainable transport, renewable energy generation, and energy efficiency, while only 2 percent was allotted to cross-sector programming.[87] This need is compounded by the reality that education will continue to be undermined by climate shocks, with resources diverted to respond to crises instead of being focused on quality. By enhancing education financing, we empower individuals with the knowledge and skills necessary to address environmental challenges.

Figure 1.3: Those with more education show greater concern about climate change



Statistically significant differences shown. Source: Pew Research Center (2021)

Education promotes mitigation behaviors

Education doesn't just improve awareness; it directly promotes climate action. In Europe, an additional year of education is associated with a significant increase in both pro-climate beliefs (by 4.0 percentage points) and pro-climate behaviors (by 5.8 percentage points).[88] Each additional year of education can lead to a 7.2 – 8.3 percent increase in the number of pro-environmental behaviors adopted by individuals.[89] Across 16 advanced economies, those with more education are more likely to say they are willing to adjust their lifestyles in response to the impact of climate change. In Belgium, for example, those with a postsecondary degree or higher are 14 percentage points more likely than those with a secondary education or below to say they are willing to make changes to the way they live. Double-digit differences between those with more and less education was also found in France, Germany, New Zealand, the Netherlands, and Australia.[90] The strong relationship between education and pro-environmental behaviors has been shown in studies from China, Thailand, U.S., and U.K.[91]

Education can also galvanize large-scale political change. Education helps promote democracy, generates trust, boosts social capital, and helps create inclusive institutions.[92] In the United States getting more education—either through preschool, high school scholarships, or smaller class sizes—leads to increased voting.[93] In Benin, receiving more education made people more politically active over their lifetimes; in Nigeria too, educational expansion substantially increased civic and political engagement of beneficiaries decades later.[94] Education could therefore enhance the capacity of the current and future generations to participate in shared political decisions around climate. It can also directly encourage voting for policies which promote less-polluting industries, such as renewable energy subsidies. In Europe, an additional year of education leads to an increase of 3.6 percentage points in green voting. Such voting gains, equivalent to a 35 percent increase, can be particularly consequential in promoting pro-climate policies at the national level.[95]

Education promotes adaptation behaviors, these are especially critical for low- and middle-income countries

Education promotes innovation and the adoption of new technologies, factors that are crucial for climate change adaptation. In Ethiopia, completing six years of education increases the likelihood of farmer to adapt to climate change by 20 percent.[96] For farmers cross ten African countries, one year of education led to a 1.6 percent reduction in the probability of no climate change adaptability measures being taken. Similarly, the likelihood that a family in Uganda will adopt drought-resistant crop varieties increases significantly when the father has basic education.[97] In Pakistan, farmers with at least a lower secondary education were more inclined to diversify their crops, adjust their planting schedules, and utilize farm insurance to manage the adverse impacts of climate change.[98] Inventors are more likely to come from highly educated backgrounds and countries with higher quality schooling produce more innovators.[99] Countries with good education systems that promote equity and quality are best prepared for any innovation challenge.[100]

Globally, **every year of learning generates about a 10 percent increase in earnings annually.**

Financing education in low- and lower-middle-income countries could **reduce global emissions by 51.48 gigatons** by 2050.

Education directly enhances resilience to climate risks. Studies from Senegal, Mali, Thailand, Cuba, Haiti, Dominican Republic, El Salvador, and Brazil show that people with higher levels of education exhibit greater disaster preparedness and response, experience reduced adverse effects and recover more quickly from disasters.[101] This is because education enhances the capacity to plan for the future and improves allocation of resources.[102] It also helps individuals be more responsive to disaster-related training.[103] In tsunami-risk areas in southern Thailand, households with higher education had greater disaster preparedness e.g., stockpiling emergency supplies and having a family evacuation plan.[104] During the Japan earthquake and tsunami of 2011, children were affected proportionally less due to school drills and preparedness trainings of what to do in emergencies.[105] Educated individuals also have diversified communication linkages and have better access to useful information.[106] In Mali and Senegal, those with a higher level of education are less vulnerable to natural hazards because they have more diversified economic activities beyond agriculture and hence are less dependent on climatic or environmental factors.[107]

Education also enhances adaptability via access to higher employability and incomes. Globally, every year of learning generates about a 10 percent increase in earnings annually.[108] It can be a powerful lever, and for many the only lever, to break the cycle of poverty. In the United States the children of households that moved to a (one standard deviation) better neighborhood had 10 percent higher incomes as adults, partly because the move improved learning.[109] High school graduates are less likely to lose their jobs than less educated workers, and they are more likely to find another job.[110]

Women's education is particularly instrumental in improving the adaptive capacity of their families and communities. Improvements in women's education have been linked to better health outcomes for their children in many countries, including Brazil, Nepal, Pakistan, and Senegal.[111] Mothers with higher education levels are more effective in reducing the risks of low birth weight and preterm birth associated with air pollution and extreme temperatures.[112] These better health outcomes, in turn, make children more resilient and adaptive to climate change, especially among the poor and vulnerable. One study goes as far as to claim that girls' secondary education is the most important socioeconomic determinant in reducing vulnerability to climate change.[113] When girls receive 12 years of quality education, they are more likely to possess the skills needed to withstand and overcome shocks stemming from extreme weather events.[114] A study of extreme weather events from 1960 to 2003 shows that countries that focused on female education could suffer far fewer losses – if countries had invested in female education during this time, the number of individuals affected by floods and droughts would go down by 465 million and 667 million, respectively.[115]

Education can galvanize action today, not just tomorrow

> "I've seen my dad throwing trash out the window of his car, and I kept getting mad at him until he realized he couldn't do it anymore. He didn't know what to do at first, and now whenever he has trash in his car he leaves in his car and later puts it in a garbage. So (my frustration) was a shock for him, but I think it was a needed shock. I think this kind of shock causes people to wake up."
>
> *—3rd year environmental engineering student Mozambique, Focus group discussions for this report, 2024*[116]

Children teach parents. There is compelling research about how values and attitudes are transmitted from parents to children.[117] But there is emerging evidence that this relationship can work just as well in reverse. And this is critical for climate change awareness, where, as discussed above, youth may have stronger concerns than their parents. For instance, in the U.S., 71 percent of those aged 18 to 29 say climate change is a threat, compared with only half of those who are 50 and older.[118] Novel data for this report shows that 58 percent of youth across eight low and middle-income countries believe that their parents do not understand climate change and its effects on the environment.[119]

Educating children can impact parental climate attitudes. A randomized control trial in India shows that climate-related outreach to children not only improved their climate awareness and pro-climate behavior, but also improved the pro-climate behavior of parents by nearly 13 percent. Parents were much more receptive to climate-related outreach when it's done with their children or through their children.[120] In Indonesia, an increase in disaster risk knowledge among students led to a significant increase in parents' attitude and knowledge sharing.[121] In U.S., providing middle-school children with climate education led to higher levels of climate change concern among parents. Politically conservative parents showed the largest gains in climate change concern and daughters were the most effective in building this concern among parents.[122] In the UK, recycling rates increased by 8.6 percent when students shared lessons in waste education with their parents.[123]

Around 67 percent of youth across eight low- and middle-income countries believe they have influenced their parents to make environmentally friendly choices.[124] Educating children, therefore, has the dual effect of creating a climate-conscious future generation and creating motivation for parents to effect change immediately.

Climate-related knowledge and skills can also help youth act today. It can help them overcome a sense of paralysis, channeling their climate anxiety in a positive and productive way. Education empowers young people to act, and action is the best antidote to anxiety. Multidisciplinary research reveals that uplifting examples of tangible climate progress can help channel students' climate emotions positively. Students reported that exposure to academic publications reduced feelings of alienation and self-consciousness.[125] At the same time, since learning is strongest when driven by interest[126], climate education can offer a sense of purpose, increasing student curiosity and activation across school subjects – which in turn, boosts overall motivation and school performance.

67 percent of youth across eight countries believe they have **influenced their parents** to make environmentally friendly choices.

BOX 1.1: TWO CAVEATS TO HARNESSING EDUCATION FOR CLIMATE

Education is necessary – but not sufficient

Human behavior is complex. Inducing behavior change is also complex. Education builds knowledge, awareness, and information which are necessary ingredients for behavior change, but they may not be sufficient to disrupt longstanding habits and behavior.[127] For information to spur action, those who receive the information must understand it, see it as actionable, care about the topic, and believe that their actions will improve outcomes. All these conditions can be hard to meet. Because of limited attention, information is often ignored, especially if it is complex or provides unwelcome news. Collective action problems may also get in the way. Information provision may raise awareness and concern, but do not always produce behavior change.[128] Similar examples can be found in other areas of social policy. Providing U.S. students with information about the tax credits for college had no impact on college enrollment.[129] A program that gave HIV risk information to teens in Botswana had no clear impacts.[130]

More educated individuals often have larger carbon footprints

Higher levels of education are typically accompanied by higher incomes and consequently higher levels of consumption and emissions.[131] People in the global top 1 percent of income cause twice as much consumption-based CO_2 emissions as those in the bottom 50 percent (15 percent versus 7 percent, respectively)[132] Higher educational attainment is associated with higher labor productivity, which increases economic growth and, all else being equal, leads to a larger scale of the economy and higher emissions.[133] However, the net relationship between education and emissions is ambiguous because improved educational attainment is also associated with lower fertility and slower population growth which reduces emissions. Education also improves adaptive capacity to climate change.[134]

Yet school education remains massively under-utilized for climate action

> "Teachers are not prepared to teach this correctly. It is often assumed that science teachers are capable of teaching climate change issues, but they do not receive updated training on this."
>
> — *Professor of mechanical engineering, Colombia. Focus group discussions for this report, 2024*[135]

Many students still lack foundational skills, the building blocks of all climate skills

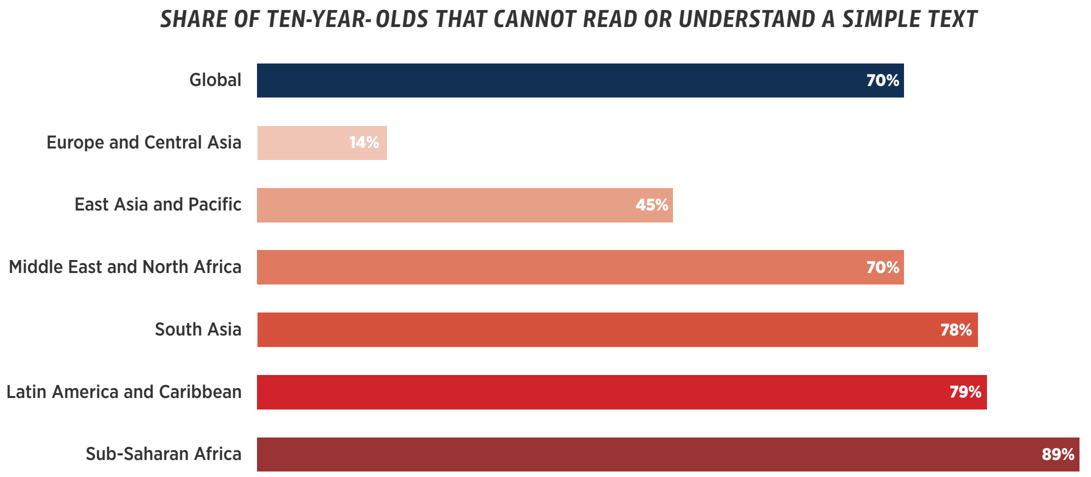
Foundational skills are vital to cope with a changing climate. For protection from extreme weather events, individuals need to be able to understand and act on risk information. Foundational skills will ensure that children can do this[136], and help their families as well. For instance, those with foundational skills will have a better ability to process weather forecast or warning messages.[137] An additional year of education can equip individuals with the critical thinking, communication, collaboration, and civic engagement skills necessary to become informed, responsible, and active participants in building a sustainable future. But are education systems really equipping students with these necessary survival skills? The answer is not really.

Between 2019 and 2022, the share of **students who couldn't read for meaning by age 10** in low- and middle-income countries **rose from 57 percent to 70 percent.**

Millions of children lack basic literacy and numeracy skills, making any climate-skilling impossible. The share of students who couldn't read for meaning by age 10 in low- and middle-income countries was 57 percent in 2019. In Sub-Saharan Africa, it was 86 percent.[138] A student born in 2019 in Sub-Saharan Africa could expect to receive about 8 years of schooling. However, after adjusting for the quality of learning[139], these students would effectively have only 5 years of schooling. Similar deficits in quality of education are visible in other parts of the world, including some high-income countries. In North America, expected years of schooling were 13, but learning adjusted years of schooling were 11.[140]

COVID induced school closures exacerbated this learning crisis. Between 2019 and 2022, largely because of long COVID-related school closures, the share of students who couldn't read for meaning by age 10 in low- and middle-income countries rose from 57 percent to 70 percent. Figure 1.4 shows that globally 70 percent of ten-year-olds are estimated to not meet minimum proficiency in literacy.[141] This means that all the gains in learning poverty that low- and middle-income countries recorded since 2000 have been lost. Only about two-fifths of youth are on track to attain secondary-level reading and math skills, transferable skills concerning global citizenship and competence (based on 38 countries with data), and digital skills to perform simple computer-based activities.[142] In addition to this, in 2021, 260 million children and youth are still out of school.[143]

Figure 1.4: 70% of ten-year-olds cannot read and understand a simple text



Source: World Bank, 2022

Changing climate is also jeopardizing foundational skills. This gives rise to a vicious cycle wherein worsening foundational skills in turn compromise the next generation's adaptability climate change. As climate change induced disasters become more common, so do school closures.[144] Monsoon rains and flooding in Bangladesh, India, and Nepal from 2017 to 2019 closed 15,000 schools. Prolonged droughts in Kenya led to significant school closures in 2017.[145] Children experiencing frequent school closures fall behind and many drop out of school to enter the job market early.[146] Climate change is also directly causing learning losses, especially among poor students. Extreme heat can reduce learning by up to 15 percent.[147] Hot school days disproportionately impact minority students. In the U.S., increased hot days could account for roughly five percent of the racial achievement gap. The relationship between climate change and education outcomes is discussed in detail in Chapter 3. But overall, there is strong evidence that student learning, including foundational skills, are vulnerable to the compounding climate stress. The changing climate may already be eroding hard-won gains on ensuring foundational skills for all.

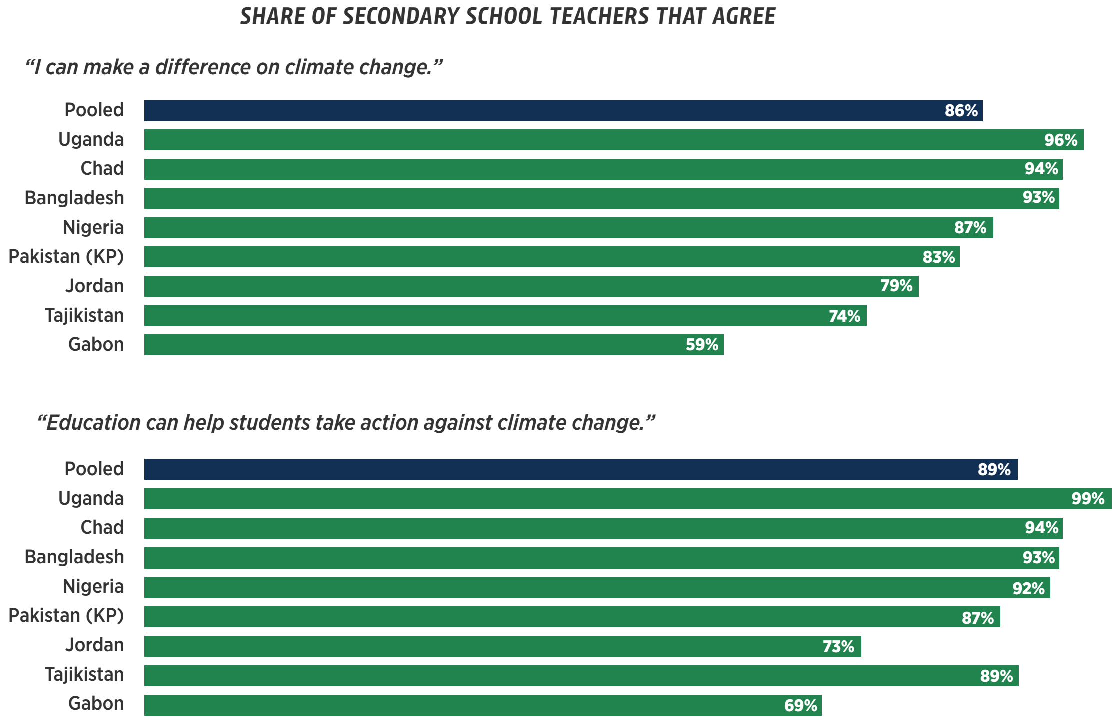
Education systems can do more to catalyze climate action

There is high demand for climate skills among students and teachers. Around 68 percent of youth across eight low- and middle-income countries believe students should start learning about climate change before secondary school. If given the opportunity to take additional classes in secondary school, 33 percent stated that they would want to learn about climate solutions and green skills, a higher share than those interested in learning about AI. [148] Teachers are also demanding the inclusion of climate education in the curriculum. Our data, noted in Figure 1.5, shows that 89 percent of teachers across six low-and middle-income countries believe that education can help students take action against climate change and 86 percent believe they can make a difference themselves.[149]

Around 68 percent of youth across eight countries **believe students should start learning about climate change before secondary school.**

Parents and policymakers also express strong demand for climate change education. Evidence from the aftermath of the 2022 floods in Pakistan show that approximately 97 percent of parents support climate change education in schools.[150] Among education policymakers across 33 low-and middle-income countries, 98 percent support the inclusion of climate education in schools.[151]

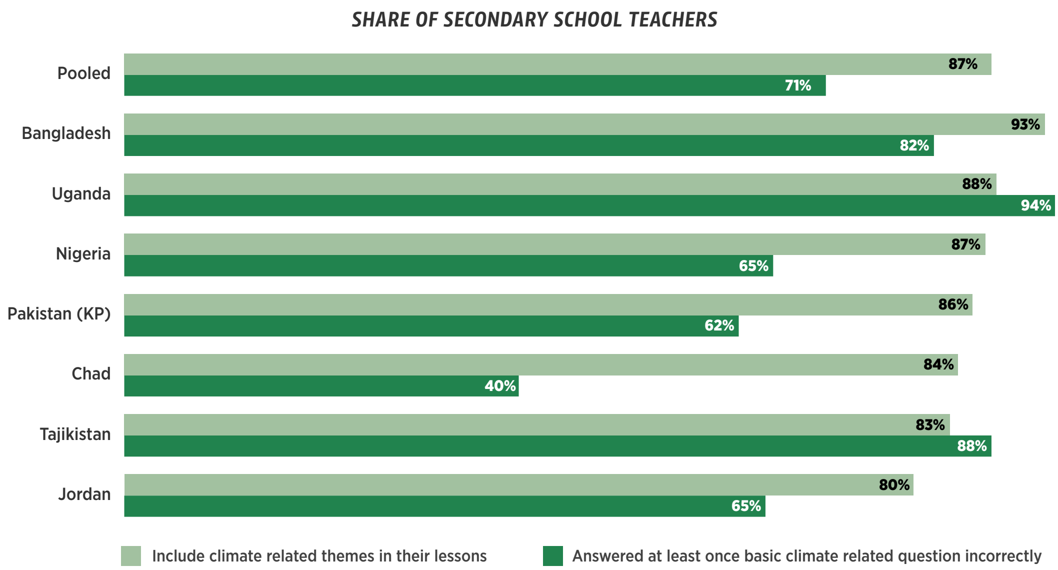
Figure 1.5: Teachers believe education can and must make a difference in climate action



Source: Novel data for this report

And yet, while educators are invested in this issue, most are ill-equipped to support climate education. As discussed above, around 86 percent of US teachers believed climate change should be taught in classrooms, however more than half do not cover it in their classrooms and further, 65 percent believe it to be outside their subject area.[152] Similarly, although over 58,000 teachers from 144 countries and territories agreed that teaching about climate change is important, less than 40 percent felt confident doing so, and only about a third believed they could effectively explain its local effects.[153] Figure 1.6 presents data from our multi-country panel showing that while many teachers are including climate related themes in their lessons, very few actually possess the necessary knowledge and skills needed to teach this topic. Across seven low-and middle-income countries, nearly 87 percent of teachers are including climate topics in their lessons, and yet, nearly 71 percent answered at least one basic climate related question incorrectly.[154]

Figure 1.6: Most teachers are including climate topics in their lessons, but also get basic climate questions wrong



Source: Novel data for this report

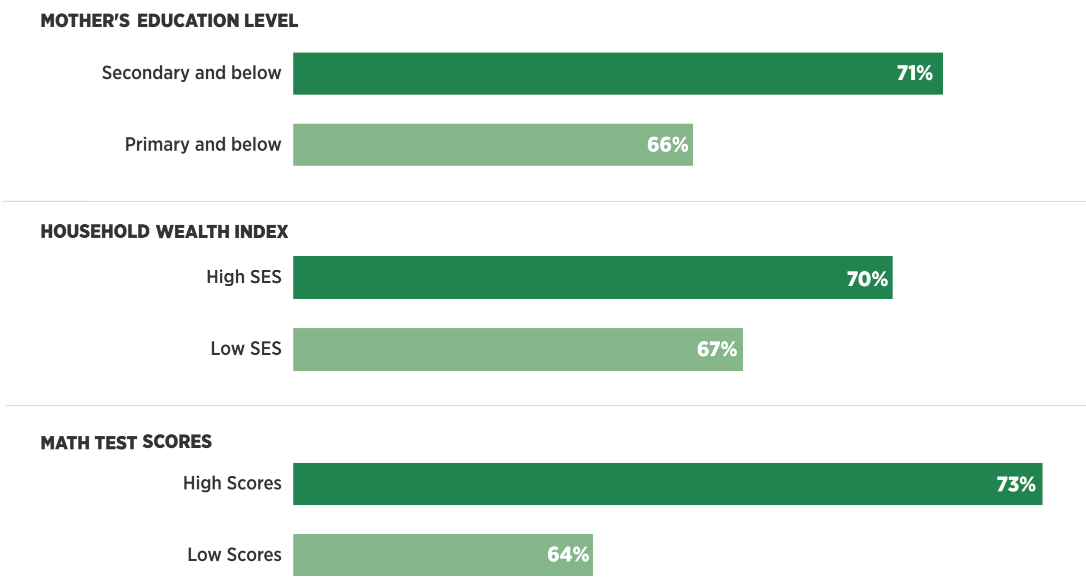
This means that students are under-prepared to work on climate issues. In fact, the gap between student eagerness to work on climate and their knowledge on climate is stark. Only 3 percent of Bangladeshi and 7 percent of Ugandan Grade 8 students could answer a set of six basic climate change questions correctly. Overall, 32 percent of Bangladeshi and 55 percent of Ugandan secondary school students could answer at least one out of six basic questions correctly.[155] In Bangladesh the most vulnerable students, who are more likely to be impacted negatively by climate change, seem to be the least equipped with climate knowledge. Figure 1.7 shows that students who perform worse in math tests, belong to less wealthy households or whose mothers have low education levels, have a lower climate knowledge that is statistically significant compared to their peers.

Only 3 percent of Bangladeshi and 7 percent of Ugandan Grade 8 students could answer a set of six basic climate change questions correctly.

Globally, many students feel that their climate change related knowledge is insufficient and that their education did not prepare them to address the impacts of climate change. Across 53 countries, only 29 percent of respondents felt competent in skills that they identified as priorities for addressing the climate crisis[156]. Further, student performance on climate knowledge tests also falls short of expectations. A global poll found that on average, 85 percent of young people aged 15-24 surveyed in 55 countries said they have heard of climate change, yet just 50 percent of those chose the correct definition of the concept.[157] Climate change knowledge among young people was found to be lowest in lower-middle- and low-income countries – those most vulnerable to the impacts of climate change - such as Pakistan (19 percent), Sierra Leone (26 percent) and Bangladesh (37 percent).

Figure 1.7: In Bangladesh, more vulnerable students had less climate knowledge

PERCENTAGE CORRECT RESPONSES FOR BASIC CLIMATE QUIZ (10 QUESTIONS)



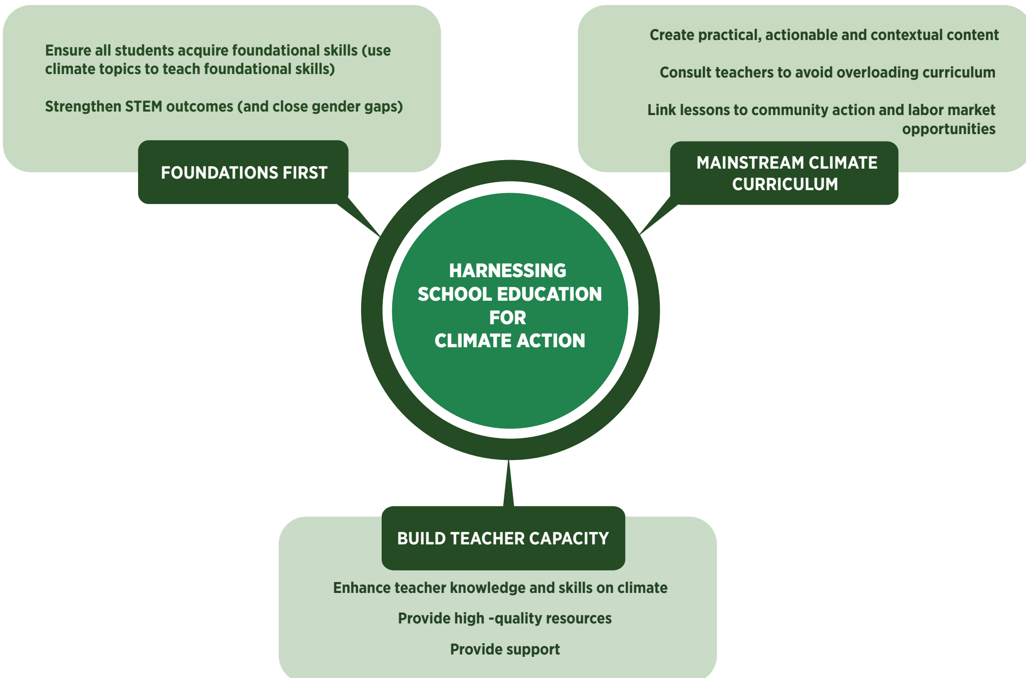
Source: Novel data for this report

And education policymakers are aware of this gap between what education systems can do and what they are currently doing. Among 103 education policymakers across 33 low- and middle-income countries, 87 percent agree that education can help students take action against climate change, yet only 34 percent think their current education system is doing a good job teaching students the science of climate change. And they want to take action. Around 44 percent of policymakers interviewed agree that climate change is a priority for the education sector and 81 percent believe education systems and processes need to be revised to address climate change and to prepare for the green transition.

What should policymakers do? Three priorities to make schools work for climate action

How can climate education be operationalized for behavior change at scale? Below we lay out a framework to help policymakers prioritize the most effective actions.

Figure 1.8: Framework to make schools work for climate action



Foundations first. Mainstream climate within foundational learning without crowding it out

For climate action, overall education attainment and quality, matters most. In the discussion on education and climate, there is often a confusion between (and conflation of) climate education and general education. It is critical to emphasize that it is the attainment of quality education overall that provides the benefits mentioned in the previous sections. As shown earlier, an additional year of education makes a difference for climate awareness and action through multiple channels. And quality is important. Pro-environmental attitudes and science proficiency tend to reinforce each other: students' environmental science knowledge and skills, as measured by their performance in the PISA science test, are positively related to pro-environmental attitudes[158].

Climate curriculum must not crowd out foundational skills. Instead, foundational skills can be taught using climate material. As the urgency around the climate crisis increases, it may be tempting to divert resources from the development of foundational skills into these other skills which seem more novel and exciting. But climate-specific knowledge and skills can only be built on a solid foundation of basic skills like literacy and numeracy. Because learning is cumulative, without foundational skills, benefits of climate-specific education are severely undermined. For instance, without focused remediation, the 70 percent of ten-year-olds today who are unable to read and understand a simple text[159], will likely struggle to understand and synthesize complex scientific ideas and develop innovation and adaptation skills as adults. Foundational skills can foster critical thinking skills that are crucial for identifying climate risks and tailored adaptive solutions.[160] In an ideal world, education systems would be able to equip students with both foundational skills and climate-specific competencies. However, for many systems this is an unrealistic target. In early grades, investing in strong foundational skills for all is likely to be a higher-impact investment compared to specialized climate curriculum that only a few can understand.

Ensuring that all students have acquired basic reading and math competencies by end of primary is essential. Foundational learning is critical to ensuring students have the right base for acquiring other skills, including those related to climate. For those countries that are lagging on foundational skills, applying the RAPID approach[161] should be the first order of business. The R.A.P.I.D. framework is a guide to tackle learning losses caused by the pandemic and build forward better that is based on five evidence-based policy actions: **R**each all children; **A**ssess learning; **P**rioritize the fundamentals; **I**ncrease the efficiency of instruction; and **D**evelop psychosocial health and wellbeing. A solid evidence-base of approaches that work and operational examples from diverse country contexts exists and can be adapted, implemented, and scaled up to ensure foundational skills for all.[162] Further, foundational literacy campaigns can use reading material that engages students in age-appropriate environmental topics and discussions.

For early grades, climate lessons should be integrated into literacy and numeracy instruction. This can be an excellent way to introduce climate knowledge without crowding out essential learning and over-stretching teachers or students. For instance, a reading lesson could include an article on local building materials that can keep buildings naturally cooler. A math lesson could include an exercise on how much sea levels would rise if Antarctica melted[163]. Teachers can leverage online resource libraries to find resources customized to their grade level and subject area. For instance, in the U.S., SubjectToClimate's database includes over 2,700 free educational resources that integrate climate change into all subjects and grade levels, all of which are vetted by climate scientists[164]. Similar resources are also becoming available or could easily be made available in low- and middle-income countries.

Once foundational skills are ensured, countries should strengthen STEM outcomes. Science, Technology, Engineering, and Mathematics (STEM) education is critical not only for fulfilling the needs of the future workforce in times of climate change, but also for producing researchers and innovators who can help to solve intractable challenges around climate mitigation and adaptation. The goal should be to nurture a cohort of secondary school graduates proficient in scientific literacy. STEM learning can easily include lessons on local and global climate issues. In India, a subject called Earth Science for middle-school students was hugely revamped in recent years, making students look at their surroundings more critically and explore the 'why' and 'how' of things.[165]

Part of this is ensuring that marginalized students, including girls, get access to STEM opportunities. Globally, consistent gender-based gaps in STEM outcomes emerge only at the post-secondary level. Despite higher rates of enrollment and graduation at a global level, women are less likely to major in specific STEM fields. Only 7 percent of women choose to study engineering, manufacturing, and construction, compared to 22 percent of men. Of the students pursuing careers in information, communication, and technology fields, 28 percent are women and 72 percent are men.[166] The reasons for these gaps are multi-faceted and girls' performance in science and math does not explain them fully (or even partially in some contexts). Other factors include individual attitudes to STEM-related subjects, along with self-efficacy, and the presence of social networks and support systems, rules, stereotypes, and norms. Promising approaches to address these gaps include boosting confidence by providing girls and women with real-world experience during their studies as well as relevant role models. For instance, in Kazakhstan, Kyrgyzstan, and Uzbekistan, UNICEF supported the development of a UniSat Nano-satellite learning platform for girls to better understand and effectively interact with satellite technologies for the purpose of gathering data on environmental issues, such as urban air pollution.[167]

Improving general education for better climate outcomes will entail more and better spending in education. To ensure the delivery of high-quality primary and secondary education, particularly to marginalized groups, education funding must be sufficient and reliable. This involves guaranteeing adequate resources and qualified teachers, as well as restructuring school systems to prioritize the integration of values related to social and environmental sustainability alongside core cognitive skills.

Practical, actionable, and contextual climate curriculum

> "Unless you do that (attain foundational skills), there's no hope for you to do the rest or participate in the rest."
>
> *Marvi Soomro, Youth Activist, Pakistan. Interview for this report, 2024*[168]

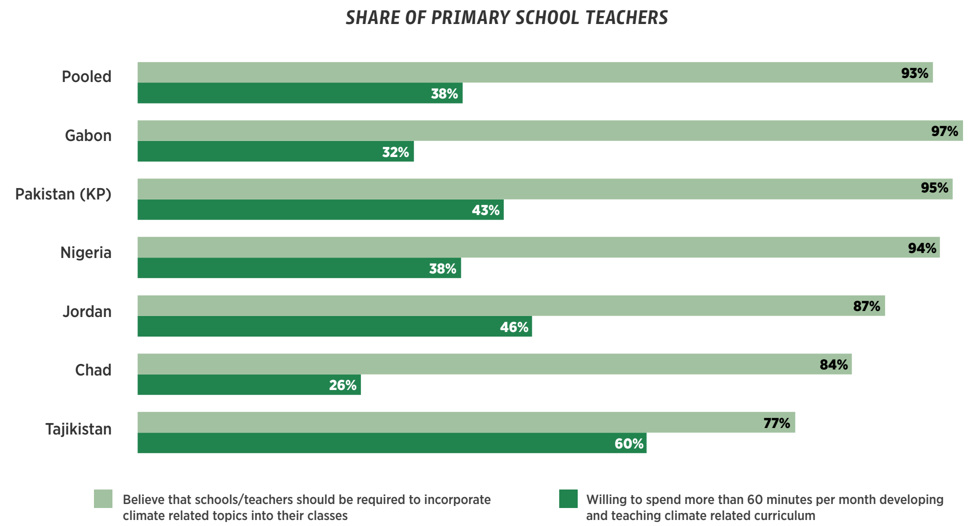
Climate education specifically, if done well, has the potential to work. A meta-analysis of 169 studies across 43 countries found that environmental education significantly improved environmental knowledge, attitudes, intentions, and self-reported behavior.[169] And there is clear evidence of climate-education-prompted behavior change. A one-year university course on global climate change reduced individual carbon emissions by 2.86 tons of CO_2 per year for the average course graduate.[170] Similarly, among secondary school students, curriculum-based learning on environmental literacy has shown to reduce electricity consumption by 15 percent among student homes and more than 30 percent at the school.[171] Climate education, along with general education attainment, can also help combat misinformation. Studies show that people with less education are more likely to believe in and share misinformation.[172]

Climate curriculum should be understandable, actionable, and meaningful to students.[173] It should be introduced at developmentally appropriate stages, allowing learners to engage with the material in a way that aligns with their cognitive abilities and emotional maturity. Moreover, climate education should foster critical thinking and problem-solving skills, empowering students to analyze complex environmental issues and develop innovative solutions. By integrating these principles into curriculum design and instructional practices, educators can effectively equip students with the knowledge, skills, and mindset needed to address the challenges of climate change and contribute to a sustainable future. In New Zealand, the ministries of environment and education worked together to develop climate-related teaching and learning materials which incorporate indigenous Māori principles and were developed in consultation with Māori leaders and educators.[174]

To the extent possible, connect climate lessons to community action and learning-by-doing approaches tied to local contexts.[175] Research shows that learning in real-life contexts can effectively develop much more comprehensive forms of knowledge.[176] Students can be encouraged to engage in climate action projects within the school environment, whether during classroom hours or in extracurricular activities. Some examples of actions by which a school can exemplify climate action include planting trees or bee-friendly plants in outdoor school facilities, implementing recycling and composting initiatives for waste management, and promoting the purchase of local products and the use of sustainable transportation among the school community.[177]

Overloaded curricula are already jeopardizing learning outcomes. Adding climate-specific curriculum can be counterproductive if curriculum overload is not addressed. For this, teacher consultations are a must. UNESCO's review of national curriculum frameworks across 100 countries has found that 47 percent of frameworks have no mention of climate change.[178] The lack of inclusion can cause a rush to expand curriculum to include climate education. Some are explicitly calling for compulsory climate education.[179] Such initiatives could be counterproductive unless early grade curricula are lightened in other aspects. Across four LMICs, even though 92 percent of primary teachers believe that it is important to incorporate climate curriculum in their classes, only 37 percent were willing to spend more than 60 minutes a month on this curriculum.[180]

Figure 1.9: Most teachers believe climate education is critical, but are unwilling to spend much time on it (more than 60 minutes per month)



Source: Novel data for this report

Opinions of local stakeholders are often divided on how precisely to incorporate climate curriculum. Therefore, it is critical to consult teachers before doing so. There is a consensus among young people that climate change related topics should be introduced early. Nearly 68 percent of youth across eight low- and middle-income countries believe that climate curriculum should be taught before secondary level.[181] This share is highest in India and Tanzania, where 91 percent believe this; but lowest in China where only 36 percent believe this. However, opinion is sharply divided on how exactly climate curriculum should be introduced. Across, eight low- and middle-income countries, around 45 percent of teachers believe climate should be a separate subject and the rest believe it should be mainstreamed in existing subjects.[182] Young people are similarly split, with around 50 percent believing it should be a separate subject.[183]

Linking secondary schools with higher education, labor markets, and advocacy efforts around climate can be transformative. This involves encouraging schools to forge strong partnerships with local businesses, industries, and environmental organizations, which offer students valuable insights into real-world applications of green skills and provide opportunities for hands-on learning experiences.[184] This could also take the form of supporting youth advocacy efforts. Enabling and ensuring the meaningful youth participation in adult-led decision-making structures can encourage increased interest in climate action and help develop participatory approaches to tackling climate change.[185] For instance, collective action programs can be created in schools and in communities for young people to engage in climate action, including through school competition and collaboration.[186] Youth-led and youth-focused groups, organizations and networks can be leveraged, and schools could serve as community hubs for climate action.[187] There are several great operational examples that use these approaches (See Box 1.2).

BOX 1.2: CLIMATE CURRICULUM IMPLEMENTATION EXAMPLES

In Zambia, schools adopt a learning-by-doing approach through climate clubs

The Climate Ambassadors Clubs (CAC) with grade 7 to 12 students. This program led by Alliance for World Change provides behavior change lessons through debates, school presentations and local interactive games. They conduct tree planting activities, particularly mulberry and Mexican apple trees, that help with water retention and provide shade and fruits, thereby promoting education in a green environment.

Learn more

In the Caribbean, schools and youth groups address local environmental challenges through community action

The Sandwatch Program. Sandwatch is a volunteer network of schools (students, teachers and principals), youth groups, non-governmental and community-based organizations working together to monitor and enhance their beach environments. In this program, which is now spread to 45 countries, students in school and community members learn and work together to evaluate and solve problems in their beach environments.

Learn more

Bhutanese schools enhance student knowledge and climate data systems through partnerships

The Himalayan Environmental Rhythms Observation and Evaluation Systems. HEROES is a school- and community-based citizen science initiative in Bhutan - an innovative example of student participation that benefits the climate data system. Students in participating schools gather data on seasonal appearances and life cycles of chosen plants and wildlife in their school vicinity over 10 months, and the data are fed into the national climate data repository system. The project has already trained 34 teachers and 1,000 students in weather station management, data collection, and plant phenology observations

Learn more

Disaster risk reduction training in Kyrgyzstan improves student resiliency and helps them train others in the community

Making schools safer from extreme weather in Kyrgyzstan has trained 1,000 young people in Disaster Risk Reduction. Now they are going from school to school in their home villages to train others — both students and teachers — on what to do in case of a weather emergency, and to verify the proper tools are in place. For example, these young inspector-trainers check that dispatch telephone numbers are displayed on the walls, and that emergency exits are marked and doors unlocked; that evacuation instructions are posted prominently; and that each school has a fire shield, water tank and other emergency gear. In the three years since launch, the young volunteers have covered almost half of all schools in Kyrgyzstan, training over 150,000 students and 10,000 t eachers and administrators.

Learn more

Climate skilling is not just technical. It also includes developing socio-emotional skills that will help students manage their anxiety and cultivate a sense of empathy. Key socio-emotional skills include problem solving, collaboration, communication, decision making, critical thinking, and teamwork, among others.[188] Integrating these components ensures that students not only gain an understanding of climate issues but also cultivate the emotional intelligence necessary to navigate environmental challenges. It empowers students to become compassionate, resilient, and effective agents of positive change in their communities and beyond.

Japan and Türkiye demonstrate how to provide socio-emotional support around climate education. In Japan, the Earth Kids space program aims to teach children peace, harmony and respect for all life and the environment through cooperative games, stories, interactive workshops, and outdoor activities. An evaluation of the program demonstrates its success in instilling appreciation for nature among children and promoting intergenerational solidarity.[189] In Türkiye, the Climate Change Action Plan 2022 notes that the framework for psychological counseling services is to be restructured to address increases in eco-anxiety as reported by students. In addition to mental health support, counselors are trained to offer vocational guidance and promotion that is in alignment with national climate objectives.[190]

Build teacher capacity

Build capacity among teachers to increase the efficiency of learning. As noted above, 71 percent of teachers across six countries, answered at least one basic climate question incorrectly.[191] Educators should be provided with opportunities for professional growth and ongoing learning, aimed not only at enhancing their comprehension of climate change but also at refining strategies to address climate skepticism, supporting students dealing with ecological grief and anxiety, and boosting their confidence in navigating contentious subjects and promoting civic engagement. This can require providing teachers with high quality educational materials, better textbooks, teacher's guides, tools, and traininj2g.[192] Teachers must also be coached to teach students at their individual level with targeted instruction,[193] ensuring improved learning outcomes.

There are good examples of effectively supporting teachers in climate education. In Greece, local teachers feel positively towards school-community collaboration, but felt that a lack of training in partnership management was hindering its success. Greece has taken a pro-active approach to ensuring that sustainable development is a key part of teacher training, adopting a whole-institution approach. Through the provision of supplemental in-service training, teachers predict that their increased confidence will help them optimize the national "sustainable schools" concept.[194]

Schools can do much more for climate action. The time to act is now.

Young people are desperate for climate action. Education is a big part of making it happen at scale. Education improves climate knowledge, skills, mindsets, and behaviors. But it is woefully underleveraged. Education must become more central in the global, national, and local climate agendas. At the same time, the climate agenda needs to be more present and active within education delivery. If we don't mobilize education for climate action now, we put current and future generations at risk. But if we do, we can unleash a transformative force to propel the climate transition.

BOX 1.3: A STEP-BY-STEP GUIDE TO INTEGRATING CLIMATE INTO SCHOOL CURRICULUM

1. **Begin with what you already have.** As a first step, identify entry points within existing school activities and curriculum. This is cost-effective, minimizes disruptions, and helps build on existing buy-in from different stakeholders. For instance, in India, UNICEF has tapped into pre-existing Ministry of Education initiatives like school safety programs, child cabinets, and school-level adolescent and youth platforms to integrate climate change and disaster risk reduction themes.[195] Similarly, in Kazakhstan, there is an already growing strong support for girls in STEM. Using this support, the UniSat project in partnership with the Ministry of Education, Ministry of Digital Development and Aerospace Industry, universities and other entities, girls are learning nanosatellite development and data analytics skills and contribute to research on topics like urban air pollution. This has allowed students to learn climate-specific skills, while building transferable 21st century skills including teamwork, public speaking, time management, creativity.[196]

2. **Identify age-appropriate climate concepts for different grades – in consultation with curriculum experts and using appropriate local and global resources.** Climate change education must be tailored to each education and learning level for effective understanding and engagement. A graduated approach can ensure each student receives relevant information that they can comprehend without compromising other educational targets. The Republic of Korea's more recent National Curriculum Framework, rooted in the Environmental Education Promotion Act (2008), follows this approach.[197] The grade-by-grade achievement and evaluation criteria includes climate change-related education as follows:
   - Pre-primary education: climate change education is part of a unit called 'scientific exploration,' where students learn about natural phenomena through exploring weather
   - Primary education: students learn about weather and climate change in greater detail, focusing on cognitive learning details around components of climate, such as clouds, air pressures, and seasonal weather
   - Secondary education: students are taught climate concepts through mandatory science and social science subjects and are also offered an additional optional course "Environmental Education" with teachers given autonomy on how the subject is taught. Here students are introduced to environmental issues and how to respond actively to various environmental problems that arise in their daily lives
   - High school education: students learn more complex concepts, with increased coverage on development and renewable energy.

   Overall, as students progress to lower secondary and beyond, there needs to be a focus on climate integration via STEM. One starting point for countries could be the OECD's environmental science framework. This framework prioritizes a baseline of scientific literacy for all learners, including the ability to evaluate different sources of evidence and to understand that scientific knowledge is conditional and constantly evolving. It also emphasizes solutions-orientated teaching. This includes helping students identify and critically examine potential solutions to complex real-life problems.

3. For all levels, look for activity-based and locally relevant materials. Elevate local knowledge and community action. Integrating curriculum with institutional sustainability practices, such as energy conservation, waste reduction, and green building initiatives, can provide students with practical, real-world examples of climate action. This alignment ensures that students not only learn about climate science and policy in the classroom but also see these principles in action within their educational environments. An example is the One Student, One Tree, One School, One Forest project in Morocco[198], where an estimated 6 million students have planted seeds and cuttings on their school grounds and surrounding areas. Pedagogical activities such as workshops educate students about the value of forests, planting, and green spaces are offered before and after each planting activity.

Partnerships with universities, private sector, local community networks, and NGOs can be extremely useful for this. In some countries, including the Australia, New Zealand and the United States, a common strategy is to offer "dual enrollment" opportunities, where students can start earning higher education credits as part of upper secondary.

SKILLS *FOR THE* GREEN TRANSITION

Anshuman Gupta, Surayya Masood, Shwetlena Sabarwal, Devika Singh, Marla Spivack, and Sai sri ram Sribhashyam

SUMMARY

Countries have made commitments to transition to low carbon economies and to adapt to the effects of climate change. These green transitions cannot happen without a workforce with appropriate skills - green skills. Demand for green skills is already present in low- and middle-income countries and may be outpacing supply in some contexts.

However, among students and workers there is a misperception that green skills are limited to highly technical, highly specific to a few sectors (energy, construction, transport etc.), and only achievable through long degrees. This is not true. In fact, we use novel analysis to highlight **four facts** about green skills:

1. Green skills are broad. They include technical and STEM skills but also include non-technical skills, cross-sectoral skills, and skills that are achievable through short courses.

2. Green skills are flexibly applicable. Any job and any sector can become greener with the right set of skills.

3. Green skills are not just for 'new' jobs. Green transitions will need some new skills for new jobs. But more importantly they would need augmented skills for existing jobs.

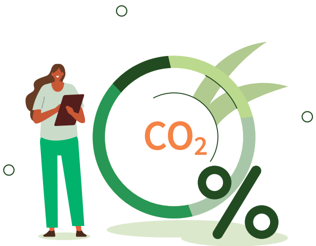
4. The demand for these skills can be unpredictable and inequitable.

Green skilling opportunities are so big and so close that accelerating this agenda does not require a big leap. A lot can be achieved in the short run through smart augmentations at the margin. However, to fully exploit these opportunities, system reforms would also be needed in the medium term. **Governments can act on two fronts**:

- In the short run, facilitate more information and the availability of market-responsive short courses for green-skilling of both students and workers.
- In the medium run, foster adaptable students and systems through strong foundations, flexible pathways, information flows, alignment of stakeholders, and intentional inclusion.

This chapter presents data, evidence, operational examples, and a policy agenda to make this happen.

WHAT ARE **GREEN SKILLS?**



Green transition is the transition of an economy away from fossil fuels and the overconsumption of natural resources.

Green skills are the skills that can help economies in their green transitions.

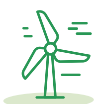
Green job is a job that requires at least one green skill.

THEIR **SCOPE** MAY **SURPRISE** YOU.

Advanced Skills like zero-energy building design

But also...

Basic Skills like food disposal using green techniques



Technical Skills like inspecting wind turbines

But also...

Socio-emotional skills like communication with local communities

New Skills like hydrogen production

But also...

Old Skills Augmented like preparing financial models using carbon pricing

Used in **conventionally high-emission sectors** like energy & transport

But also...

Used in **unconventional sectors** like arts & entertainment

Note: We use the terms Green Skills and Green Jobs as shorthand for the broader concepts of '***Skills for a Green Transition***' and '***Jobs for a Green Transition***', respectively. Also, there are other possible definitions of these concepts beyond what we use.

Most countries want green transitions

> *"This is not the time to just talk and talk, but this is the time to put action into our countries, into our societies, and look for ways that are going to sustain our lives."*
>
> *Beatrice, age 16, Zambia*[199]

In 2015, 195 countries adopted a legally binding treaty to limit global warming.[200] **These commitments require green transitions - shifting towards more environmentally sustainable economic growth.** Currently, around 140 countries have set a net-zero target for carbon emissions. Together these commitments cover about 88 percent of global emissions.[201] **Countries as varied as Bangladesh, Madagascar, Mexico, and Yemen have all made at least some commitment to progress on this path.**

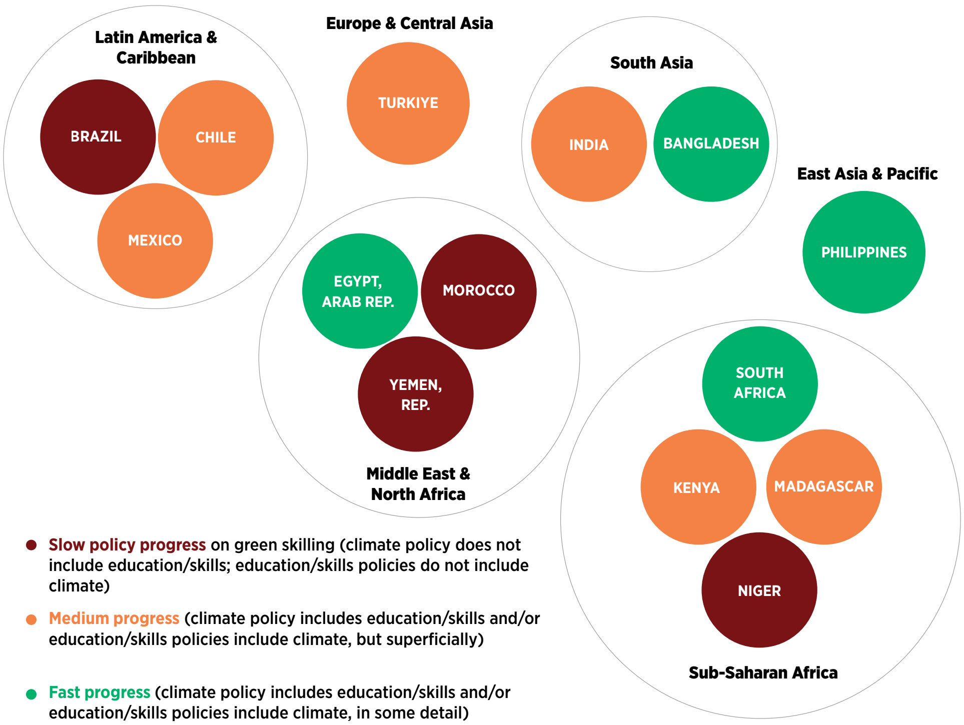
The extent to which green transition commitments have translated into action varies considerably. Analysis of green transition policies from 14 countries from different regions and income groups - Bangladesh, Chile, Egypt, India, Kenya, Madagascar, Mexico, Morocco, Niger, Philippines, South Africa, Türkiye, and Yemen shows that every country has at least one national level policy and/or commitment to addressing climate change. Every country also has conditional and unconditional targets to decarbonize. However, about 6 out of 14 countries do not have any sectoral roadmaps (Mexico, Niger, Morocco, Chile, Madagascar, and Yemen). Also, only 4 out of 14 countries have climate framework laws and policies in place (these are Brazil, Mexico, Morocco, and Türkiye, see Figure 2.1).

To move green transitions from commitments to reality, economies need skilled workers. Skilled workers can accelerate green transitions; their scarcity can thwart them. Nearly 80 percent of global business leaders believe that green skills will be the most important driver of the green transition.[202] More than half the respondents from the construction industry in Indonesia report that they cannot meet sustainability goals because of lack of skilled workers.[203] In India, 60 percent of respondents in the energy sector report shortages of skilled workers for adaptation and mitigation activities such as retrofitting, renewable energy, and activities to increase energy efficiency.[204] The construction of a new windfarm in Kenya – the largest in the region – relied on workers from outside the country, recruiting 80 percent of the needed workers from abroad.[205]

> **80 percent of global business leaders** believe that **green skills will be the most important driver** of the green transition.

Green skills are skills that: (i) help mitigate the impacts of human activity on the environment[206] **and (ii) help societies adapt to the effects of climate change**. It can be useful to think of green skills in two ways: the technical and STEM skills needed for jobs that most directly lead to a transition to a lower carbon economy. For example, the skills needed to install solar panels, retrofit heating and cooling systems, or repair electric cars. However, a second, more expansive perspective of green skills includes non-technical skills as well because they can also support transitions to green economies. For instance, communication and leadership skills. In fact, nearly any job or industry can become greener if workers are equipped with the necessary skills to shift the tasks and outcomes related to that job or industry in greener directions. In this view, the classification of a skill as a green skill depends on their application, so it is not straightforward to come up with a singular list of all green skills. And applications can vary dramatically across contexts. For instance, in Brazil, some of the most frequently demanded green skills in online postings included ecosystem science, corporate governance, and recycling, while in the Philippines they included environmental health and safety, waste management, etc.[207]

Figure 2.1: The pace of the green skilling varies significantly across the 14 low- and middle-income countries analyzed



Source: Authors

Increased supply of green skills can itself spur green transitions. When countries make fiscal investments for green transitions, they often do it in areas that already have existing high levels of green skills. The 2009 American Recovery and Reinvestment Act created 40 percent more jobs in communities with higher pre-existing green skill levels than average skill communities.[208] Analysis form global LinkedIn data finds that for workers that transition into green jobs, 81 percent already had green skills prior to getting the new job.[209]

Fiscal investments for green transitions are often in areas that already have green skills.

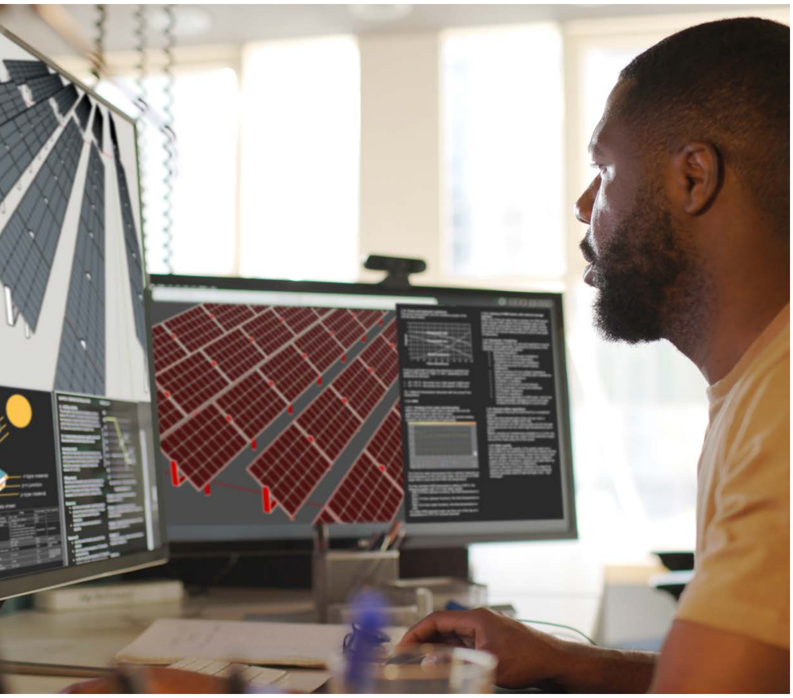
Green skills are so central to green transitions that their current demand is a barometer of how advanced a green transition is. Specifically, the types of green skills demanded by the labor market can reveal whether the green transition is merely at the stage of intention, or if it extends to business/industry application, or even further to policy and regulation. For example, in the Philippines, green skills are being demanded and applied in selected occupation groups such as health, safety and waste management. On the other hand, in Brazil, green skills are being demanded and applied not only in specific industries but also in governance and regulation, indicating that a country may be more advanced in its green transition.[210]

But green transitions demand green skills

Global green transitions would require skilled workers for an estimated 100 million new jobs.[211] These new jobs are expected to arise through the adoption of sustainable practices, growth in the use of electric vehicles, and increases in energy efficiency in construction, among others. India alone could create up to 35 million new green jobs by 2047.[212] The 2022 Inflation Reduction Act in the United States is expected to create 9 million jobs linked to climate, energy, and environmental justice. Emergence of new jobs can also be seen within specific sectors. Around 30 million new jobs will be created in the energy sector alone by 2030.[213] Investments in clean energy in Morocco are expected to deliver almost 770,000 net jobs per year through 2020 to 2050, with trade, commerce, and services sectors seeing the largest employment expansion.[214]

Global green transitions would require **skilled workers for 100 million new jobs.**

Green transitions will also require up-skilling for changes in existing jobs. This would mean retraining and updating specific skills, practices, and tasks. For instance, in Asia, many existing jobs (i.e. plumber, construction worker) will be "greened" and will require shifts in the day-to-day skills applied as part of the job.[215] In Indonesia, in the manufacturing sector 76 percent of respondents report that job changes are the biggest change their industry is experiencing as a result of efforts to green their business. Similarly in the services sector, 60 percent of respondents agree that jobs will change due to sustainable practices and 90 percent agree that environmental awareness is important in the sector.[216]



Finally, an estimated 78 million jobs are likely to be destroyed by green transitions. These workers will need to be reskilled. Although the green transition will result in a net increase in jobs (direct and indirect), employment in sectors that are natural resource intensive and fossil fuel based is expected to decrease.[217] The green transition in energy sector in the United States may result in the displacement of 1.7 million workers (in fossil fuel related jobs).[218] In Europe, between 54,000 to 112,000 direct jobs may be lost due to the phasing out of coal energy production systems.[219] These displaced workers will need to be supported to transition to other jobs. Re-skilling these workers will be essential for reducing the social costs of the green transition in terms of unemployment, risky behavior, and social tensions.[220] Some jobs created by green transitions, such as those related to building and installing new energy infrastructure, will be temporary,[221] and these workers may need re-skilling in the future.

BOX 2.1: METHODOLOGY

(Further details are in Annex A)

We classify skills into green and non-green using the European Classification of Occupations, Skills and Competences (ESCO) classification.

The supply of green skills is estimated using labor force household survey data for Egypt (2022), Kenya (2020), and India (2022-2023). Granularity of occupational data in these surveys is limited to 3-digit level aggregation (hereafter 'occupation group'). These data present number of workers in various occupation groups. Occupation groups are overlaid (cross-walked) with the ESCO skills required for occupations in their group and classified into green and non-green using the ESCO definition. To obtain a list of skills at that aggregation, we roll up all the skills sets of occupations that fall into an occupation group, even though ESCO skills data is available to most granular occupations. We use this to define green and non-green occupation groups along a spectrum.

An occupation group contains several occupations. For each occupation, we calculate what share of the total skills used in this occupation are green. Next, we average this across all occupations within the occupational group. Using this metric, occupational groups are classified into four categories:

- **High-green occupation-group**: On average, within the occupations in this group, more than 15 percent of the skills used are green skills. In this group we can say with some confidence that nearly all workers have at least one green skill.
- **Medium-green occupation-group**: On average, within the occupations in this group, between 5-15 percent of the skills used are green skills.
- **Low-green occupation-group**: On average, within the occupations in this group, between 0-5 percent of the skills used are green skills.
- **No-green occupation-group**: 0 percent of skills required in occupations within this group are green.

The demand for green skills is measured using online job portal data.

- For Brazil and the Philippines, we use job portal data scraped and analyzed by Lightcast for this report. They identify 1.12 million online job postings in Brazil and around 500,000 job postings in Philippines between September 2022 and August 2023, and apply their proprietary classification to categorize these into green and non-green.
- For Egypt, Kenya, and India, job portal data was scraped by JobKred. We obtained data between Jan 2022 and March 2023, from 52,300 job postings for Egypt; 11,500 for Kenya; and 1.8 million for India, and use generative AI to extract skills mentioned in the job posting and categorize them. We then apply the ESCO classification into green and non-green skills to categorize jobs as green (if at least one green skill was included) and non-green (if no green skill was included).

There are three caveats to our analysis. First, the ESCO classification we use for green skills is well established but not adapted to low- and middle-income countries. Second, our estimates of green skills supply using labor force survey data are highly aggregated. Finally, the online job postings data we use to analyze green skills demand are highly granular, but likely offer a non-representative view of the labor market overall.

Green skilling opportunities are closer and bigger than many think — Busting 5 myths about green skills

> "Trillions of dollars will be required to adopt clean electricity, retrofit homes and businesses, establish new manufacturing processes, and protect cities and towns from changing weather patterns … To put all this public and private capital to use, the country needs a sizable workforce."
>
> *— Joseph Kane and Adie Tomer, Brookings, July 2023*[222]

Although green skills are central to ongoing green transitions, their characteristics are not well understood. Their definitions remain amorphous; their policy agenda remains abstract.

What types of green skills are in demand? Studies point to occupation-specific cognitive and technical skills, certain socio-emotional skills, and knowledge about sustainability practices. Case studies in India, Indonesia, Sri Lanka, and Vietnam identify general sustainability awareness, occupation-specific skills predominantly related to STEM fields such as engineering, mathematics, and technology, and socio-emotional skills including leadership, management competencies, and the ability to adapt to and facilitate change as skills that will be in higher demand as green transitions progress.[223] Analysis of online job postings data from Indonesia finds that management skills like quality assurance, planning and project management are in high demand in green jobs.[224] Similarly, green jobs in the US require higher rates of non-routine analytical skills, higher interpersonal skills, management skills, IT skills, and greater ability to adapt.[225]

At the same time, there are several misconceptions about green skills. This chapter addresses five common myths around green skills, using a data driven approach. We complement existing literature with novel data. Demand-side data comes from online job portals in Brazil, Egypt, India, Kenya, and Philippines and supply-side from labor force surveys in Egypt, India, and Kenya (see Box 2.1 and Annex A for details). We complement these with youth surveys from across eight low- and middle-income countries to showcase the misconceptions around green skills.[226]

Myth 1: Green skills are only relevant for high-income countries

> "Now almost all companies need an environmental engineer… Many projects that are done today have some environmental component attached to it. And it requires that there is someone who was trained in the area."
>
> *An Environmental Engineer, Mozambique, in focus group discussions, 2024*[227]

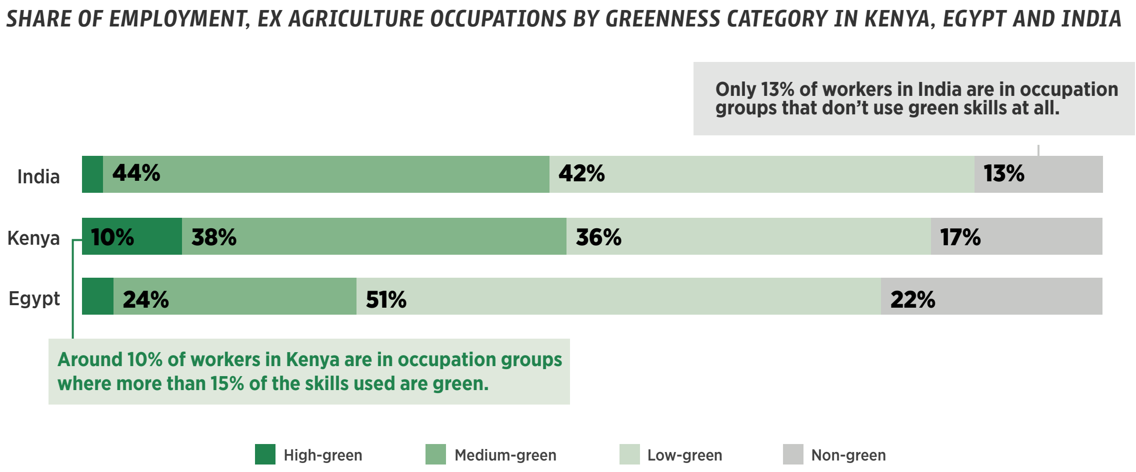
In high-income countries, demand for green skills is high and increasing. Between 2022 and 2023 there was a 22.4 percent increase in the share of job postings that required at least one green skill across high-income countries. This increase in demand is outpacing supply - the share of green talent in the workforce rose by a median of only 12.3 percent, over the same period.[228]

In Kenya, **nearly 8 percent** of **jobs posted to online job portals** between January 2022 and March 2023 were **green jobs**.

Demand for green skills is also manifesting in middle- and lower-middle income countries. While it is true that the share of green jobs in the economy rises with income per capita,[229] demand for green skills is also manifesting in lower- and middle-income countries. In Kenya, nearly 8 percent of jobs posted to online job portals between January 2022 and March 2023 were green jobs (in that they required at least one green skill). This rate was 4.5 percent in Brazil.[230] In India, around 51,000 out of the 1.8 million jobs posted online (between January 2022 and March 2023) require at least one green skill.[231]

Green skills are already being utilized in low-and middle-income countries. Around 78 percent, 88 percent, and 84 percent, and of non-agricultural workers in Egypt, India, and Kenya work in occupation groups that utilize at least some green skills (see Figure 2.3). This is not to say that all these workers have green skills. It simply shows that most workers are employed in occupations that are already utilizing at least some green skills.

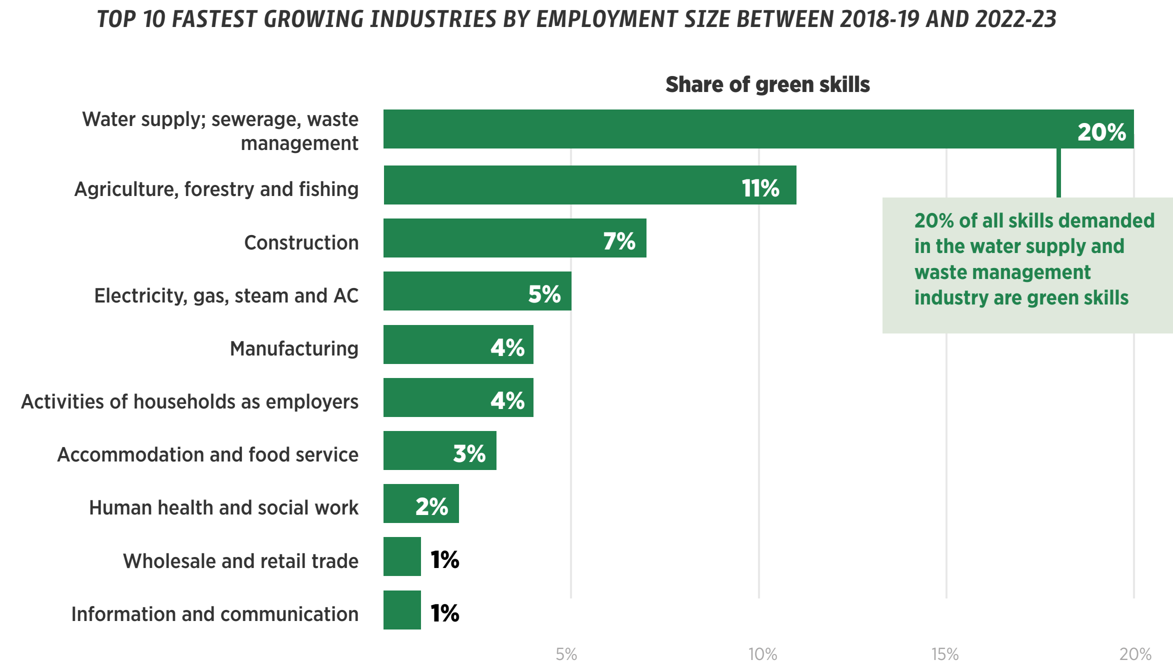
Figure 2.3: Green skills are widely utilized in Egypt, India, and Kenya



Source: India Labor Force Survey 2022-23 Egypt Labor Force Survey 2022, Kenya Continuous Household Survey 2021 Microdata, cross-walk with ESCO skills classification. Details on methodology are available in Box 2.1.

In fact, green skills demand may be outpacing supply in low- and middle-income countries. In India, the fastest growing industries require at least some green skills. Between January 2022 and March 2023, water supply and waste management was the third fastest growing industry. Nearly 20 percent of the skills needed in this industry are green skills (see Figure 2.4). These signals are corroborated by primary data. Nearly 60 percent of respondents in the energy sector in India report shortages of skilled workers for adaptation and mitigation activities such as retrofitting, renewable energy, and activities to increase energy efficiency.[232]Many respondents in energy, construction, and transport sectors in Sri Lanka report that the inability to acquire adequate green skills is impacting their business.[233] These shortages can impede transitions by making them more costly and time consuming.

Figure 2.4: The ten fastest growing industries in India demand at least some green skills



Source: India Labor Force Survey 2022-23 Microdata, ISIC, cross-walk with ESCO skill classification. Details on methodology are available in Box 2.1.

High demand for green skills is also visible in the wage premium associated with green jobs. There are signs that green jobs are more financially attractive compared to non-green jobs. In South Asia, workers in green jobs earn about 31 percent more than other workers. Even after controlling for worker, industry, and location characteristics, workers in green jobs received 7 percent higher wages than their peers in non-green jobs.[234] Labor force survey data from Egypt shows that the average monthly income for salaried employees with post-secondary education is around 3,191 Egyptian pounds in non-green occupations and 5,249 Egyptian pounds for those in high-green occupations (where more than 15 percent of skills used are green).

In South Asia, **workers in green jobs earn about 31 percent more** than other workers.

Myth 2: Green skills are only relevant for those with higher education

> "In today's hiring landscape, you don't need to count yourself out of the running if you don't have a degree. What's more important is to show that you're driven, passionate, and possess the skills that the workforce needs."
>
> — *Jeff Mazur, Harvard Business Review, August 2021*[235]

In Egypt, **11% of the green jobs** posted online **required only lower secondary education.**

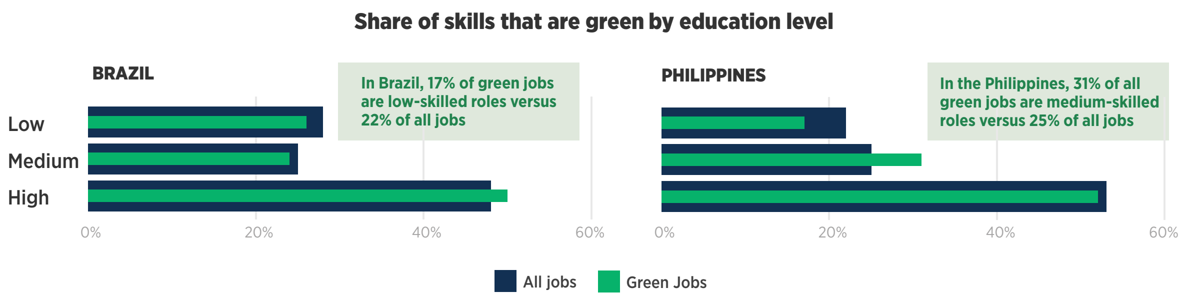
In many contexts, demand for green skills is disproportionately concentrated in high-skill jobs. For instance, in the US, green skills are associated with higher levels of education and formal training.[236] Similarly, in Brazil, the highest green skill demand is amongst high-education roles.[237] In India, 37 percent of workers in green jobs are medium skill workers and 30 percent are high skill workers.[238]

However, green skills are also being demanded in medium- or low-skill jobs. In India, out of the 48,000 green jobs posted online between 2022 and 2023, 7 percent require only lower secondary education, this number is 21 percent for Kenya and 11 percent for Egypt.[239] In Kenya, out of the 947 online green jobs posted Jan 2022 and March 2023, 24 percent require only lower secondary education and 21 percent only a primary education. In Brazil, the distribution of green jobs across different education levels follows the same pattern as the distribution of non-green jobs. In the Philippines, the distribution of green jobs is somewhat more concentrated in middle levels of education, but the differences are not large (Figure 2.5).[240]

And yet the misperception about green skills only being available to those with higher education persists. Across eight low- and middle-income countries, around 54 percent of youth believe that green jobs are only available to those with a master's degree or higher.[241]

Figure 2.5: Green jobs demand includes across low- medium- and high-skill workers

DISTRIBUTION OF GREEN JOBS ACROSS EDUCATION LEVELS COMPARISONS TO ALL JOBS



Note: Data are taken from online job postings data in Brazil and the Philippines between September 2022 and August 2023. Occupations are classified using the Lightcast Occupation Taxonomy (LOT), A green job is identified as a job that uses at least 1 green skill. To classify jobs as low, medium or high skill postings are classified based on the proportion of postings in that occupation category requiring a bachelor's degree. If between 0 percent and 20 percent of postings requested a bachelor's degree or above, this is a low skill job; if between 20 percent and 60 percent of postings requested a bachelor's degree or above, this is a middle skill job; and if between 60 percent and 100 percent of postings requested a bachelor's degree or above, this is a high skill job. Source: Lightcast™. 2024 (for this report)

Not all green skills demand new or additional educational degrees. Green skilling can come from education, but it can also come from training and experience. For instance, in the US, green jobs tend to require only slightly more education than non-green jobs, but significantly more training and on the job experience. Green jobs do require some additional schooling - 1.9 percent more years of schooling (equivalent to 13 more weeks), but significantly more training - 41 percent, or 15 weeks, and experience - 43 percent or 10 months, than similar non-green jobs.[242] Similarly, while new jobs arising from the green transition do not require more education, on average, than comparator jobs, they do require 18 percent more training (a little less than 7 weeks).[243] This implies that while these jobs tend to require similar levels of formal preparation and high-level skills, they require more adaptation of these skills to specific job contexts.

The bottom line is that while green skills demand is likely to be more concentrated in occupations requiring higher levels of skills, those with low and medium skill levels can also access green skills and green jobs.

Myth 3: Green skills are only relevant for technical and/or STEM fields

> "There's definitely a need to include an environmental perspective from more inter-disciplinary approach, because we don't only need environmental engineers. We also need businessmen … thinking about what kind of a business they want to work in … We need as well, lawyers who are focusing on specializing in environmental laws, teachers, etc. And then people who communicate."
>
> *Eyal Weintraub, Co-founder, Youth for Climate Argentina. In interview for this report, 2024*[244]

Related to the point above, green jobs are often associated with STEM skills and/or specific technical skills. In a survey across eight low-and middle-income countries, around 73 percent of youth (between ages 17-35 years) believe that it would be impossible to get a green job if they do not have STEM skills.[245] This is not entirely unfounded. Case studies in India, Indonesia, Sri Lanka, and Vietnam show that skills related to STEM fields such as engineering, mathematics, and technology will be in greater demand in green transitions.[246] Green jobs in the US are found to require higher rates of non-routine analytical skills. These types of non-routine activities typically require higher degrees of analytical skills.[247]

74% of young people across six countries wrongly believe that it is impossible to get a green job without STEM skills.

However, STEM skills are not the only skills required for green jobs. Among the online green-job postings in Egypt, India, and Kenya, only 38 percent, 43 percent, and 26 percent, respectively, required a STEM skill. In other words, in all three countries, less than half of the online postings for green jobs needed a STEM skill at all.[248] Job postings data from US shows that green jobs are more likely than comparable neutral or brown jobs to require cognitive, IT, management, social and technical skills.[249] Data from Brazil and the Philippines also show that digital skills are required in similar intensity in green jobs as they are in all jobs.[250] This point is recognized in the ESCO definition of green skills[251] (described in Annex A) which claims explicitly that these skills include not just technical competencies but also general/ foundational competencies and even socio-emotional competencies.

Demand for green skills is evolving rapidly. Therefore, these skills require a foundation of transferable cognitive and socio-emotional skills that can help young people become more adaptable. Nearly 94 percent of business leaders report that they expect employees to pick up new skills on the job, a sharp increase from 65 percent in 2018.[252] Adaptability—the ability to respond to unexpected circumstances and to unlearn and relearn quickly - requires a combination of certain cognitive skills (critical thinking, problem solving) and socio-emotional skills (curiosity, creativity). These skills ensure that young people can pick up new skills faster, can apply core competencies in a variety of ways, and can adjust more readily to changing demands. They are the best inoculation against job uncertainty as economies go through the de-stabilizing green transitions and future, as yet unknown, jobs take shape.

BOX 2.2: GREEN SKILLING OPPORTUNITIES ARE CLOSER THAN WE THINK IN KENYA

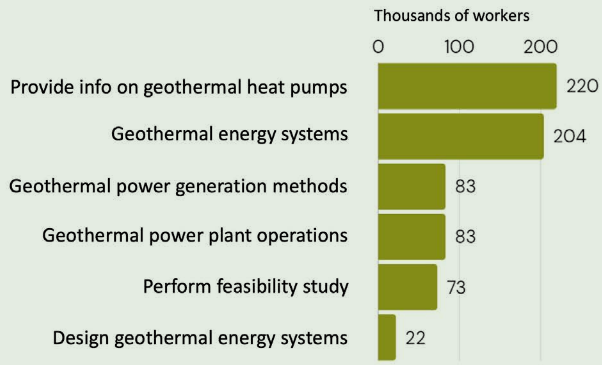
GEOTHERMAL POWER PLANT OPERATOR

Geothermal power plant operators operate and maintain equipment, often steam-driven turbines, which produce electrical energy. They monitor measuring equipment to ensure the safety of operations, and that the production needs are met. They also react to system problems, and repair faults. They may regulate the generators to control the flow of electricity to the power lines.

Skills related to the profession

1. Control steam flows maintain sensor equipment
2. Operate steam turbine
3. Electrical power safety regulations
4. Geothermal energy systems
5. Thermodynamics
6. Geothermal power generation methods
7. Maintain electrical equipment
8. Geothermal power plant operations
9. Regulate steam pressure
10. Apply health and safety standards

Despite the ambitions to growth the sector, geothermal skills are concentrated within 0.3-1.2% of the country's workforce.



50%

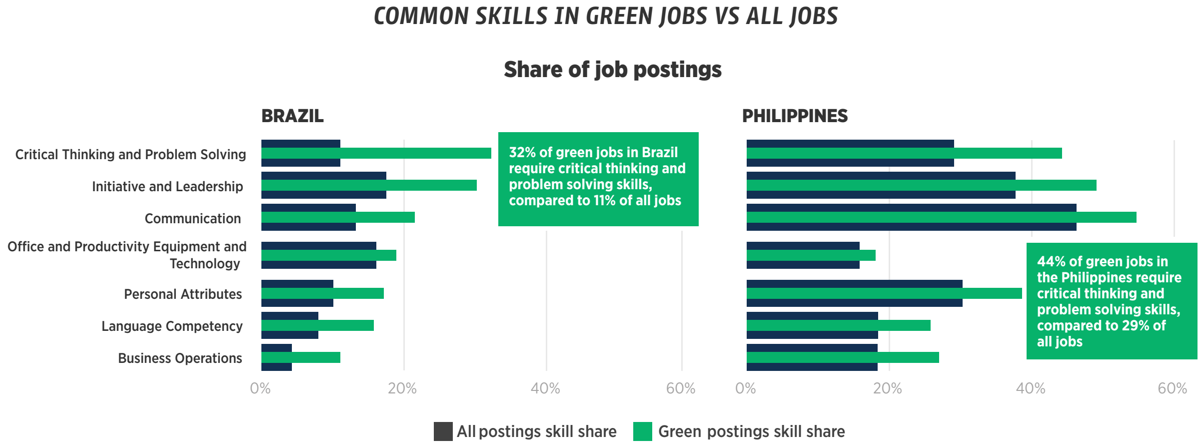
Geothermal resources play a major role in Kenya's electricity mix, and is expected to double in the next 2 decades, accounting for 50% of the country's power generation

16 THOUSAND

Despite Kenya seeing one of the fastest increases in electrification rates in sub-Saharan Africa, its electricity sector workforce size is relatively modest compared peer countries, with only 0.9% of its workforce contributing to the industry.

Key socio-emotional and digital skills are important for green jobs. Green jobs in the US require higher rates of interpersonal skills to adapt to new ways of working.[253] Green jobs related to training others in environmental practices, encouraging behavior change, and promoting environmental management, all require soft skills such as communication and relationship building. Online job postings also show that jobs that demand green skills often also demand soft skills**.** For instance, in India, demand for green skills related to corporate social responsibility co-occurs with demand for the soft skill of entrepreneurship. Similarly, in Kenya demand for green skills related to climate smart agriculture co-occurs with demand for the soft skill of innovative thinking. Finally in Egypt, demand for green skills in textile industry co-occurs with the demand for soft skills related to 'approaching challenges positively'.[254] In Brazil and the Philippines[255] critical thinking, communication, innovation, and problem-solving skills are all demanded more frequently in green job postings than non-green job postings (Figure 2.6).

Figure 2.6: In Brazil and the Philippines critical thinking, communication, and problem-solving skills are all demanded more frequently in green job postings than non-green job postings



Note: Data are taken from online job postings data in Brazil and the Philippines between September 2022 and August 2023. Occupations are classified using the Lightcast Occupation Taxonomy (LOT), Lightcast has identified and tagged more than 500 unique green skills which include skills related to clean energy, climate change, and environmental regulation, and resource management. A green job is identified as a job that uses at least 1 green skill. Source: Lightcast™. 2024.

Myth 4: Green skills are only relevant for 'Green' Sectors

> "When Kristy Drutman graduated … she knew she wanted to pursue a career in environmental communications, but she didn't know where to start. Years later, after an initial struggle … Drutman became a climate influencer …"
>
> *Ilana Cohen in The Nation, June 2, 2023*

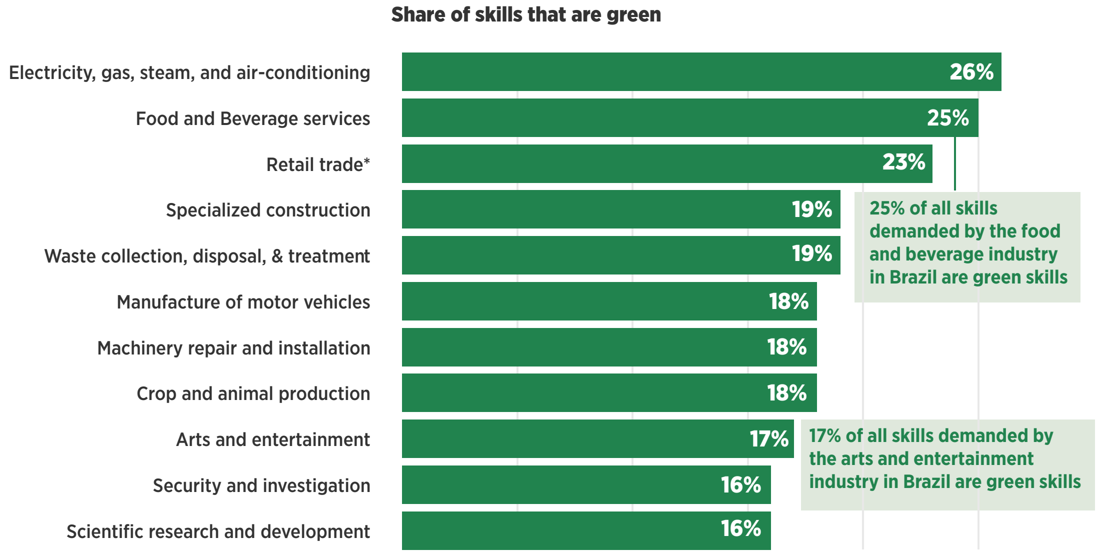
Sectors like energy, transport, and construction are most likely to be associated with green jobs. And they do see a high demand for green skills**.** This is because these sectors are implicated in high carbon emissions. It stands to reason, therefore, that when countries embark on a green transition, these sectors would be ones most in need of greening and by extension green skills.[256] Empirical data bears this out.

In Brazil, **25 percent of the skills** demanded for jobs **in the food and beverage service industries are green.**

In Brazil, industries with the highest share of job postings with green skill demand are electricity, construction, gas, steam and air conditioning.[257] In fact, the top co-occurring skills alongside green skills are construction-related skills, suggesting that this sector may be seeing the most rapid greening in terms of its workforce. Not just that, in both Brazil and the Philippines, there is a high number of green skills demanded in postings for both construction workers and also construction managers. This suggests that regardless of seniority in this sector, those in construction need to have some green skills.[258] Around 70 percent and 37 percent of all online job postings within the energy sector (electricity, gas, steam, and air-conditioning) in India and Egypt, respectively, are green jobs. In Kenya, around 51 percent of all online job postings in the water supply and waste management sector were green.[259]

However, green skills are also being demanded in sectors that are not traditionally associated with green jobs. For example, in Brazil, on average 25 percent of the skills demanded for jobs in the food and beverage service industries are green, as are 17 percent of the skills demanded for jobs in creative industries (see Figure 2.7). In the Philippines, 19 percent of the skills demanded by jobs in the education sector can be classified as green skills.[260] This is also evident when we compare green skills demand in some conventional green sectors (energy, construction, transport) with some unconventional green sectors. In Egypt, 7 percent of online job postings in the transport and storage sector (a sector conventionally associated with green jobs) are green. At the same time, 6 percent of online job postings in accommodation and food services sector (a sector not generally associated with green jobs) are green.

Figure 2.7: Green skills are demanded across a range of industries in Brazil



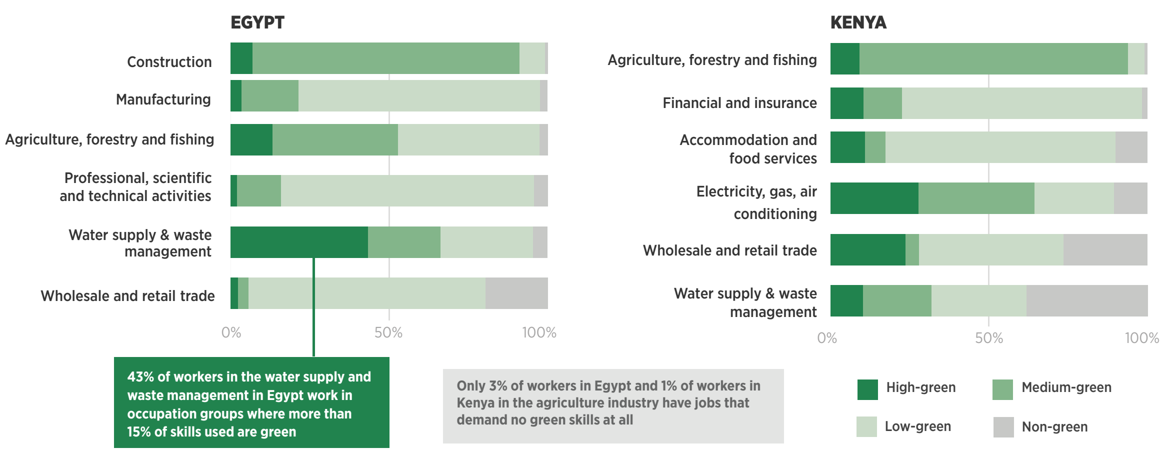
** except of motor vehicles and motorcycles*

Note: Data are taken from online job postings data in Brazil between September 2022 and August 2023. A green job is identified as a job that uses at least 1 green skill. Source: Lightcast™. 2024.

As on the demand side, supply side analysis shows that high-emission sectors do exhibit strong demand for green skills in Egypt, India, and Kenya.[261] The top industries (outside of agriculture) showing high use of green skills include construction (in India and Egypt) and electricity, gas, and air-conditioning (India and Kenya), and water supply and waste management (in all three; Figure 2.8).[262]

However, even on the supply side, we find high use of green skills in some sectors not normally associated with green jobs. For instance, sectors like arts, entertainment and recreation and also public administration in India; wholesale and retail in Egypt; and finance and insurance in Kenya, are all exhibiting high use of green skills in labor force survey data (see Figure 2.8 below). In fact, if we were to group selected sectors into those 'conventionally linked to green jobs' (agriculture, mining, energy, construction, transportation, water supply and waste management[263]) and 'not conventionally linked to green jobs' (wholesale and retail, accommodation and hospitality, information and communication, finance and insurance etc.); the average use of green skills (as a share of total skills used) across the two ranges around 5 percent, with only marginally higher numbers within the former set of industries.[264]

Figure 2.8: Green skills are needed in a wide range of sectors in the Indian, Egyptian, and Kenyan Economies



Source: India Labor Force Survey 2022-23 Egypt Labor Force Survey 2022, Kenya Continuous Household Survey 2021 Microdata, cross-walk with ESCO skills classification. Details on methodology are available in Box 2.1.

However, many young people do not associate green skills with non-green sectors. Nearly 80 percent of youth (17-25 years old) across eight low- and middle-income countries mistakenly believe that green skills are not needed in the finance sector; 58 percent do not think green skills are needed in the food services sector.[265]

80 percent of youth across eight countries **mistakenly believe that green skills are not needed in the finance sector.**

Myth 5: Green skills are highly sector-specific

"... It's really important from a young age for students to realize that green skills or going into a climate change-related industry isn't an industry. It's everything, everywhere, and it has to be, and this is kind of the framework we're trying to build."

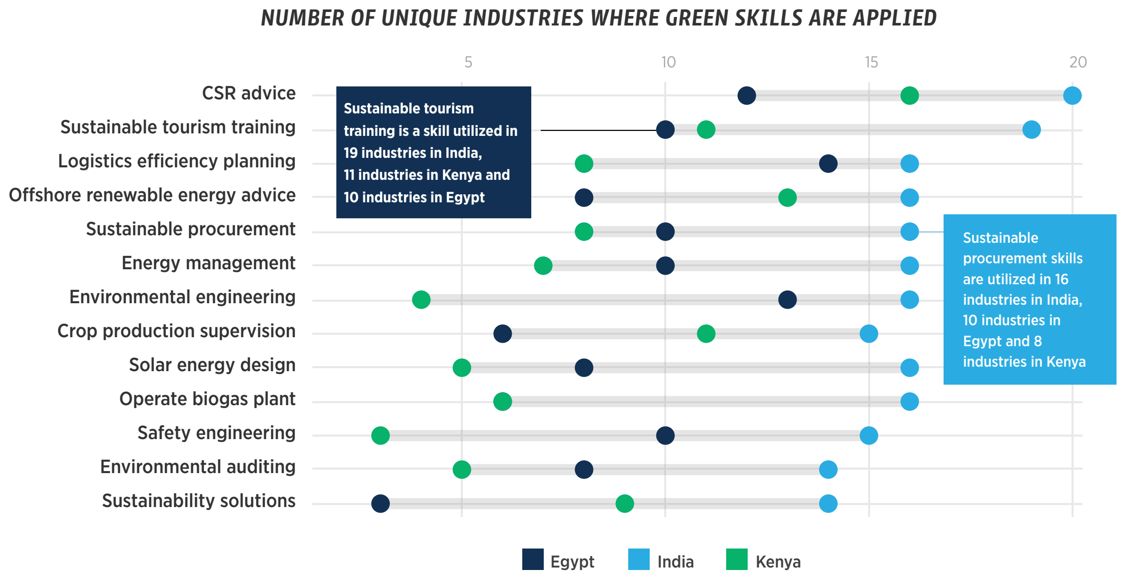
Keya Lamba, Co-Founder, Earth Warriors Global, UK

Green skills around corporate social responsibility are demanded across 20 industries in India and 16 in Kenya.

Another mistaken idea about green skills is that they are narrowly defined by sector. This idea has emerged, in part, because a lot of green jobs discussions have happened within the context of specific, highly technical sectors, such as energy. It also comes about because a lot of the conversation may focus on re-training existing workers in green skills rather than about preparing new workers.

However, many green skills are highly versatile and cross-cutting. As in, the same green skills are being demanded across a range of different industries and sectors. For instance, advise on corporate social responsibility, one of the most commonly occurring green skill in job postings, is demanded across 20 industries in India, 16 in Kenya, and 12 in Egypt. Logistics and operations is another skill demanded across sectors, required among jobs postings across 16 industries in India, 14 in Egypt and 8 in Kenya. The figure below shows the most versatile green skills and the number of industries they are being demanded in, using online job portal data.

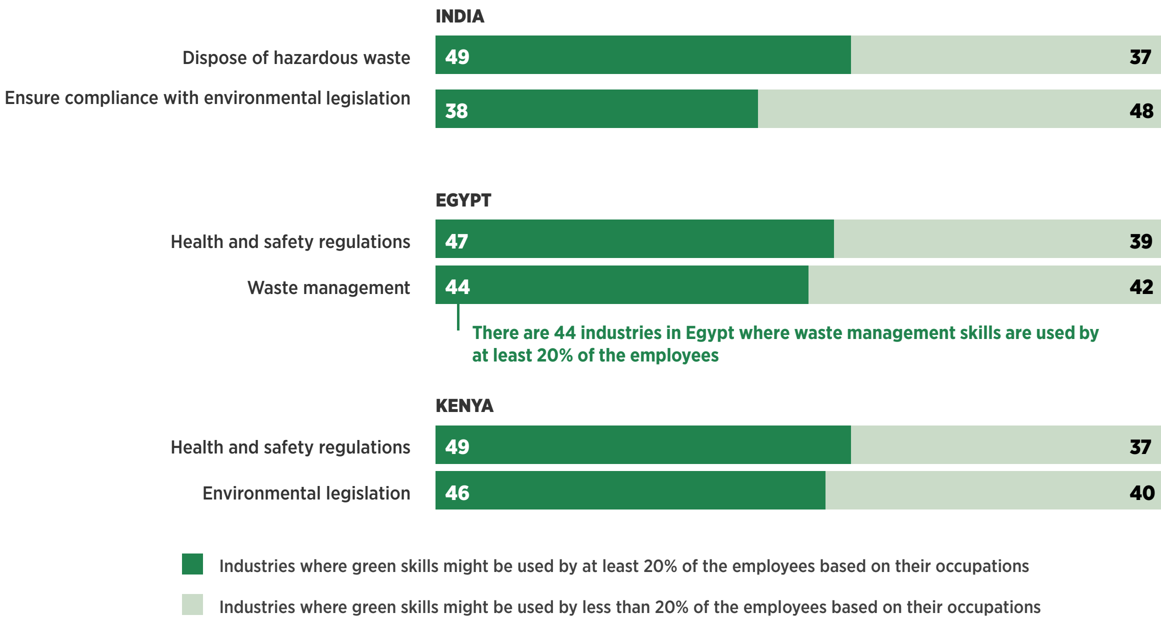
Figure 2.9: Some green skills are versatile and are being used across many industries



Source: Egypt, India and Kenya online job postings data 2022-2023 obtained from JobKred. ESCO skills classification applied using Generative AI, ISIC Industry

The top green skills are utilized in a diverse range of sectors. Below we show the most versatile green skills in Egypt, India, and Kenya.

Figure 2.10: Some green skills are being used very widely across industries



Source: India Labor Force Survey 2022-23 Egypt Labor Force Survey 2022, Kenya Continuous Household Survey 2021 Microdata, cross-walk with ESCO skills classification. Details on methodology are available in Box 2.1.

But green skilling opportunities can also be unpredictable and inequitable

Unpredictable

Green skills that are in high demand can look very different across contexts in ways that are hard to predict. For instance, in Brazil between 2021 and 2023, one of the green skills showing the most growth is *Environmental and Social Governance*. But this skill does not appear in the green skills showing most growth in Philippines. In contrast, *Hazardous Waste Management* was the one of the top five green skills showing most growth in Philippines between 2021 and 2023, but it doesn't appear in the top ten list for Brazil. It is difficult to imagine a clear a-priori rationale for such differences in the growth of green skills.

Green jobs like sustainability manager and energy auditor didn't exist a few years ago.

The types of jobs that are asking for green skills can change quite rapidly. Online job portal analysis done for this report shows that even specific job titles that are requesting green skills can change substantially over short periods of time. For instance, in India, online job advertisements for '*Credit Advisors*' were seeking green skills related to advice on corporate social responsibility in 2023 but not in 2022. Similarly, in Egypt, online job advertisements for '*Freight transport dispatchers*' were seeking green skills related to developing efficiency plans for logistics operations in the period October 2022- March 2023 but not in January – September 2022. This is corroborated by LinkedIn data from advanced economies, where some green jobs are quite new, but growing quickly. These include job titles like sustainability manager and energy auditor which didn't exist a few years ago.[266]

Unexpected changes in global trade and regulations are another source of unpredictability. The EU Carbon Border Adjustment Mechanism (CBAM) is a border tax that has significantly impacted the demand and supply of skills in its key trading partners such as Türkiye and Mozambique.[267] Türkiye, a large trading partner with the EU, has started revising its national policies and strategies, and adopting EU standards and norms of production and emissions reductions to be compliant. Mozambique, where nearly 20 percent of total exports are destined for the EU is doing the same.[268] The complex web of international trade means that specific sectors in some lower- and middle-income countries are particularly susceptible to the global policy shift towards the green transition. For instance, iron and steel in Zimbabwe, aluminium in Mozambique and Kazakhstan, cement in Ukraine, electricity in Türkiye, fertilizers in Georgia, among many others are highly exposed to global norms and standards around decarbonized production and distribution processes.[269]

And of course, green skills demand is likely to be unpredictable, just as all skills demand is unpredictable due to rapid technological change. The adoption new technologies such as software, robots, and artificial intelligence (AI) will also impact green skills demand. However, these interactions between the technology and green transitions are complex, making them hard to study and even harder to predict[270]. For example, while AI may eliminate some jobs, evidence from the US indicates that it will alter the tasks for even more jobs. Nearly 80 percent of workers in the US could have at least 10 percent of tasks in their jobs affected by AI.[271] Some of these will be related to the green transition.

Inequitable

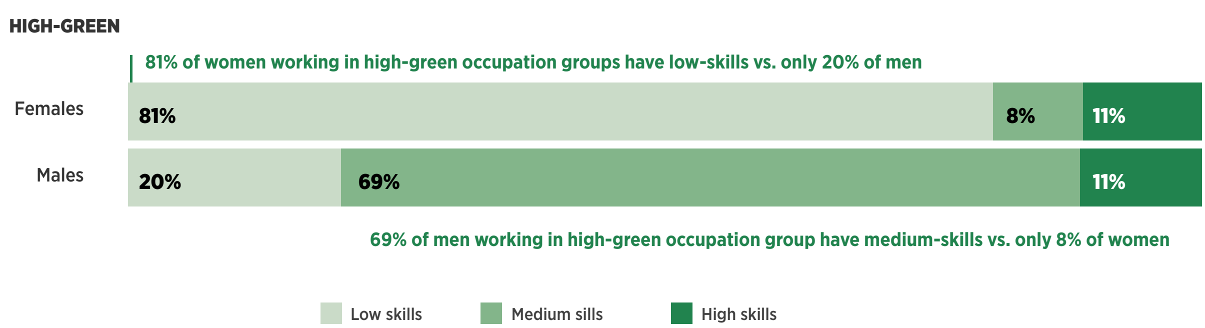
> "We need to encourage girls to enter these areas because, culturally, engineering is for men. You must create spaces where they feel safe taking those courses… They need support from their families to go in that direction. Also, professors might sometimes say you shouldn't be in that space. When explaining a concept in engineering, I had a professor who said, "Now, for the women in the classroom, this is like when you go shopping."
>
> *Industrial engineering student in Colombia. Focus group discussion for this report.*

While it is true that green skilling opportunities are relevant for most economies and workers, they do remain concentrated in a way that benefits some groups more than others. As mentioned above, green skilling opportunities are more widespread in higher-income contexts relative to their lower-income counterparts. In some contexts, these opportunities are much more concentrated in specific sectors or among the highly educated and highly skilled cohorts.

Women may be underrepresented in green skills and green jobs. In high-income contexts, there were 62 women for every 100 men with green talent, a number that has remained stagnant since 2015. Only 1 in 10 women has at least one green skill or green job experience, compared to 1 in 6 men.[272] Analysis from India's Labor Force Survey highlights that compared to men, women represent a much smaller share of green employment, and when they do work in green jobs, they are more likely to be employed in low skill occupations (see Figure 2.11). Novel data for this report shows that 93 percent of young people across eight low-and middle-income countries believe governments should take special measures to encourage women to gain green skills.[273]

In high-income contexts, there were **62 women for every 100 men with green talent.**

Figure 2.11: Women are more likely to be employed in lower skill green jobs



Source: India Labor Force Survey 2022-23 Egypt Labor Force Survey 2022, Kenya Continuous Household Survey 2021 Microdata, cross-walk with ESCO skills classification. Details on methodology are available in Box 2.1.

While women are underrepresented in green jobs overall, they are even more underrepresented in leadership positions within these jobs. For example, data from publicly listed companies worldwide shows that in the environmental services sector 26 percent of employees are women, in executive management the share of women is 23 percent, and in boards this falls to 12 percent. Similarly, in the oil and gas sector, these numbers are 25 percent, 20 percent, and 12 percent.[274]

Green transitions can also exacerbate inequalities because the workers most likely to gain new jobs are not the same workers who are most likely to lose jobs. As mentioned above, the green transition will create new jobs but also destroy some existing jobs. However, those who lose jobs would not have an easy time securing new jobs, because of differences in sectors and skill-requirements. This requires careful policy action, otherwise it will increase inequality.

Students, Workers, and Governments want green skills, but don't know how to get them

Students and Workers

> "I only knew about climate change when I joined the university because I am taking an environmental engineering course."
>
> *3rd year Environmental Engineering and Disaster Management student, Mozambique*

Novel data from young people shows how interested they are in green skills and how little they know about them. A survey of university students and recent graduates across Bangladesh, Kenya, and Mexico (2,800 respondents) reveals that:

- **Young people are deeply interested in green skills**. 91 percent of students were interested in or open to acquiring green skills. Nearly 80 percent were likely to recommend an environmental course or certification to a peer**.** In fact, nearly 43 percent had sought out one or more online courses for green skills.
- **But many lack specific and actionable information on these skills.** Only 14 percent became aware of the concept of green skills in school. Nearly 59 percent became aware of them only when they were in university or college. This means that for most, awareness about green skills may be coming too late for it to optimally inform their education and career choices. They are also misinformed about the nature of green skills: nearly 68 percent mistakenly believe green skills are only technical skills.
- **Information gaps become even more salient when discussing actual labor market prospects.** While 87 percent indicated that they would be interested in jobs related to the climate-sector, nearly 37 percent could not name a single climate-related job. In Kenya, this difference is even starker – while 95 percent of respondents are interested in working in the climate sector, only 43 percent were able to name a climate job that they are interested in.

In Mexico, **only 11 percent believe the green skilling course** they had taken **prepared them well** for environment or climate related jobs.

- **And young people feel unprepared for green skilling opportunities.** While 92 percent of youth believe education can help prepare students for the green transition, only 27 percent believe the current system is doing a good job providing them with the skills needed for this transition. In Mexico, only 11 percent believe the green skilling course they had taken prepared them well for climate or environment related jobs. This sentiment is echoed by professors (124 surveyed in Bangladesh, Kenya, and Mexico), nearly 82 percent consider students to have moderate or high interest in green skills courses. But only 43 percent of lecturers believe green skills will benefit students by enhancing employability in green industries.

Universities in low- and middle-income countries are not offering enough green skilling opportunities. Nearly 46 percent of university lecturers Bangladesh, Kenya, and Mexico find that regulatory barriers towards registering new courses is a significant obstacle. This misalignment between available education and the industry's need for qualified personnel is seen more broadly. While 68 percent of the world's energy-focused educational degrees were oriented towards fossil fuels, only 32 percent focused on renewable energy, failing to fulfill the increasing need for a workforce in clean energy.[275] This means that at its current rate, energy-focused university degrees would be 100 percent dedicated to renewable energy only by the year 2107.[276] In Egypt, most universities only started offering courses in renewable energy in 2019, with only 750 estimated annual graduates across 25 universities.[277]

Governments

Green skills are under prioritized by policymakers. We analyzed green transition policies from 14 countries from different regions and income groups - Bangladesh, Chile, Egypt, India, Kenya, Madagascar, Mexico, Morocco, Niger, Philippines, South Africa, Türkiye, and Yemen. Out of these 14 countries, only five referenced skills in their NDCs (Bangladesh, Chile, Egypt, Philippines, and South Africa). In fact, India, Kenya, South Africa, and Türkiye reference green jobs in their national skilling policies but fail to explicitly mention corresponding development of green skills.[278]

Likewise, education and skills policies often do not reflect national climate priorities. Out of the 14 countries in our climate policy analysis, about two-thirds do not address green skills in their national education policies. Further, only half of the national skills development policies reference green jobs, and only four countries (Bangladesh, Egypt, Kenya, Philippines) mention green skill. The Philippines is the only country in our sample that addresses green skills in detail and even explicitly mentions budgetary allocations for green skills both its national education and skills policy.

And education policymakers are aware of how the education system is letting youth down on green skills. In an online survey of 103 education policymakers from across 33 low- and middle-income countries, 50 percent of government officials believe that students want opportunities to learn green skills, but only 29 percent believe that the ministries of education in their countries are emphasizing green skilling.[279]

Only 29 percent of policymakers across 31 countries **believe their countries are emphasizing green skills.**

What should policymakers do? Priorities for short and medium run.

Efforts to build green skills need to strengthen the pipeline for STEM and technical skills. At the same time, these skilling efforts should recognize a broader view of green skills to leverage their potential across a wide array of sectors and jobs. As the analysis in this chapter has shown, STEM skills are an important component of green transitions, but many jobs and industries can become greener when the right skills are applied. Improving levels of foundational skills, generating, and disseminating information about skill requirements, and creating flexible pathways are essential for both.

By investing in green skills, governments can accelerate green transitions while also improving youth outcomes. This agenda is urgent but can seem intimidating. The debunking of the five myths shows that on the one hand, green skilling opportunities are big and close, so harnessing them should not take a big leap. On the other hand, since these skills are broad and unpredictable, it may be unclear where and how precisely to intervene.

Because the green skilling agenda is big and unpredictable, simply increasing specific narrowly defined courses in tertiary education will not be enough. Green skills cut across sectors that are transversal, dynamic, and diverse**.** At the same time, their demand is changing fast in unexpected ways. It is impossible to anticipate the green skills employers will want even five years from now. It is a mistake to believe that government-provided training in specific and narrowly defined technical and vocational skills will suffice to unlock the potential of green skilling. Such an approach risks creating an education and training system that is always catching up with new demand, rather than being in step with it.

The focus needs to be on facilitation, not just provision. This facilitation can have a short run can have a short-term and a medium-term focus.

Short run priority: Increasing information and accessibility; especially around technical green skills

In the short run, facilitate more information and the availability of market-responsive short courses for green-skilling of both students and workers. Technical skills are required in high skill green jobs that require advanced degrees, and medium skill jobs that require some advanced training but a higher degree. Education systems need to prepare more students on both tracks for green jobs. Specifically, tertiary education systems should be: (i) disseminating information about the returns to specific green skills across sectors and (ii) facilitating availability of short stackable courses for green skilling including in technical and STEM fields that are easily accessible by both students and workers.

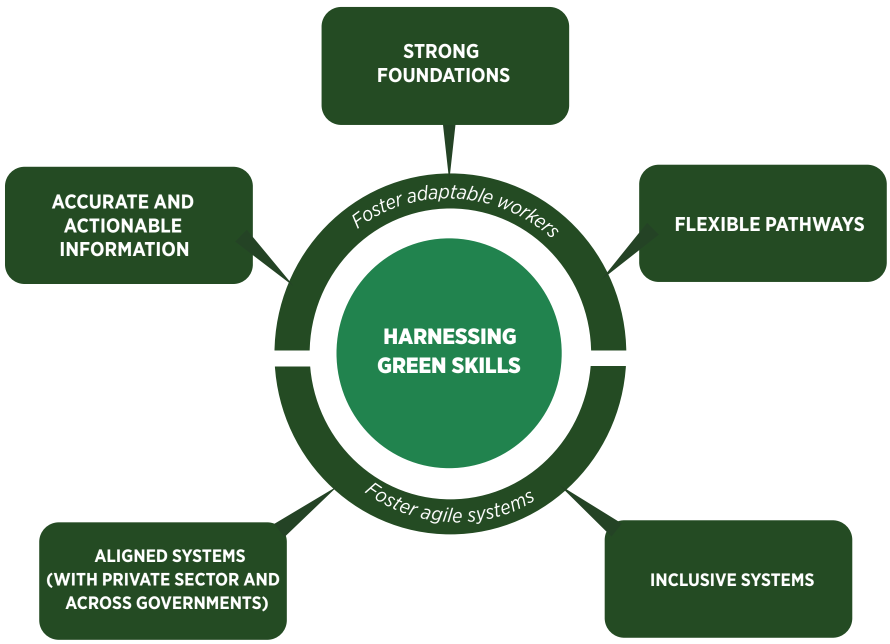
This can be done by strengthening STEM and technical education pathways that prepare workers for green jobs, creating partnerships with the private sector, proactively engaging young people, and providing financial support to the marginalized. For instance, governments can pilot more green training pathways, such as apprenticeships skills boot camps, and on-the-job trainings for skills upgradation. They can also support improved information pathways, so that students are aware of opportunities in green sectors to use the technical skills they are building and can be connected to relevant jobs. Such initiatives can provide more pathways to acquire the technical skills needed for some green jobs, instill in young people an early understanding of green career pathways, boost confidence and help firms address green skills gaps proactively.

Governments can also support the development of workers with technical green skills by laying out the educational requirements to qualify for these positions. This allows education and training institutions to develop courses to prepare workers for these roles and facilitates employment for graduates. In Brunei Darussalam for example, an Energy Industry Competency Framework lays out the skills required for occupations in the energy sector, supporting coordination between training institutions and industry and increasing employability.[280]

Medium run priority: Fostering adaptable workers and systems

In the medium-term, governments should have two priorities - foster adaptable students and foster adaptable systems.

Figure 2.12: Medium-Run Approach to skilling for the green transition



FOSTER ADAPTABLE WORKERS THROUGH STRONG FOUNDATIONS AND FLEXIBLE PATHWAYS

"In Asia Pacific, 77 percent of young people aspire to have a green job within the next ten years."

Laetitia Exertier, Impakter, February 13, 2023[281]

The first priority for education systems is to prepare students better for the big and unpredictable demand for green skills. This has three parts – information, strong foundations, and flexible pathways.

INFORMATION

Students urgently need clear, accurate, and actionable information about green skills and their labor market prospects. While the demand for green skills is booming and tertiary education is more accessible and popular than ever before, employers continue to complain about difficulties finding the right candidates for green jobs. The root cause can often be traced to limited information at the level of students, tertiary education institutions, and employers. As seen above, there are many misconceptions about green skills. To correct this, information needs to flow between the private sector and education sector in a timely way on two fronts. First, better communication of regular information on the returns to different fields of study to help students make better choices. Second, better tracking of graduates' employability.

Tertiary education should invest in information services around green transitions, including job intermediation and search assistance. System-wide mechanisms to collect, produce and disseminate information on costs and returns to tertiary education for students are particularly important. In the context of green skilling programs, governments can use their expanding administrative datasets to develop LMIS, informing training providers, students and workers about in-demand occupations and skills, thus improving career decisions, and reducing skills mismatches.

Bac Thang Long Economic Technical College in Vietnam **uses a local approach including needs assessments and institutional dialogue** adapt their curriculum to labor market needs.

There are some good operational examples of this approach. In Vietnam, Bac Thang Long Economic Technical College uses a local level approach for labor market forecasting gathering information through needs assessment surveys and institutional dialogue. This well-functioning system allows them to effectively translate labor market needs into their curriculum.[282] At a state level, the French National Observatory for Jobs and Occupations of the Green Economy (Onemev) analyses employment changes and trends in the green economy, with special attention to its implications for jobs and skills and produces relevant methodologies and statistics.[283]

Another way to enhance information systems is to undertake graduate tracker studies for green skilling programs. These studies will allow policymakers to better understand the quality and relevance of green skilling programs, especially if they include employer feedback. They can generate data on employability that would be useful for students and employers. They can also shine a light on access and equity issues. For example, since 2016, the World Bank has been supporting the Government of Bangladesh in undertaking graduate tracker studies in tertiary education. These studies have dramatically improved the available information on the functioning of the country's tertiary education system. They have fostered stakeholder discussions, improved planning, and improved design and implementation of tertiary education policy and programs.

STRONG FOUNDATIONS

Green skills can only be fostered on a solid foundation of other bed-rock skills. Government should ensure that each cohort enters the workforce with a solid foundation of skills acquired through basic education. This was discussed in Chapter 1.

Tertiary education systems should also guarantee a minimum threshold of transferable cognitive and socio-emotional skills. The future of work increases the demand for higher-order general cognitive skills—such as complex problem-solving, critical thinking, and advanced communication—that are transferable across jobs[284] but cannot be acquired through schooling alone. This demand will also apply to jobs for the green transition. Similarly, specific socio-emotional skills such as teamwork, collaboration, etc. are in high demand for green jobs (as seen above) and beyond.

Tertiary systems need to be re-jigged to ensure that all students are equipped with such core general cognitive skills and socio-emotional skills that are transferable across jobs. An additional year of general education was added in 2012 to undergraduate programs in Hong Kong SAR, China, focusing on problem-solving, critical thinking, communication, leadership, and lifelong learning skills. For a large majority of students, this change seems to be effectively promoting desirable graduate attributes. Other systems are adopting innovative pedagogy. In Tunisia, introducing an entrepreneurship track that combines business training with personal coaching reshaped the behavioral skills of university students.[285] Through the USAID Young Southeast Asian Leaders Initiative – Mekong Program (YSEALI-Mekong), youth aged 18 – 35, undertake a tailored leadership development program that provides them with knowledge, training, networking, and a platform to take action on climate change issues and promote sustainable development in the Mekong region. YSEALI focuses on critical topics such as civic engagement, economic empowerment, social entrepreneurship, along with environmental education.

FLEXIBLE PATHWAYS

Strong foundations in basic and tertiary education need to be coupled with flexible pathways, in three ways.

First, more flexibility between different tracks, especially general and vocational education. This means that when students open the door to one pathway, the doors to other pathways do not close irrevocably. In most countries, students need to choose between these streams very early on and once this choice is made—especially if it is for vocational training—it is typically difficult and expensive to reverse. Building flexibility between general and vocational tracks will help students build combinations of general and technical skills, that seem to be in demand in green jobs. It also allows people trained in narrow vocational green skills (e.g. solar panel installers) to benefit from wider opportunities.

Building flexibility between general and vocational tracks will help students build combinations of general and technical skills.

Second, more flexibility to access short term courses and stackable credentials, that allow students to build customizable combinations of skills. The lead times required to bring on a heat pump installer or wind turbine engineer - from inspiring interest in STEM in schools through the necessary apprenticeships and university degrees and into the workforce – can be extremely long and rigid. However, both the labor market and the students require rapid, "just-in-time" skilling opportunities.

Stacking credentials is an increasingly popular higher education policy and can be particularly beneficial for green skilling. It has multiple advantages: it ensures individuals can get credit for a range of different learning experiences and build customizable skill profiles; it supports students who want green skills but may be unable commit to longer-term programs; it also helps companies reskill through training and credentials. For example, a student might complete a short-term certificate in environmental systems one term and later return to apply some of those credits to earn an associate degree in environmental management. The short-term certificate enables the graduate to immediately gain work experience in the field and the second credential helps them advance along that career ladder. In the US, seventeen states have allocated funding to colleges to develop stackable credentials pathways, and 10 states require that their community college systems offer and advertise stacking options.[286] One US study shows that stacking increases employment by four percentage points and quarterly wages by four percent.[287]

Third, more flexibility to access skilling opportunities irrespective of age or location. To truly transform tertiary education for lifelong learning. Technology-enabled platforms can help make green skilling more accessible, especially for those already in the labor market or those with historically low access. Sustainability-related courses are being offered as Massive Open Online Courses (MOOCs) on various platforms, such as Edx, Coursera, Canvas.net, and FutureLearn, with universities from high-income countries such as the US, UK, Netherlands, and Canada providing them. The topics covered in these courses include energy, sustainable development, natural resources, ethics, sustainable economy, ecology, climate change, green engineering, among others.[288]

Tertiary education and training can be harnessed for workers who have been negatively impacted by job-transitions. In Scotland, for example, the government has focused on subsidizing training for displaced workers. A Transition Training Fund (TTF) offered grants for the retraining of oil and gas workers who have lost their jobs or are at risk of redundancy. The TTF ran from 2017 to 2019 and supported reskilling and training for 4,272 workers. Nearly 89 percent of the participants found a job after completing the program.[289] Similarly, the Government of Portugal introduced the Green Skills and Jobs Programme in 2023, aimed at reskilling and upskilling employees of enterprises directly or indirectly affected by the energy transition and climate action, as well as the unemployed. Training courses are based on identified skills gaps and needs, incorporating short- and medium-term courses as well as training activities that fall within the scope of energy and environment.[290]

BOX 2.3: POLICY EXAMPLES FOR FOSTERING ADAPTABLE WORKERS

In France, Onemev generates data with the aim to monitor the green transition and its impact on skills and jobs

National Observatory for Jobs and Occupations of the Green Economy (Onemev) France
The French National Observatory for Jobs and Occupations of the Green Economy (Onemev) analyses employment changes and trends in the green economy, with special attention to its implications for jobs and skills and produces relevant methodologies and statistics. Collaborating across institutions, Onemev is responsible for providing forecasting and statistics on the impact of the green transition on the jobs, tasks, and education needs. The observatory also identifies required competencies and appropriate reskilling/upskilling programmes to facilitate the transition.

Learn more

YSEALI in the Mekong region equip youth with climate knowledge along with transferrable skills

YSEALI
Young Southeast Asian Leaders Initiative

Young Southeast Asian Leaders Initiative – Mekong Program
Through the USAID Young Southeast Asian Leaders Initiative – Mekong Program (YSEALI-Mekong), youth aged 18 – 35, undertake a tailored leadership development program that provides them with knowledge, training, networking, and a platform to take action on climate change issues and promote sustainable development in the Mekong region. YSEALI focuses on critical topics such as civic engagement, economic empowerment, social entrepreneurship, along with environmental education

Learn more

The Government of Portugal offers flexible pathways through reskilling and upskilling opportunities in the green transition

Portugal's Green Skills and Jobs Programme 2023. The Green Skills & Jobs programme, created under the umbrella of the Portuguese 2030 Energy and Climate Plan, offers short- and medium-term training courses in the environment and energy fields to prevent the risk of unemployment, promote job retention and encourage the creation of new jobs in the context of accelerating the country's energy transition and efficiency. Training areas focus on energy efficiency, renewable energy, water efficiency, sustainable mobility and circular economy. The online or face-to-face training courses, ranging from 25 to 375 hours, are integrated into the national qualifications and can be developed as certified modular training, allowing the certification of individual modules.

Learn more

Medium-Run Priority 2: Foster agile systems that are aligned and inclusive

ALIGNED SYSTEMS

System agility and alignment needs to happen at two levels. First and most importantly, between the tertiary system and private sector. Second, across different government units and entities.

In South Korea's **vocational high schools** industries are involved in curriculum planning, school boards, and graduate recruitment.

Close collaboration between industry and tertiary education will play a critical role in smoothing and accelerating green transitions. Green skilling tertiary programs can be designed to have built-in linkages to labor market for on-the-job training. Close collaboration with the private sector can help ensure that programs equip students with the technical skills required in specific jobs and industries. Close linkages to labor markets can be fostered through proactive internship programs, active career centers, and strong alumni networks. It is also in the interest of the private sector to coordinate with tertiary institutions so they can expand the pool of adequately skilled workers, identify qualified graduates and invest-in and readily update their own talent pipelines.

Such collaborations between the private sector and education institutions can be fostered in different ways. In South Korea, the government encourages industry-academy partnerships in the provision of skills development through 'Meister' schools (vocational high schools) where industries are involved in planning the curriculum, school management boards, and the recruitment of graduates. These schools have specialized courses in areas such as renewable energy, carbon reduction energy, LED applications, and the green transportation sector. As of 2021, Meister high schools account for 2.2 percent of all high schools in the country.[291] Another example is the MOBILISE project, a collaborative effort between the Netherlands and Tunisia, Egypt and Ethiopia for the strengthening of climate-smart agriculture. The project seeks to meet the demands of the labor market in participating countries by involving partners from the public and private sector while developing cooperation with local higher educational institutions.[292]

Another aspect of private sector collaboration is fostering university-based innovation for green technology development and diffusion. To do this, it is important to provide funding opportunities for technology development and early-stage funding for clean tech startups as well as incentives for academics to participate. It is also important to foster inter-disciplinarity in research and strengthened collaboration with non-academic actors and foreign organizations.[293] Such approaches can help foster academic entrepreneurship and accelerate spinoffs - from research institutions to market applications. Some examples where universities are a key part of green innovation clusters include the California (US) and Jiangsu (China) solar PV clusters, the U.S. Great Lakes region wind cluster, and the São Paulo and Midwest U.S. ethanol clusters.[294] The Indian Institute of Technology (IIT) Madras Research Park innovation cluster is bringing together researchers and nearly 30 companies to address the R&D requirements, skills development, incubator creation, testing and validation standards, and policy advocacy within the *Green Hydrogen* sector.[295]

Africa Centers of Excellence[296]**, a series of regional higher education projects (co-financed with the World Bank), demonstrate the transformative power of higher education for green innovation.** For example, the ACE at the *Institution for Training and Research in Water Science and Technology* in Burkina Faso created a startup called *TECO* which uses recycled plastic waste to produce ergonomically designed economic eco-benches for use in local classrooms. The ACE for *Water and Sanitation* in Benin has partnered with over 50 private sector organizations to improve water quality and management by developing a strategic plan for the management of water resources and a flood warning system. The ACEs in *Crop Improvement* in Ghana and Uganda and the ACE in *Dryland Agriculture* in Nigeria have developed and released to farmers over 200 high yielding, pest, disease and climate/drought resilient varieties of crops, including tomatoes, groundnuts, maize, etc.

Alignment is also important across government entities. Climate policies need to integrate education and education policies need to integrate climate. Climate policies and investments have generally overlooked the education and skilling interventions needed for achieving climate mitigation and adaptation goals. And by overlooking education and skilling, countries are under-leveraging a powerful and vital fuel for their green transitions.

The first step to fix this is better coordination between education, labor, and environment policy and programming. Better coordinating these three key policy areas better will help avoid inconsistencies and mismatches between skills demand and supply that can hamper green transitions. Dialogue and collaboration across these areas is key to coherence.

The second step is to redirect a bigger share of development and climate change funds to well-designed skilling interventions. This will be money well spent. Education provides foundational skills, cognitive skills, and socio-emotional/ transversal skills which can enable a country's workforce to adapt to rapidly evolving labor market needs of the green economy. It can also help mitigate the cost of adapting to the green transition (job losses and job changes) through upskilling and reskilling. Countries and economies that can proactively drive the green transition through research and innovation are also likely to be least impacted by its ill-effects.[297]

Finally, foster meaningful collaborations across ministries and between the public and private sectors to leverage the win-win opportunities. The Philippines, for example, has taken a whole of government approach to creating green jobs and equipping workers with the skills to take on these jobs. The Philippines Green Jobs Act of 2016 is specifically designed to generate, sustain, and incentivize green jobs. It promotes training for green jobs by mandating the appropriate Commission and Department develop and implement curricula to support the skills and knowledge requirements of a green economy. It tasks the appropriate Commission to develop training regulations and qualifications frameworks to facilitate the certification of skilled and professional green manpower. At the same time, this act provides financial incentives for green job creation, including tax deductions for skills training, research and development for green jobs, and tax-free imports of capital equipment that would be used directly and exclusively to promote green jobs. The Department of Labor and Employment together with the Philippine Statistics Agency, maintains a database of green jobs as well as a list of companies that are expected to create new clean energy jobs in support of skills training assessments and certifications.[298]

The Philippines Green jobs act of 2016 provides financial incentives for green job creation, and promotes training for green jobs, setting qualification standards to certify workers have the necessary green skills.

Similarly, India's Skill Council for Green Jobs (SCGJ) was established in 2015 to address skilled manpower requirements for India's climate commitments. SCGJ coordinates with various ministries and government programmes particularly related to clean energy and industrial schemes. It is working towards introducing green jobs vocational education in schools, universities, and engineering institutions. It has so far developed 44 nationally approved qualifications across various sub-domains (e.g. renewable energy, waste management, etc.), along with supplementing coursework and content. SCGJ through its partners has enabled training of over 500,000 candidates, including over 100,000 in solar and other renewable energy domains. In addition, SCGJ has developed an e-learning management system through which over 4,000 candidates have received virtual training.[299]

INCLUSIVE SYSTEMS

> "If well managed, we have a unique opportunity to not only protect the environment but advance gender equality and intergenerational equity, at the same time as creating millions of jobs."
>
> *Jessica Cooke, Plan International, February 2023*[300]

Green skilling efforts should prioritize marginalized groups including women, youth, and displaced people. There is a relatively high concentration of green jobs in STEM and technical fields and construction, which still tend to male dominated in some countries. Girls globally represent 35 percent of students enrolled in STEM-related fields of study.[301] In Lebanon, for example, the average enrollment of females in sciences is about 54 percent, while it is only about 25 percent in engineering.[302] Only 122 out of 1,000 "most influential" climate scientists are women.[303]

Governments should aim to make programs available across regions, with a focus on marginalized areas. Often the costs and opportunities presented by the green transition are unequally distributed across geographies. Governments should try to ensure that in addition to equitable distribution across groups, investments in skills building are equitably distributed across geographies. The Canadian Government launched the Sustainable Jobs Plan (SJP) in February 2023. One of its goals is to address existing inequities in the distribution of jobs in the energy sector, which are primarily concentrated in the oil and gas-rich regions. The SJP focuses on including each province and region, indigenous people, and other marginalized groups. The Plan involves developing economic strategies through the Regional Energy and Resource Tables—a collaborative initiative—and advancing funding for skills development towards sustainable jobs for jobseekers and workers of all ages.[304]

Programs should aim to create pipelines for women and marginalized groups into green skills focused fields of study and jobs. Programs that give students exposure to role models and mentors, particularly when the role model comes from a similar background or gender to the student, can increase students' persistence in education and performance in school.[305]

Another dimension of intentional inclusion is migrant youth. As climate change accelerates more families and youth will experience displacement. In light of this, governments should remove barriers to access faced by migrant groups. These can include barriers due to language differences, lack of documented previous qualifications, or legal status. To increase efficiency and uptake, implementers should also focus on including climate education and sustainability elements in existing programs, rather than creating new ones. For instance, Campaign for Female Education (CAMFED), a large NGO active across East and West Africa, has added climate science training and sustainable farming techniques to their existing, successful CAMFED Learning Guide Program. Women trained in this enhanced program return to their communities to promote sustainable farming techniques such as intercropping, crop diversification, and waste management.[306]

BOX 2.4: POLICY EXAMPLES FOR FOSTERING AGILE SYSTEMS

Meister schools in South Korea leverage industry-academy partnerships for green skills development

Meister High Schools
Meister high schools are high-performing vocational high schools that provide tailored curriculums directly connected to industry demand for professional vocational education development. As of 2022, 54 schools are recognized as Meister high schools, of which 53 are in operation. Meister high schools achieved more than 90% employment rates between 2013 and 2017. The industry-school-government (both central and local) cooperation system was established to enable Meister high schools to rapidly detect and actively respond to industry changes and effectively nurture core talents for national and local strategic sectors through their linkage with relevant ministries.

Learn more

The Philippines Green Jobs (2016) act collaborates across government agencies to incentivize green jobs

The Philippines GreenJobs Act of 2016.
This major piece of legislation was designed to create and maintain jobs in the emerging green economy using a whole-of-government approach. Implemented by the Department of Labor and Employment (DOLE), the Act brings together 21 government agencies to oversee the development and implantation of curricula and certifications for skills needed for a clean energy transition e.g. the Department of Trade and Industry has developed a facilitation programme for people and businesses that create green jobs.

Learn more

The Sustainable Jobs Plan adopts a pan-Canadian approach to sustainable jobs in every region of the country

Sustainable Jobs Plan Canada
The Canadian Government launched the Sustainable Jobs Plan (SJP) in February 2023. One of its goals is to address existing inequities in the distribution of jobs in the energy sector, which are primarily concentrated in the oil and gas-rich regions. The SJP focuses on including each province and region, indigenous people, and other marginalized groups. The Plan involves developing economic strategies through the Regional Energy and Resource Tables—a collaborative initiative—and advancing funding for skills development towards sustainable jobs for jobseekers and workers of all ages.

Learn more

ANNEX A: DEFINITIONS AND METHODOLOGY FOR GREEN SKILLS ANALYSIS

Definitions

The “greenness” of the labor market can be analyzed at four levels:

- **Industry level:** Industries can be analyzed for the proportion of products or services produced by the industry that reduce environmental impact such as conserving energy or reducing pollution.[307]
- **Job level:** A job is considered green if it produces a final output that benefits the environment, promotes production processes that are environmentally friendly, or produces its final outputs in a way that generates fewer negative impacts on the environment.[308]
- **Task level:** Where green tasks are those that produce green outputs or reduce an environmental footprint, regardless of the job or industry they are performed as a part of. Classifications of tasks as green can then be used to calculate the relative greenness of a job by the proportion of tasks performed in the job that are green.[309]
- **Skill level:** Where individual skills are identified as green or nongreen; based on how they are being applied.

Various taxonomies have been developed to enable the description and measurement of “greenness” at these levels, with different approaches to classification within that level.

We adopt a skills-based approach. In our discussion of green skills, we emphasize the skills needed for reducing environmental impacts, adapting to climate change, and supporting a green transition. In our analysis, we adopt the definition used by the European Classification of Occupations, Skills and Competences (ESCO), which focuses on skills that support the green transition. ESCO follows the Cedefop (2012) definition to label skills and knowledge concepts needed to live in, develop and support a society which reduces the impact of human activity on the environment as green skills.[310] Their labeling of skills and knowledge concepts as green follows a methodology based on a 3-step process, which combines human labelling and validation, and the use of Machine Learning algorithms. For example, as per the ESCO classification conducting energy audits is a green skill.

We define green jobs as jobs that draw on green skills. To define green jobs, one can take a firm’s perspective (firm’s output or technology) or a worker’s perspective (the tasks workers are doing, or the skills workers need). In this analysis, we use a worker’s perspective, specifically the perspective of the worker’s skills. So, a job is green if workers need at least one green skill to do the job.

Why use a skills-based approach?

Using a skills-based approach to defining green jobs and examining labor demand and supply patterns around green transitions has several advantages. This approach allows us to use a variety of data, while adhering to an intuitive and consistent approach across countries. For Kenya, India, and Egypt we look at supply of green skills using labor force data and demand for green skills using job portal data.

Data on supply of green skills

We measure the supply of green skills using labor force survey data for Egypt (2022), Kenya (2020), and India (2022-2023). These data present number of workers in various occupation groups in the economy using the International Standard Classification of Occupations (ISCO) at ISCO level 3 codes. We use a cross-walk to overlay these occupations with the skills they require in using the ESCO framework, which includes tags for green skills.[311] Then, we calculate what share of skills required by all of the occupations in an occupation-group[312] are green and use this measure to define 'greenness' of different occupation categories. In summary, we leverage labor force surveys, then apply a cross-walk between these and ESCO skills classification, to examine the *green skills share* at the occupation level (three-digit code level). Green skills share refers to the proportion of green skills required in an occupation relative to the occupation's total skill set, as follows:

- **High-green occupation-group**: If more than 15 percent of the skills required in an occupational group are green. In this group we can say with some confidence that nearly all workers have at least one green skills.
- **Medium-green occupation-group**: If between 10-15 percent of skills required in an occupation group are green.
- **Low-green occupation-group**: If between 5-10 percent of skills required in an occupation group are green, it is a
- **No-green occupation-group**: If less than 5 percent of skills required in an occupation group are green.

Figure A1: Defining high-green, medium-green, low-green, and non-green occupation groups using labor force survey data

HIGH-GREEN

This category covers workers in occupational groups with share of green skills above 15% of total skills

ISCO-08 code	TITLE
713	Painters, Building Structure Cleaners and Related Trades Workers
213	Life Science Professionals
961	Refuse Workers

Professions included in these occupation groups include:
1. Decontamination worker (7133.5)
2. Environmental protection professionals (2133)
3. Recycling worker (9612.1)

MEDIUM-GREEN

This category covers workers in occupational groups with share of green skills between 5-15% of total skills

ISCO-08 code	TITLE
713	Painters, Building Structure Cleaners and Related Trades Workers
213	Life Science Professionals
961	Refuse Workers

Professions included in these occupation groups include:
1. Park guide (5113.1.2)
2. Wood processing plant operators (8172)
3. Dangerous goods safety adviser (4323.5)

LOW-GREEN

This category covers workers in occupational groups with share of green skills less than 5% of total skills

ISCO-08 code	TITLE
312	Mining, Manufacturing and Construction Supervisors
132	Manufacturing, Mining, Construction and Distribution Managers
722	Blacksmiths, Toolmakers and Related Trades Workers

Professions included in these occupation groups include:
1. Industrial assembly supervisor (3122.3)
2. Supply, distribution and related managers (1324)
3. Drilling machine operator (7223.5)

NON-GREEN

This category covers workers in occupational groups with no green skills

ISCO-08 code	TITLE
264	Authors, Journalists and Linguists
411	General Office Clerks
951	Street and Related Service Workers

Professions included in these occupation groups include:
1. Translators, interpreters and other linguists (2643)
2. Membership administrator (4110.1.1)
3. Leaflet distributor (9510.1)

The step-by-step process for supply-side analysis is as follows:

1. This analysis uses International Standard Classification of Occupations (ISCO), European Skills, Competences, Qualifications and Occupations (ESCO), International Standard Industrial Classification (ISIC) and available microdata for respective countries (these include labor force and household surveys).

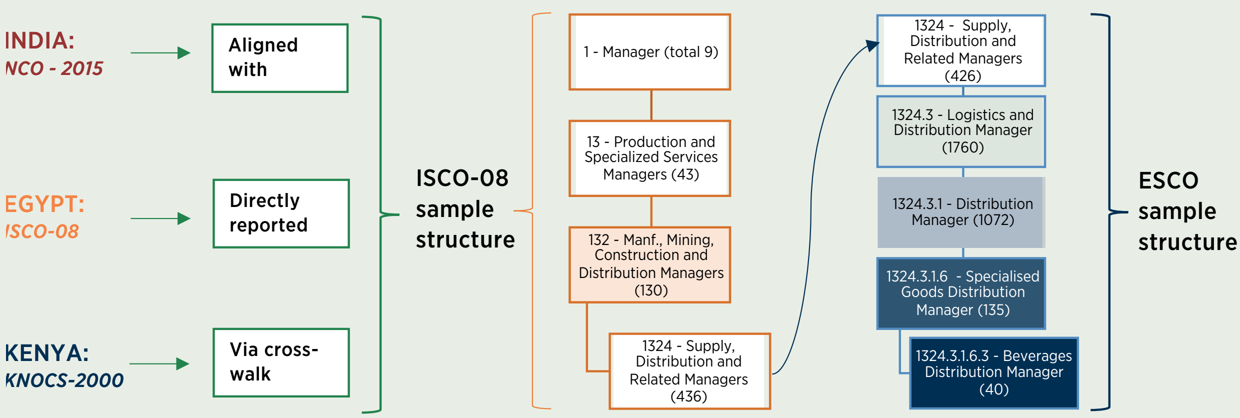
2. Labor force surveys provide information about workers' occupations based on national occupational classifications, generally related to ISCO (version 08 or 88). However, ISCO does not include information on skills linked to occupations. To incorporate this information, we use the ESCO classification. ESCO is an extension of ISCO-08 occupational classification which assigns required skills for each occupation. Overall, around 426 out of total 436 ISCO-08 occupation groups are reflected in ESCO. Note that ESCO skills are not to be confused with skills level provided by ISCO taxonomy, where skills level is a concept that refers to the complexity and range of tasks and duties to be performed in a job.

3. ESCO skills data is available up to most granular occupation. However, granularity of occupational data in countries' labor force survey data is limited to 3-digit (hereafter 'occupation group') level aggregation. To obtain a list of skills at that aggregation, we roll up all the skills sets of occupations that fall into an occupation group.

4. Occupational details of workers in India's Labour Force Survey is reported by 3-digit level granularity of National Classification of Occupations (2015) which is directly aligned with ISCO-08. Similarly, Egypt's Labour Force Survey uses ISCO-08 in reporting occupational details.

5. Occupational details of workers reported in Kenya's Continuous Household Survey, however, is based on its national standard (KNOCS-2000) which doesn't have direct linkages to ISCO-08. Hence, a cross-walk, utilizing OpenAI and manual validation, was developed to map workers' occupations onto ISCO-08.

Figure A2: Step-step process for Green Skills supply analysis



Data on demand for green skills

Demand for green skills is measured using online job portal data. Data were scraped from online job-portals, and jobs were tagged as green if their advertisement on the online job portal contained at least one green skill; and as non-green if they contain no green skills. We do this for two sets of countries.

For Brazil and Philippines, we use job portal data scraped and analyzed by Lightcast[313] for this report. They identify 1.12 million online job postings in Brazil and around 500,000 job postings in Philippines between September 2022 and August 2023. To these data they apply their proprietary classification into green and non-green (instead of the ESCO classification applied elsewhere in the report). Lightcast has identified and tagged more than 500 unique green skills which include skills related to clean energy, climate change, and environmental regulation, and resource management.

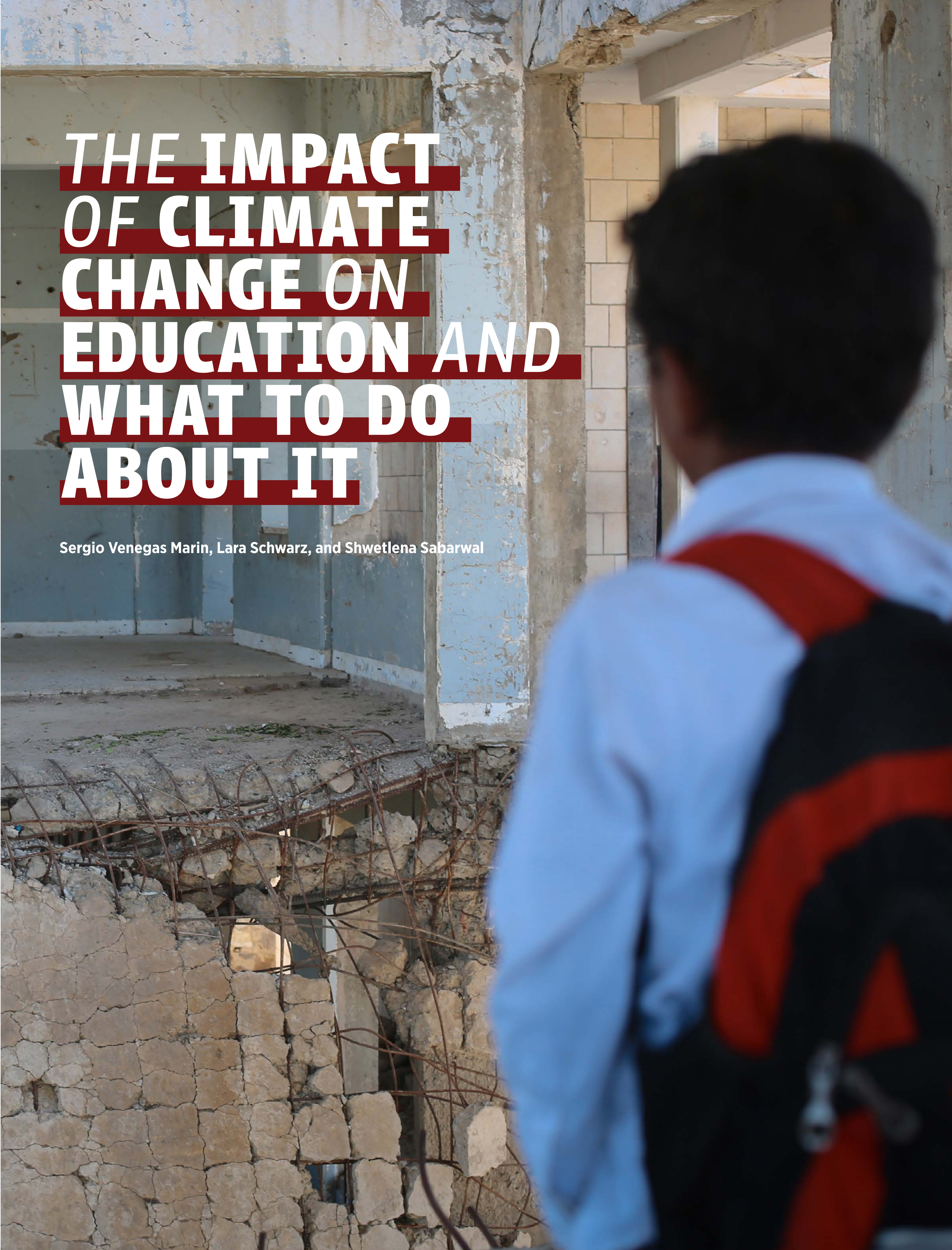
For Egypt, Kenya, and India, job portal data was scraped by JobKred[314]. We obtained data between Jan 2022 and March 2023, from 52,300 job postings for Egypt; 11,500 for Kenya; and 1.8 million for India. The authors use generative AI to extract skills mentioned in the job posting and categorize them. To this, the authors apply the ESCO classification into green and non-green skills to categorize jobs as green (if at least one green skill was included) and non-green (if no green skill was included).

There are three main caveats to our analysis.

1. **First, our green skills classification is not contextually adapted** to the countries where it is being applied. By using the ESCO classification of green skills, we have the advantage of applying well-vetted concepts in a systematic and consistent way across countries. However, these concepts were developed on the basis of high-income country economies and applying them in low- and middle-income country contexts may introduce some bias.[315] This does have the downside that our analysis is not fully customized by the labor market realities of each country. For instance, we may have missed specific green skills that are highly localized and not included in the ESCO definition that comes more from the advanced economies.

2. **Second, the supply of green skills estimations (using labor force survey data) are done in a highly aggregated way.** Because of the way the labor force data is structured, we can only assign green-skills classification at an aggregated occupational group level (three-digit level). This means we cannot identify the actual number of employees with specific skills or the exact employment levels in green occupations. This analysis also excludes employment in agriculture occupations (major occupation code 6: Skilled Agricultural, Forestry and Fishery Workers). This exclusion is done mostly to make the analysis consistent across countries.

3. **Third, for the demand for green skills, data comes from online job portals that offer a limited and non-representative slice of the labor market**.



THE IMPACT *OF* CLIMATE CHANGE *ON* EDUCATION *AND* WHAT TO DO ABOUT IT

Sergio Venegas Marin, Lara Schwarz, and Shwetlena Sabarwal

SUMMARY

Education can be the key to ending poverty in a livable planet, but governments must act now to protect it. Climate change is causing massive school closures. A 10-year-old in 2024 will experience twice as many wildfires and tropical cyclones, three times more river floods, four times more crop failures, and five times more droughts over her lifetime in a 3°C global warming pathway than a 10-year-old in 1970. Over the past 20 years, schools were closed in at least 75 percent of the extreme weather events that impacted 5 million people or more. Most worryingly, the frequency and severity of school closures continues to grow due to climate change. At least 81 countries shut down schools temporarily due to extreme climate events between January 2022 and June 2024. As a result, an estimated 404 million students experienced significant learning disruptions. These closures are often frequent and long-lasting. During the same timeframe, students in Philippines experienced 23 episodes of school closures. In Pakistan, they lost 97 days of school (nearly 54 percent of a typical academic year). But these cases are not isolated. From January 2022 to June 2024, countries that closed schools to respond to climate shocks lost on average 28 days of instruction in affected schools. Evidence from COVID-19 shows that, on average, a day of school closures is a day of learning lost.

At the same time, rising temperatures are also inhibiting learning. While the size of the impact remains uncertain and highly context specific, temperatures that are very high or deviate significantly from local trends do precipitate learning losses. Heat-related learning losses may appear unremarkable when looking at changes in average temperatures over time. However, detailed new analysis shows that even the small learning impacts of slowly increasing temperatures could amount to significant cumulative losses over time, especially for those in hotter regions.[316] An average student in the poorest 50 percent of Brazilian municipalities could lose up to 0.5 years of learning overall due to rising temperatures. Together these effects will lead to significant learning losses which will turn into significant income losses, lower productivity, and greater inequality.

Despite these catastrophic consequences, education remains overlooked in the climate policy agenda. Education made up less than 1.3 percent of climate-related official development assistance in 2020 and mentioned in less than 1 in 3 Nationally Determined Contribution plans.

This chapter lays out four concrete ways in which governments can protect education systems from climate change so that their positive impacts on economic development, poverty alleviation, and social cohesion can be sustained and boosted. These are: (i) education management for resilience; (ii) school infrastructure for resilience; (iii) ensuring learning continuity in the face of climate shocks; and (iv) leveraging students and teachers as change agents. The chapter presents an actionable agenda for each of these with operational examples in different contexts.

Climate change is threatening education outcomes

> "[The 2019 cyclone] demolished houses—even our dishes were broken—and both our hospital and school were damaged. Our classroom was destroyed. And at the spot where I used to study under the mango trees, the books, pictures, and notebooks got really wet when it rained."
>
> *Candida, 12-year-old student, Mozambique*

Education needs to be protected from climate change. Climate change is increasing the frequency and intensity of extreme weather events such as cyclones, floods, droughts, heatwaves, and wildfires as well as the probability of co-occurring events.[317] These extreme weather events are increasingly disrupting schooling; precipitating learning losses, dropouts, and long-term impacts. The education of 75 million children is estimated to have been disrupted by conflict and natural disasters. These are projected to increase in frequency and severity with climate change.[318] Over 99 percent of children around the world are exposed to at least one major climate and environmental hazard, shock or stressor and nearly half of the world's children live in extremely high-risk countries for climate shocks.[319] These are eroding education outcomes and recent progress in improving school access and learning.

Extreme weather events threaten learning, enrollment, and the future prospects of students through both direct and indirect channels.[320] Direct effects of climate shocks harm the quality-of-service delivery and classroom environment, increase school closures, extend the length of those school closures through the use of schools as emergency centers, and destroy school infrastructure. Indirect effects can emerge through economic shocks, food insecurity, health shocks, and increased conflict, migration, and displacement (see Figure 3.1). These indirect pathways result in reduced student readiness to learn due to health and nutrition shocks, diminished demand for schooling due to household coping mechanisms, and disruption to education services due to displacement and conflict.

Climate change is causing massive school closures

> "I have only one thing to say about Cyclone Idai: we were left with nothing. Our houses were all destroyed; the school too. We didn't have classes because classrooms were full of water and the walls were damaged. Later, when the rains stopped, we continued to teach, but under the trees."
>
> *Celeste José Mucaisse, Primary School Teacher, Mozambique*

A 10-year-old in 2024 will experience three times more river floods, twice as many tropical cyclones and wildfires, four times more crop failures, five times more droughts, and 36 times more heat waves over their lifetimes in a 3°C global warming pathway compared to a 10-year-old in 1970.[321] Already, the population affected by climate shocks on an annual basis has more than doubled over the past 40 years (See Figure 3.2).

Figure 3.1: Climate change erodes education outcomes through both direct and indirect impacts

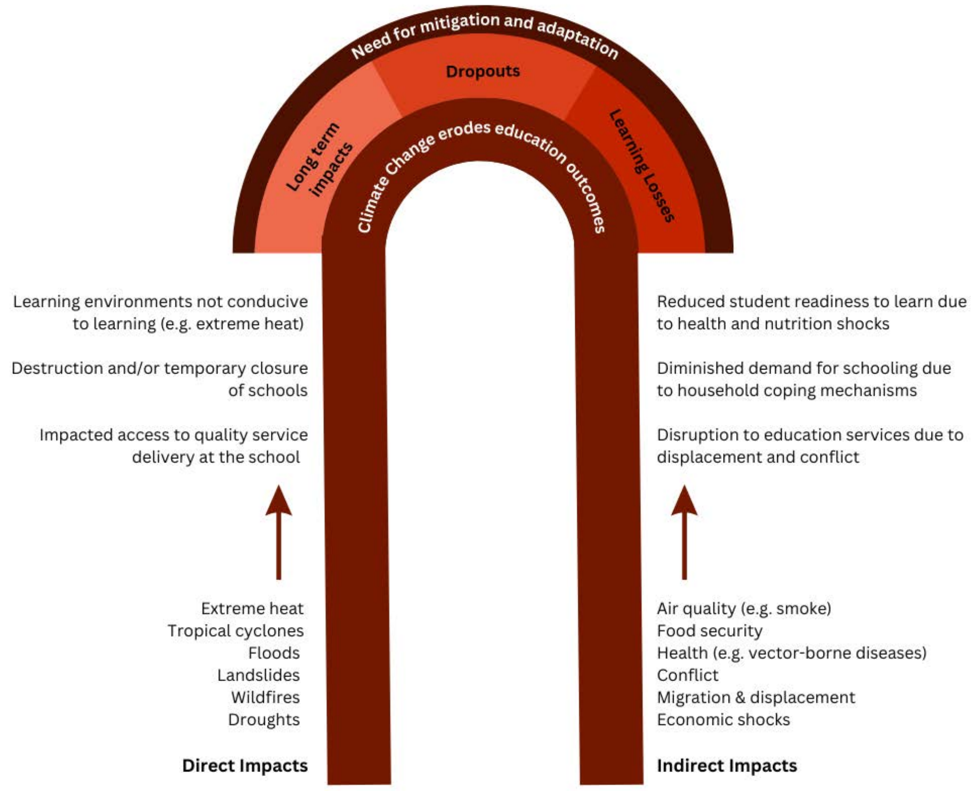
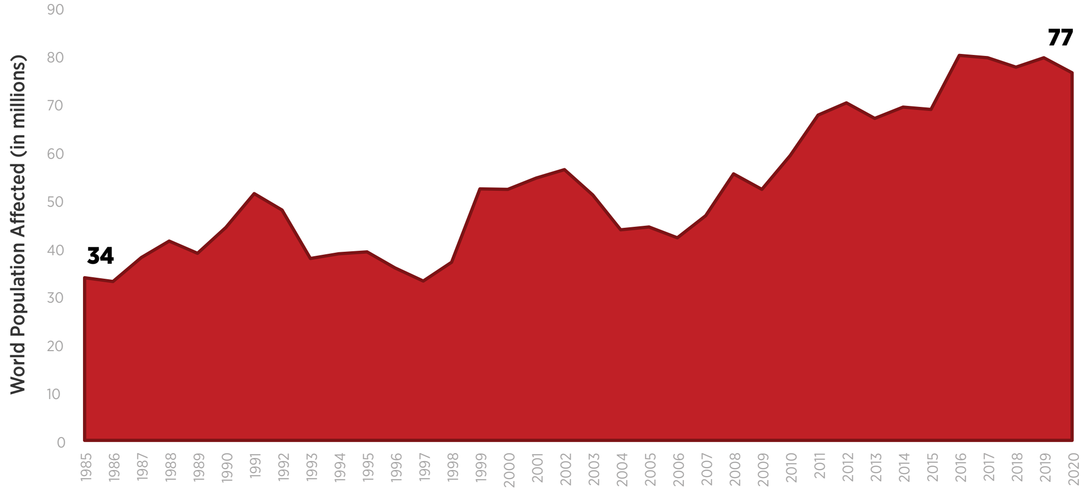


Figure 3.2: World Population Affected by Climate Shocks in 1981-2020, 5-Year Moving Average[322]



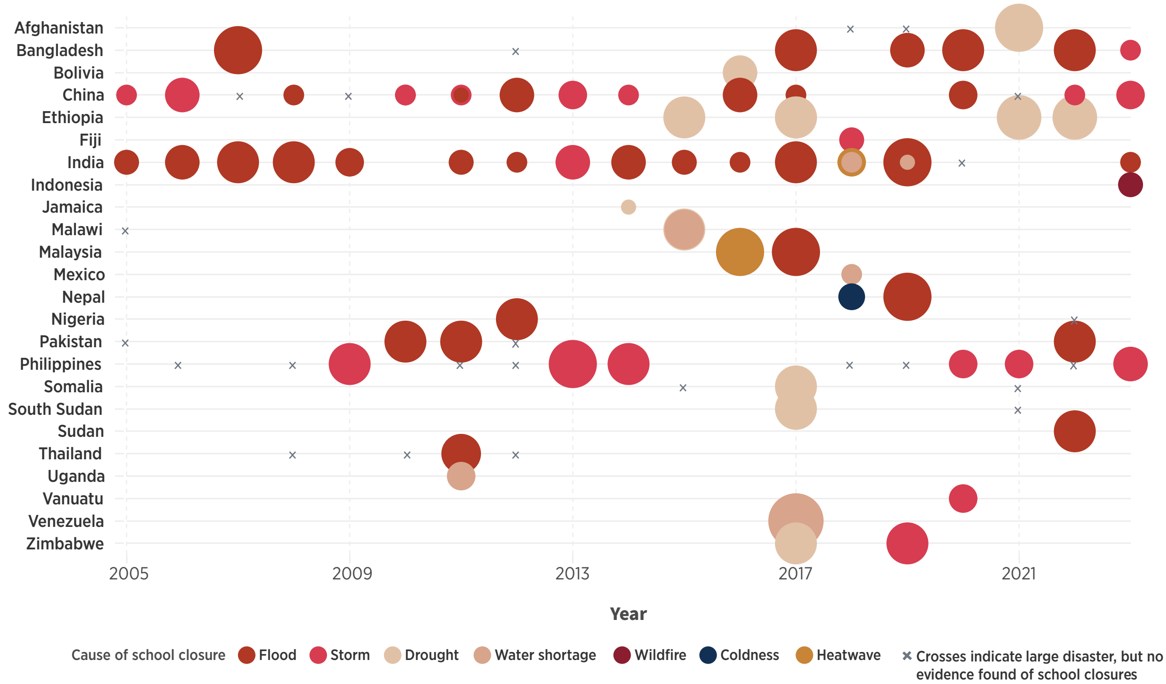
Cyclones, floods, wildfires, and storms cause widespread school closures which generate huge learning losses. When cyclone Freddy hit Southern Africa in March 2023 nearly 5 percent of students across Malawi faced school closures.[323] In the Philippines, over 21 percent of schools are flooded at least once every school year, and this can happen twice a month in some areas.[324] During the 2022 flooding in Pakistan, estimates show that 3.5 million children had schooling disrupted and 1 million children could stop attending school.[325] Higher impacts were observed for children of caregivers who had lower levels of education and income. These closures generate huge learning losses.[326] During COVID-19 (March 2020-2022), each month of school closures translated to a month of learning losses.[327] A day of school closures is a day of learning lost. Flooding in Thailand and Brazil decreased test scores by up to 33 percent.[328]

Cold weather also disrupts schooling and learning. Although cold extremes have been decreasing globally, some regions such as central Asia and areas of Australia and South America have observed increases in both extreme heat and cold.[329] Cold snaps and storms can produce property damage and power failures which can have consequences on infrastructure and educational systems.[330] This can also produce school closures.[331] In Mongolia, children of schooling age living in severely affected districts during winter storms were less likely to have completed basic education ten years after the shock than those children in less affected districts.[332] In January and February 2024, winter storms caused school closures in central and eastern Europe and the midwestern United States.[333]

Most extreme weather events result in school closures. Over the past 20 years, schools were closed in at least 75 percent of the extreme weather events impacting 5 million people or more (see Figure 3.3). In Malawi, 42 percent of primary schools were closed due to the drought in 2015, forcing over 130,000 boys and girls to drop out of school. In the Philippines, cyclones in 2009 and 2013 damaged 4,300 and 19,300 schools respectively, leading to extended school closures. As the incidence of extreme weather events continues to increase, so does the likelihood of these school closures.

Despite their prevalence, climate-related school closures remain invisible because no one is tracking them. There is no official data on the frequency and severity of school closures due to extreme climate events, including heatwaves and floods. Consequently, this crisis is going largely unnoticed. And it is a crisis because school closures don't just interrupt children's learning but also exacerbate educational inequalities, disproportionately affecting vulnerable populations and jeopardizing future opportunities.

Figure 3.3: Most countries experience more climate-related school closures every year



Shown is an index on school closures that combines the duration of school closures and their geographic spread. The larger the bubble the larger either the length of the school closure or the number of people affected, or both. Source: Angrist et. at (2023). Building resilient education systems: Evidence from large-scale randomized trials in five countries. No. w31208. National Bureau of Economic Research. Compiled school closure information based on press releases of the United Nation's Office for the Coordination of Humanitarian Affairs (OCHA) ReliefWeb, World Vision, UNICEF, the BBC, and other local outlets.

Between January 2022 and June 2024, an estimated 404 million students, at a minimum, faced school closures due to extreme weather events.[334] These widespread disruptions spanned at least 81 countries, with 63 of them being low- and middle-income nations. Schools were forced to close temporarily in response to floods, storms, and heatwaves. We estimate these by drawing on an extensive review of media reports documenting schooling disruptions caused by floods, storms, and heatwaves. Importantly, these estimates only account for direct closures caused by these severe weather events, as reported through press releases and media outlets. These estimates exclude closures where the link to climate change is indirect. For example, in 2024, schools in Malawi and Zambia shut down due to a severe cholera outbreak, which was precipitated by heavy rains in 2023. They also exclude small-scale and localized school closures that are not covered by media. This means the actual number of students affected by climate-induced disruptions is likely much higher, indicating that the crisis is even larger than the numbers suggest.

Students in climate-vulnerable contexts are particularly at risk of losing significant schooling due to climate-related school closures. Climate-vulnerability of schools can manifest in both frequency and duration of school closures. In countries like the Philippines, the frequency of school closures is quite dramatic, with at least 23 episodes of climate related school-closures between January 2022 to June 2024. In other cases, climate-related school closures can be long lasting. When heavy rains hit Pakistan in October 2022, devastating floods closed schools nationwide for over 3 months. In Pakistan, students lost 97 days of school (nearly 54 percent of a typical academic year).

In low income countries, students in affected schools lost around 45 instructional days due to climate-related school closures between January 2022 and June 2024.

Between January 2022 to June 2024, countries that closed schools to respond to climate shocks lost on average 28 days of instruction in affected schools.[335] However, the average masks significant disparities. Affected schools in low-income countries lost about 45 days between January 2022 and June 2024 (or 18 instructional days per year), while those in high-income countries lost only 6 days, or 3 percent of a typical year.

The duration of school closures is often prolonged when school infrastructure is vulnerable or when schools are used as evacuation centers. For example, between 50 to 90 percent of 6,000 school buildings across Samoa, Tonga, and Vanuatu may not withstand a strong cyclone.[336] In Zimbabwe, over half of schools (57 percent) reported the complete destruction of some infrastructure following Cyclone Idai which hit the country in 2019.[337] In Haiti, physical damage to the education sector from natural disasters has damaged four out of five schools across the country.[338] In addition, schools are often used as evacuation centers as seen in Haiti,[339] Japan,[340] Libya,[341] Pakistan,[342] and the Philippines[343] have shown. In Pakistan, 92 percent of households affected by flooding in 2022 were still uncertain six months later of when local schools would reopen.[344]–

Even when schools do not close, extreme weather events reduce attendance and attainment. In Brazil there are more absences during the rainy season even when classes are not suspended. This is due to challenges in transportation, particularly for poorer and more vulnerable students. The number of days impacted by small-scale floods ranges from 7 to more than 12 days every year.[345] Students in flood-affected areas spend more time traveling from home to the university on flood days (2.54 hours compared to 1.24 hours on non-flood days).[346]Attendance is also affected with the percentage of students present for face-to-face classes decreasing from 77 percent on days without flooding to 27 percent on flood days.[347] Even online participation can be affected- overall participation on an online learning platform for undergraduate and graduate school courses decreased by 20 percent due to two major typhoon events that affected the Philippines in 2020.[348] In India and Kenya, positive rainfall shocks were associated with 0.2 to 0.8 less years of schooling, respectively.[349]

Some students do not return to school after school closures. In Chile, school closures increased the probability of students dropping out of high school by 49-68 percent.[350] Following COVID-19 school closures, in Ethiopia and Pakistan, school enrollment among children 6-14 dropped by 4 percentage points and 6 percentage points, respectively, once schools re-opened.[351] Declines were much larger for students from lower socioeconomic backgrounds.

Rising temperatures threaten children and their education

A school day under extreme heat is a day in which some learning is lost, but the size of the loss remains uncertain and very context specific. Across 58 developed and developing countries participating in the Programme for International Student Assessment (PISA), each additional hot day (above 26.7 °C) in the three years preceding exams lowered learning by 0.0018 standard deviations, equivalent to 1.08 days.[352] These impacts were stronger on school days and disproportionately affected poorer countries. However, it is difficult to extrapolate these findings to countries and regions of the world where starting temperatures are much higher, and thus, reaching high temperature thresholds represents less of a deviation from normal. In countries with higher temperatures, the temperature threshold needed to be surpassed for learning to be inhibited will naturally be higher. For instance, in India, each additional hot day lowered learning for reading for primary school students by 0.002 standard deviations, similar to the previously cited paper, but this impact was associated with days surpassing a temperature threshold of 29 °C compared to 26.7 °C.[353] A novel survey for this note, covering 103 education policymakers across 33 low- and middle-income countries, reveals that 44 percent of policymakers believe that learning is only compromised when temperatures are above 37.8 °C. This type of finding implies the incidence of days with extreme heat negatively impacts learning, but the size of the impact will be very much dependent on starting temperatures and the local context.

Extreme heat on exam day significantly reduces test scores. Even a modest increase of 1°C in outdoor temperature on exam days can result in a substantial decline in test scores.[354] In China, temperatures exceeding 32°C on exam days, compared to a more moderate range of 22°C–24°C, decreases math scores by 0.066 standard deviations.[355] In Vietnam, each 0.56°C increase in temperature on exam day for college entrance exams decreased standard deviation by 0.006. Notably, female students and those residing in rural areas were most vulnerable to these effects.[356] These big impacts could be particularly problematic for high-stake exams which disproportionately impact a student's future employment and earnings.[357] The effect of extreme heat on Korean college entrance exams is equivalent to increasing class sizes by 2-3 students.[358]

Higher average temperatures overall also negatively impact learning outcomes. In Brazil, an increase of 1°C during the 2 years prior to the basic education national assessment (SAEB) translates into perceptible learning losses.[359] In the United States, test scores decreased by 1 percent for every 0.56°C increase in temperature in the school years leading up to the test.[360] Similar results were also found for English/ Language Arts and Math test scores for students in third grade through eighth grade across the United States. Strong effects were also observed when considering days of extreme heat above 37.8°C. [361]

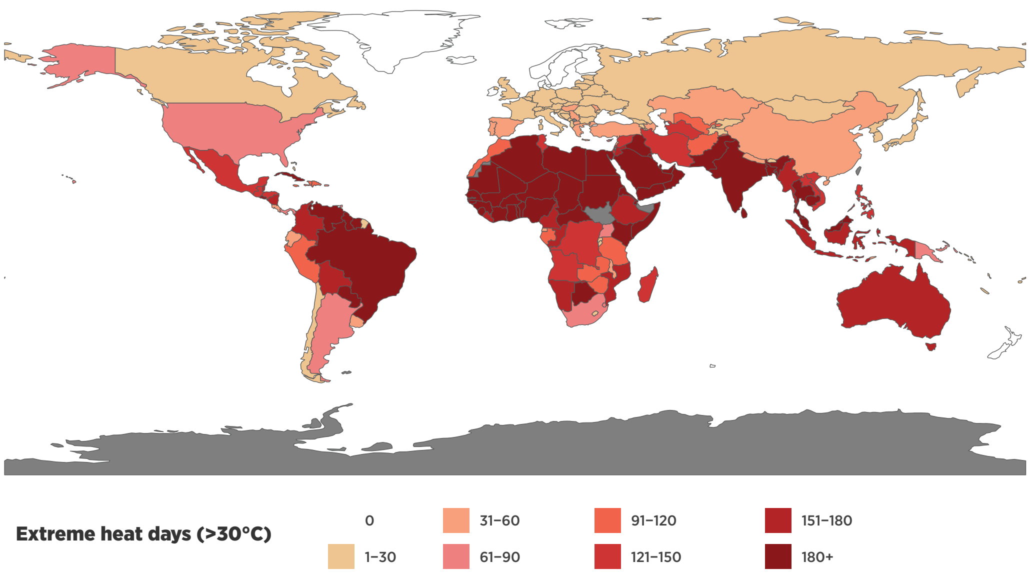
Crossing specific temperature thresholds causes stronger learning losses than an overall relationship between average temperatures and learning may suggest. Therefore, studies that look at increases in the average temperature in the year(s) prior to an exam find relatively small impacts while studies that look at the impact of extreme heat on specific school days find larger impacts. In other words, strong learning losses may emerge only when temperature crosses certain thresholds.

While there is some variation in the precise temperature level, it is clear that exceeding specific temperature thresholds compromise learning outcomes. In several middle- and high-income settings, the ideal classroom temperatures lie between 19.5 and 23.3°C.[362] In those settings, any temperature above 24°C can compromise reaction time, processing speed[363], and accuracy[364] through changes in heart rate and respiratory rates. The heart rates of children can increase by approximately 10 beats per minute for every degree Celsius increase in body temperature.[365] Similarly, respiratory rates can increase by up to 2 breaths per minute per degree Celsius increase in body temperature.[366] In China, higher classroom temperatures increased reported health symptoms of dry throat, dry skin and headaches, dizziness, difficulty in thinking and concentrating clearly, fatigue, and decreased well-being and mood.[367] Across 5 experimental studies, high temperature produced declines in student performance ranging from 2 to 12 percent for each 1°C increase in classroom temperature.[368]

Beyond exceeding temperature thresholds, deviations from normal also matter for learning, and this goes in both directions. The effects of extreme temperatures on learning will differ regionally due to local climate and adaptive capacity. In regions used to lower temperatures, hot days may have a larger effect as the students may not be used to such temperatures. In the United States, learning was more affected by hot days in schools with lower average temperatures (55° F compared to 85° F).[369] Students living in hotter climates may be more resilient to the effects of extreme temperatures and the schools may have stronger adaptation measures to combat these effects. While less common under climate change, the opposite is also true. In regions used to higher temperatures, cold days may have an equally negative impact on learning. For example, in Australia, an additional 10 cold school days with maximum temperature under 15.6°C in the exam year reduced test scores by 1.2 percent of a standard deviation, or 4 percent of a typical year of learning.[370]

Further, even the small learning impacts of slowly increasing temperatures could amount to significant cumulative losses over time. Novel analysis from Brazil shows that students in the poorest Brazilian municipalities, lost about 1 percent of learning due to increasing heat exposure during their schooling time.[371] Despite the seemingly small impact, the cumulative nature of learning makes this estimate significant. An average student in the poorest 50 percent of Brazilian municipalities could lose up to 0.5 years of learning overall due to rising temperatures.

Figure 3.4: Global Incidence of Extreme Heat Days (> 30°C) in 2020[372]



Extreme heat will disproportionately affect the poorest regions. Warmer and lower resource settings are facing higher exposures to extreme heat conditions and as a result experiencing the greatest burden on educational outcomes (See Figure 3.4). A country like Gambia will experience a median of 280 hot days (above 35 C) a year under a pessimistic (SSP5-8.5) scenario while a lower impact of 209 days under a middle of the road (SSP2-4.5) scenario.[373] In contrast, the Netherlands is expected to experience around 2 hot days a year even under the most pessimistic climate scenario. In addition, within countries, hot days will disproportionately affect poorer students who are significantly more likely to attend schools without electricity (or air-conditioning).

Climate change impacts on health and fragility further erode education outcomes

> "Because of climate change… now we have a crisis of water, and then a crisis of land… And then we have terrorist groups again… which has devolved into this civil war we are witnessing now in Mali. And then, because of this insecurity there is no education, there is no security, there is no development."
>
> *Houyame Hakmi, Malian PhD student in Morocco*

Climate change is adversely affecting education outcomes indirectly through a range of health shocks. A child exposed to high temperature in-utero or in early life will attain 1.5 fewer years of schooling in Southeast Asia.[374] Exposure to normal weather conditions in-utero as compared to extreme weather conditions decreases the probability of dropping out of school by 5 percent in Colombia.[375] Vector-borne diseases such as malaria, dengue and Lyme disease are highly sensitive to temperature and precipitation and will increase in many regions under climate change.[376] Around 48 million people could be at increased risk of seasonal malaria transmission and 62 million at an increased risk of endemic malaria transmission in Central, Eastern and Southern Africa by 2030.[377] Rising temperatures also amplify the impacts of air pollution, from wildfire smoke and other sources, on children's health and academic performance.[378] Exposure to fine particulate matter, a harmful air pollutant, lowers test scores as shown with evidence from Brazil, Chile, China, India, Iran, Italy, and the United States (See Box 3.1).[379]

BOX 3.1: CLIMATE CHANGE, *AIR POLLUTION AND EDUCATION*

Climate change can increase air pollutants through changes in photochemical reactions, ventilation and dilution, and removal processes such as precipitation.[380] Climate change is likely to increase global air pollution and associated mortality. Projections have shown that 14 percent of the overall increase in ozone mortality from 2000 to 2100 estimated in a high emissions scenario (RCP8.5) will be attributed to climate change.[381] Although particulate matter is expected to decrease overall, the decrease would be approximately 16 percent greater without the adverse effects of climate change.[382] Poor air quality can affect learning and schooling through closures and impacts on cognition and academic achievement. In Brazil, higher particulate matter ($PM_{2.5}$) and nitrogen dioxide (NO_2) around schools is associated with 0.05 percent and 1.02 percent lower scores, respectively.[383] In China, high air pollution increases school absences, and this was shown to persist for up to 4 days. An air quality that is 10 units higher can produce over 80 thousand student absences student across China every day.[384] The effects of climate change and air pollution can also co-occur and interact, continuing to produce even more detrimental effects in vulnerable regions.

The mental health of students is also compromised by climate shocks. Droughts, hurricanes, and wildfires can also have negative impacts on student mental health. Following hurricane Katrina in the United States, the majority of affected ninth grade ethnic minority students had mild or severe symptoms of post-traumatic stress disorder (PTSD).[385] College students affected by the Fort McMurray wildfires had a 11 percent in PTSD following the fires.[386] Climate anxiety has also been shown to be an increasingly prevalent stressor for youth.[387] Across 50 countries covering 56 percent of the world's population, almost 70 percent of children believe climate change is a global emergency which can produce higher stress and anxiety.[388] These mental health impacts are likely to adversely affect both student learning and retention.

Climate change is causing food insecurity and economic fragility which jeopardize school enrollment. It is estimated that up to 170 million additional people will be at risk of hunger by 2080 due to climate change.[389] This will have adverse effects on student learning and achievement.[390] Extreme weather events strain on household resources and can lead to lower expenditure on schooling lasting years after a shock.[391] In Bangladesh, exposure to cyclones, floods, and droughts increased child marriages as families use bride payments as a coping mechanism to financial hardship.[392] The economic strain of climate shocks on households will increase learning poverty and prevent educational continuity.

Climate shocks exacerbate conflict, displacement, and migration, threatening education outcomes for millions of children. A one standard deviation change in climate (temperature and rainfall) can increase the risk of intergroup conflict by 14 percent and interpersonal violence by 4 percent.[393] Migration and displacement will also increase due to changes in water availability, crop productivity, and wealth which will impact educational continuity for children. Conflict, violence, and war in turn have severe consequences on children's educational attainment and achievement. In some settings, temperature shocks also increase recruitment of boy and girl as child soldiers.[394] Approximately 222 million children are out of school or at risk of dropping out of school due to conflict or crises.[395]

The education impacts of climate change are an economic time-bomb

Reduced education attainment will translate into lower earnings and productivity. Climate change and weather extremes will have severe costs on human capital and human development.[396] School attainment is linked with higher earnings, with estimates suggesting a return of 9-10 percent for each additional year of schooling. These returns are higher in poorer countries and among girls. As climate shocks reduce education attainment, future earnings will suffer. As witnessed with the COVID-19 pandemic, learning losses and lower levels of education attainment reduce income and productivity, with students in grades 1-12 affected by school closures expected to earn 3 percent less in their lifetime. Studies looking at the impact of wildfires also infer deep impacts on future earnings, with estimates implying one year of higher wildfire smoke inhalation reduces future earnings of affected populations in the U.S. by US$1.7 billion. This affects primarily disadvantaged groups.[397] These impacts are compounded by the direct economic effects brought about by climate shocks, which can directly reduce economic growth and levels of output.[398]

The impacts will be felt across generations, as lower education attainment perpetuates cycles of poverty and limits social mobility. Individuals with lower education attainment face economic disadvantages and restricted access to stable employment. These inequalities are transmitted from one generation to the next.[399] Parents with lower education attainment often struggle to offer adequate support and resources for children's education, further perpetuating the cycle of lower education levels within families.[400] This can manifest in various ways, such as limited access to early childhood education due to cost, fewer opportunities for enrichment activities, and inadequate academic support at home. Health disparities also arise, as lower education correlates with poorer health outcomes. The combination of these factors traps families in cycles of poverty, and further increases their vulnerability to climate shocks.[401]

The erosion of education outcomes threatens the progress on poverty reduction. The individual returns to education and the acquisition of skills add up to large benefits for economies. Three-quarters of the variation in growth of GDP per capita across countries from 1960 to 2000 can be explained by changes in math and science skills, highlighting the importance of education in economic security and growth.[402] But for many countries, realizing the benefits of education remains a challenge. In 2019, learning poverty rate in low- and middle-income countries was 57 percent, or 6 out of 10 children could not read and understand a basic text by age 10. In Sub-Saharan Africa, the rate was even higher, at 86 percent.[403] The looming threat of climate shocks, akin to the challenges posed by the COVID-19 pandemic, further worsens the acquisition of vital skills. Without these foundational skills, individuals lack the tools needed to secure stable employment and higher incomes, hindering poverty reduction efforts.

Vulnerable communities, who have contributed the least to climate change, will be the most affected

> "Unfortunately, we are the ones who can no longer mitigate. We have to adapt."
>
> *Lashanti Jupp, Education Activist, Bahamas*

The more severe impacts of climate change will occur in low- to-middle-income countries (LMICs), which are home to 85 percent of the world's children.[404] Yet, these countries contribute the least to carbon emissions responsible for climate change. For example, the ten highest-risk countries collectively emit only 0.5 percent of global emissions. In addition, consumption-based emissions data shows that high income countries are responsible for 92 percent of excess global CO2 emissions.[405] In poor countries, economic growth is reduced by 1.3 percent for each 1°C increase in temperature each year.[406]

Within affected communities, the most vulnerable children will bear most of the effects. Approximately 90 percent of the global burden of disease associated with climate change affects children. According to the Young Lives study which followed the lives of 12,000 children in poor communities across Ethiopia, India, Peru, and Vietnam, children in the poorest households within each country are more affected by extreme weather events. For example, in Ethiopia, 81 percent of children from the poorest households had experienced one or more extreme weather events while 22 percent from the least poor households had been exposed to these events.[407] Certain groups of people will suffer greater climate impacts, including those with chronic illness and mobility challenges, people of color and women and girls, and those from low-income populations.[408]

Education impacts from climate disasters disproportionately harm young girls. Climate-related events prevent at least 4 million girls in low- and lower-middle-income countries from completing their education.[409] In India, girls and children from a lower socio-economic status are more susceptible to flooding and its effect on learning outcomes.[410] More broadly, girls and women are particularly vulnerable to the social responses triggered by weather shocks, especially in places where they face restrictive gender norms.[411] Coping strategies to extreme weather events can be particularly harmful to women. Girls are more likely to experience violence and exploitation related to climate shocks,[412] be forced into early marriage,[413] and become pregnant,[414] all of which can affect their ability to stay in school. During or after weather shocks, boys can also be taken out of schools to be put at work and young men working in agriculture are often forced to migrate to find alternative sources of income.[415]

What should policymakers do? Adapt education systems for greater resilience through four steps

> "We always say climate change is a global issue. But actually, it looks completely different in different cities and countries. And so, children are experiencing it differently, and the solutions also have to be local."
>
> *Keya Lamba, Youth Activist, UK*

There is an urgent need to adapt education systems for climate change. Even if the most drastic climate mitigation strategies were implemented, we will continue to observe extreme weather events having detrimental impacts on education outcomes. For the millions of children that need to attend school over the next 50 years, the results of mitigation will simply come too late. Actions can be implemented now to increase the capacity of education systems to adapt and to cope with these increasingly prevalent climate stressors.

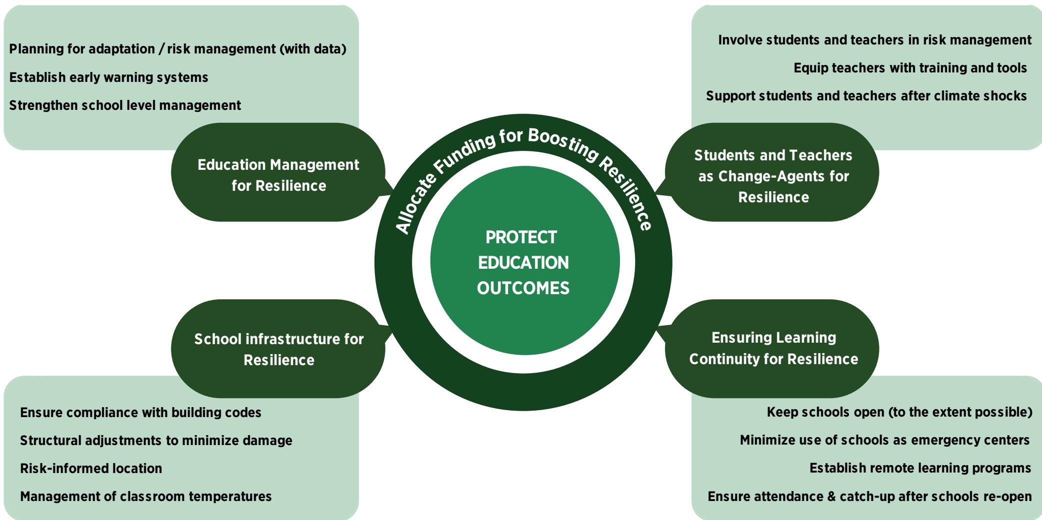
Education policymakers do not seem to fully appreciate the urgency for climate adaptation within the education sector. A novel survey for this note, covering 103 education policymakers across 33 low- and middle-income countries, reveals that only about half (51 percent) believe that hotter temperatures inhibit learning and nearly 45 percent also got one of five basic climate change related questions wrong. Further, 62 percent said the protection of learning from climate change is among the bottom three priorities in their country (out of a set of ten priorities). The corresponding number for World Bank education task team leaders was 74 percent. This low prioritization of adaptation is troubling given that increasing heat exposure during the school year could come to explain around one-third of the difference in the PISA performance between countries like Brazil and South Korea.[416]

This section presents a broad menu of options that can be part of a sound adaptation strategy, as well as examples of how countries are applying these solutions. Ultimately, countries will need to contextualize their strategies according to the climate stressors they face, the resources available, and what would work best for their populations.

Adapting education systems for greater resilience requires policymakers to act on four fronts (see Figure 3.5): (i) education management for resilience; (ii) school infrastructure for resilience; (iii) ensuring learning continuity in the face of climate shocks; and (iv) leveraging students and teachers as change agents.

But this adaptation requires policymakers to allocate sufficient funding for boosting climate resilience within the education sector. Effectively implementing adaptation strategies to minimize harm and cope with climate shocks will require additional funds for the education sector. The case for education investment must be strengthened for improved domestic resource mobilization and increased allocation of global adaptation financing to education. Each dollar invested in disaster risk reduction to make education systems climate-smart can save up to 15 in post-disaster recovery.[417] Part of the strategy to mobilize funding may involve the education sector accessing existing, or setting up new, loss and damage funds.[418] Innovative financing mechanisms, such as the use of parametric insurance in the education sector, may also be useful in ensuring funds are available when coping with shocks.[419] Though no global figures exist to summarize the additional financing needed for this effort, scattered estimates give a sense of the scale. Looking at just damages due to tropical cyclones, global estimates indicate the education sector experiences financial losses of USD 4 billion annually.[420] In the Philippines alone, over 10,000 classrooms per year are damaged due to typhoons and floods.[421]

Figure 3.5: Approach to Adapt Education Systems to Climate Change



Education management for climate resilience

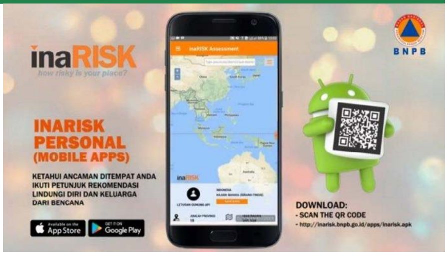
First, support adaptation and disaster risk planning at the sector and school levels. Education policies, at the national and subnational levels, need to reflect the reality of climate change and what it means to their sector. Critical aspects to cover include an assessment of climate risks, strategies to minimize impacts to infrastructure and education outcomes, clear coping mechanisms to manage learning continuity during climate shocks, plans to effectively restore learning process after natural disasters, and a sensible approach to involve teachers, students, and their families in the overall adaptation process. Nearly 60 percent of countries in a 2017 survey of 68 high-risk countries for disasters include either disaster risk reduction or disaster response components in their education sector plan, but these are not always comprehensive.[422] The Ministry of Education of Liberia has integrated climate mitigation and adaptation measures into its education sector plan running through 2027, which identifies medium and long-term adaptation needs and implements strategies to address them.[423] Climate change learning strategies led by national institutions have been implemented by various countries such as Benin, Uganda and Indonesia to strengthen linkages between the education and training institutions and the climate change community.[424]

Such planning should be underpinned by clear data and analysis related to climate risks and possible coping strategies. Effectively preparing for, coping with, and recovering from climate shocks requires education policymakers to understand the climate risks faced by their sector. Periodically assembling and discussing data about schools that are at risk can help the system minimize negative impacts. Infrastructure assessments are equally important to identify sub-optimal school structures that need upgrading for greater resilience against climate shocks. The process of assembling these data may involve coordination and consultation with non-education ministries and experts.

Second, invest in early warning systems. Investing in mechanisms to alert schools in real time and take early action will minimize the damage of adverse climate events on students, teachers, and schools. Risk reduction measures benefit schools and help communities learn of the risk through students. Multi-hazard early warning systems are being implemented in a growing number of countries and have been proven to minimize damage and the number of people impacted by climate shocks.[425] In the Philippines and Indonesia, an early warning system for typhoons, floods, and earthquakes is used for disaster preparedness and response. In Indonesia, the education sector is provided information through a mobile app to improve disaster knowledge for students and staff (see Box 3.2).[426]

BOX 3.2: EXAMPLE EARLY WARNING SYSTEM FOR SCHOOLS

Mobile app for disaster response – Indonesia



InaRISK is a platform that summarizes results of local-level disaster risk following hazard assessments conducted by the local government. It has a mobile app that provides information about risks and guidance on how to take anticipatory actions during a disaster. Indonesia's education system, from primary schools to high schools, are using the app as part of the Disaster Safe Education Unit (SPAB) programme implemented by the Ministry of Education, Culture and Research and Technology to improve the disaster knowledge of students and staff. Schools receive alerts through different channels, and evacuation procedures are often practiced during drills.

Learn more!

Third, supporting good management at the school level can really pay off. Offering targeted in-service training to school principals on crisis response and overall management practices can help with risk mitigation and improve the speed and recovery following climate shocks. In Haiti, following Hurricane Matthew, better managed schools recovered faster, with the difference even more pronounced at higher levels of damage.[427] School principals scoring higher on a range of management practices were able to re-open schools faster, bring students and teachers back sooner, significantly minimize learning losses, and introduce disaster risk reduction measures in case of re-occurrence. Similarly, in Puerto Rico, school principals scoring higher on management practices were better able to keep students engaged though remote learning opportunities.[428]

School infrastructure for climate resilience

For infrastructure the key actions are strengthening the resilience of existing buildings, protecting classrooms from heat, and adopting innovative best practices (for both resilience and cooling) for any new construction.

Compliance with local building codes must be enforced for all school buildings. Building codes are the minimum design and construction requirements to ensure safe and resilient structures. Though they vary by country, these codes establish the acceptable levels of risk from an engineering perspective. When school buildings operate outside the scope of the building codes, they are at risk of severe damage and destruction during climate shocks. This is unfortunately far too common. In Niger, nearly 47 percent of school infrastructure stock continues to rely on temporary structures (*classes paillotes*) made of straw, which are built based on demand and are dismantled annually during rainy season, leaving millions of children and youth without access to school.[429] Note however that different climate risks add different types of stress on school infrastructure, and thus require different solutions. Even for each specific risk, there is no one-size-fits-all solution as different contexts will have different resources available to respond and mitigate damage.

Structural adjustments can help minimize potential damage to schools from floods and landslides. Measures specifically aimed at preventing urban run-off and flooding can be implemented at the school building level. Options include the construction of retaining walls, improved gutters and drainage systems to guide water away from the schools, as well as the construction of schools with elevated foundations. Temporary retaining walls can even be made out of sandbags. In Rwanda, a new project is equipping 1,367 school sites with retaining walls to mitigate flood- and rainstorm-related landslides, as well as related risks to communities and their assets living downstream from the school location.[430] In Vietnam, schools in flood-prone areas have been designed with elevated foundations, and classrooms are often constructed on stilts to reduce the risk of inundation.[431] Infrastructure built for flood risk reduction not only increases resilience to climate stressors but can have co-benefits on environmental, social and economic systems.[432] There are programs like the World Bank Global Program for Safer Schools, that aim to improve the safety and resilience of schools to natural hazards through large-scale investments in safer school infrastructure.[433] In Peru, the program supported policy reform to improve resources for disaster risk management, reduce infrastructure vulnerabilities in the education and housing sectors including flood protection measures and increase governmental capacity for post-disaster recovery and reconstruction.[434]

Risk-informed location for new schools is critical. The geographical location of a school determines the climate hazards to which it is exposed. Hazard maps can be particularly useful. For existing infrastructure, an understanding of the exposure of each school facility to natural hazards can serve as a starting point for managing climate risk. For new infrastructure, knowledge of the risks of particular locations can guide decision-making into where to locate schools to minimize risk. If risk cannot be avoided, because of the location of the community that needs to be served by the new school facility, the risk information can inform the design of the new school building to minimize damage during the most likely climate shocks. In Indonesia, optimal locations for education facilities have been identified using a model for land suitability by considering a multi-hazard disaster risk index, with over 25 percent of schools currently located in high vulnerability areas.[435]

Classroom temperatures need to be better managed, but this doesn't need to be costly. As discussed above, heat impedes learning. Reducing classroom temperature from 30 °C to 20 °C could increase performance on learning-related tasks by 20 percent.[436] In Costa Rica, air conditioning units were used to reduce classroom temperatures from about 30 to 25°C and speed on cognitive tests increased up to 7.5 percent, and accuracy increased by 0.6 percent for each degree reduction in classroom temperature.[437] Interestingly, this effect was stronger for lower performing students. While installing air conditioning units in classrooms is an option that some countries have implemented, it is certainly not the only approach to lowering temperatures. Less costly solutions range from painting rooftops with solar-reflective white paint, increasing tree coverage in and around the school, leveraging water features to mist the air, to even modifying school schedules to avoid peak heat (See Box 3.3).

BOX 3.3: SAMPLE STRATEGIES TO COMBAT CLASSROOM EXTREME HEAT

Low Tech

INDONESIA

Painting rooftops white.
In Indonesia, a project established a facility to produce affordable coatings to install cool roofs on over 70 buildings including schools. Indoor temperatures were reduced by over 10 °C by replacing dark roofs with a white coating.

Learn more

Low Tech

KENYA

Tree planting.
Kenya has set a target to plant 15 billion trees by 2032. Trees will be planted by students and education workers and will provide shade in school grounds lowering temperatures. This practice can reduce temperatures in the school area by 1-5 °C.

Learn more

High Tech

TAIWAN

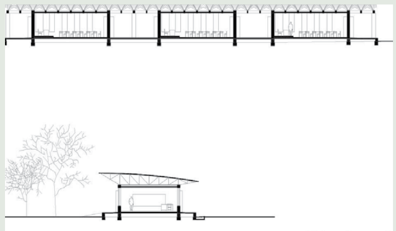
Air conditioning in schools.
The government of Taiwan has invested $1.2 billion USD to install air conditioning in every public classroom. Evidence from Costa Rica has shown AC to be effective at managing temperatures and supporting learning.

Learn more

New classrooms can be designed to keep cool. The use of natural ventilation, insulating materials, and climate-responsive designs for schools can be alternative strategies to interventions like air conditioning, which may not be feasible in all contexts. School construction integrating natural daylight and cross-ventilation as well as trees and/or shade structures can reduce the energy needed.[438] For example, Kenya implemented a Green Economy Strategy and Implementation Plan that promotes bioclimatic design for school buildings and will increase thermal comfort for students during high temperatures.[439] In Burkina Faso (see Box 3.4), the Gando Primary School is a good example of locally-contextualized and innovative design that addresses the issue of extreme heat in classrooms.

BOX 3.4: SAMPLE INNOVATIVE DESIGN FOR TEMPERATURE CONTROL

Gando Primary school – Burkina Faso



The Gando Primary school was designed by Francis Kéré within the parameters set by cost, climate, resource availability and construction feasibility. For construction, Clay was used. This material is abundant in the region and can offer thermal protection against hot climate. To avoid overheating due to the commonly used corrugated metal roof, the design pulls the roof of the Gando Primary School away from the learning space of the interior. A dry-stacked brick ceiling is introduced in between, allowing for maximum ventilation: cool air is pulled in from the interior windows, while hot air is released out through perforations in the clay roof. This also significantly reduces the ecological footprint of the school by alleviating the need for air-conditioning.

Learn more

When the schools are running, make sure water runs as well. Access to water, beyond a basic human need, is also a highly effective practice for increasing attendance, enrollment, and learning.[440] Ensuring this provision, especially in water-scarce environments, requires innovative thinking and local solutions. In Kenya, water tanks and sanitation infrastructure were installed on rooftops through a water harvesting project. This not only creates storage to harvest water during the rainy season to provide water access during the drier months but can also help minimize local flooding of schools.[441] In Vietnam, 300,000 water purifiers are being distributed to schools and other community institutions to provide access to clean drinking water to 2 million children. This option provides clean water to students and is expected to reduce carbon emissions by 6 million tons over 10 years.[442]

Ultimately, climate shocks add a level of stress to school infrastructure that cannot be fully remedied, but enhancing the resilience of school buildings and ensuring continuity of learning during school closures can significantly reduce their impacts.[443]

Ensuring learning continuity in the face of climate shocks

Keep schools open (to the extent possible). There is overwhelming evidence that school closures lead to tremendous learning losses, especially for the disadvantaged. And these losses may be impossible to recover. Therefore, schools should only be closed when essential and every effort should be made to reopen as soon as possible.

Minimize the time schools are exclusively used as emergency shelters. A key part of minimizing school closures is to minimize their use as evacuation centers and/or emergency shelters. While these centers offer a lifeline to the community, they do so at the expense of children's learning and their future. At times of crisis, it is normal for countries to resort to their public infrastructure to meet the needs of their people, and this includes schools. However, given the high-cost school closures can have on students and their learning, it is important to minimize the length of the school disruption regardless of how the school buildings are being used. Establishing alternative options, keeping dual functions by using classrooms as shelters only at night and reverting to classes during the day, or using alternative temporary learning facilities on school sites can lower impacts on schooling.[444]

In the event of school closures, four actions can protect or even boost education outcomes.

1. **Strengthen remote learning mechanisms to ensure learning continuity during climate-related disruptions.** COVID-19 disruptions demonstrated that remote learning needs to be done more effectively. It's time to put these lessons to work to protect learning from climate shocks. Across five countries (India, Kenya, Nepal, Philippines and Uganda) phone-based targeted instruction significantly improved learning by delivering up to four years of quality instruction for every 100 dollars spent.[445] On flood days in Brazil, students who had only face-to-face classes had approximately 33 percent lower test scores, but no difference was observed when students had access to virtual learning options.[446] Remote learning models can be an important adaptation strategy to ensure continuous learning during school closures. Remote instruction proved to be most successful when it ensured fit-for-purpose, enhanced effectiveness of teachers, established meaningful interactions, and engaged parents and students as partners.[447]

2. **Conduct re-enrollment campaigns if school closures last long.** As schools re-open, many children do not return on their own.[448] Back to school communication campaigns, both general and targeted to at-risk students, can help increase attendance and re-enrollment rates.[449] As parental concerns about risk and safety may be an important factor keeping children from returning, addressing those fears and ensuring safety will enhance the effectiveness of those campaigns. Following COVID-19-related school closures, Ghana conducted a very successful back-to-school campaign resulting in nearly 100 percent re-enrollment.[450] This campaign was successful because it was conducted at the district level, involving government, civil society, and media, and it leveraged different means of communication including radio, TV, and community events.

3. **Targeted financial support to disadvantaged students may be needed to bring them back to school.** After climate emergencies, poor households may not send children back to school for financial reasons. Removing school fees, offering subsidies to cover the cost of textbooks and uniforms, or giving cash transfers to families have all been shown to increase school participation in the aftermath of shocks. In Sierra Leone, following the school closures associated with the Ebola outbreak in 2014, the government removed school fees for two years, and offered subsidies to cover basic inputs like textbooks.[451] These efforts to boost re-enrollment increased access to schooling with an additional 800,000 children enrolling. Broader cash transfer programs that were conditional on schooling in Brazil and Mexico have

also increased the resilience of households as well as school participation.[452] Easing transport difficulties after climate shocks can also be impactful, such as providing bicycles to rural girls, which increases access to schools (as seen in Zambia and India).[453]

4. **Targeted and customized support may be needed for girls.** Following shocks, girls are more likely to fall prey to violence and exploitation,[454] experience deeper income losses,[455] be forced into early marriage as a coping mechanism,[456] become pregnant,[457] and drop out of school as a result. These vulnerabilities make them most likely to benefit from communication campaigns as well as financial and nonfinancial incentives, so long as they are targeted appropriately. Following COVID-19 related school closures, Bangladesh, Benin, Ethiopia, Ghana, Pakistan, and Uganda implemented advocacy campaigns for girls' re-enrollment.[458] Other incentives such as scholarships and adaptations for young mothers have also shown success in bringing back girls to school after shocks.[459]

As students return, catch up and remedial programs may be needed. When schools reopen after climate shocks, not all students will be at the same level as learning losses will likely take place; catch-up programs and extension of the academic calendar can address learning losses for the most impacted students. There are numerous examples of remedial and catch-up programs that proved effective in mitigating learning losses once schools re-open after COVID-19, which can offer valuable insights as countries prepare for increasing climate shocks.[460] Common elements of success in those programs include the use of regular classroom assessments to guide instruction and the teaching prioritization of fundamental skills.

School feeding programs can keep students enrolled through climate shocks and offset some of their indirect impacts by improving nutrition and health. Globally, 418 million children have access to school meals[461] and many rely on them for their entire caloric intake. This reliance is growing as increasing weather and climate extreme events are driving millions of people towards acute food insecurity. Hence, the provision of school meals offers a strong incentive for children to go to school daily. It can also be an effective tool to keep children well-nourished, healthier, and enrolled. There is also evidence that school meals can support better learning outcomes. In India, children receiving school meals for prolonged periods of time achieved better test scores in math and reading.[462] In the Philippines, children enrolled in early childhood nutrition programs performed significantly better in school and every dollar invested in these programs produced a three-dollar gain in academic achievement.[463]

Schools may need to provide socio-emotional programs to help address students' anxiety and distress after climate shocks. Climate change and climate shocks are affecting mental health and psychological well-being of students. And mental health is strongly correlated with academic performance.[464] School-based mental health services for elementary school-aged children can be effective in decreasing mental health problems and improving academic performance.[465] For example, California provided mental health services to address the psychological impact on students after the Camp Fire ravaged through Paradise, California in 2018.[466] In Mozambique, following multiple climate shocks, primary school teachers were trained to provide mental health and psychosocial support (MHPSS) to students affected by natural disasters, conflict, and COVID-19 (See Box 3.5 for more details).[467]

BOX 3.5: POLICY STRATEGIES TO INCREASE RESILIENCE OF EDUCATION SYSTEM TO CLIMATE STRESSORS

Learning continuity

BANGLADESH

Online learning program. Bangladesh had one of the longest school closures during the COVID-19 pandemic which lasted 18 months. A project that helped students continue education through distance learning helped around 3.26 million children, providing training to teachers and the development of digital content. This increases the resilience of students to stressors by ensuring learning continuity through school closures.

Learning more

Catch-up programs

LIBERIA

Second Chance
The Luminos Fund Second Chance Program is a remedial learning program for Liberian out-of-school children aged 8 to 14. The 10-month program helps students develop literacy and numeracy skills to transition back into the formal education system. Children in the program increased their reading skills from under 5 correct words per minute to 39. Over 12,000 have participated and 90% have transitioned to formal schooling.

Learn more

Socio-emotional programs

MOZAMBIQUE

Increasing teacher capacity to provide psychosocial support
UNICEF and its education partners have established a program in Mozambique to ensure access to mental health and psychological services in crisis-affected provinces. This includes mental health and psychosocial support interventions and manuals for professionals and school staff to support student well-being before, during and after cyclones and other emergencies.

Learn more

Leveraging students and teachers as change agents

Students don't have to be passive victims of climate shocks; they can play a key role in risk management. Disaster risk reduction involving student training and leadership can be a low-cost strategy to increasing climate resilience. Primary schools in Cambodia with frequent schooling interruptions from floods, droughts and storms have raised disaster risk knowledge among students by integrating disaster risk reduction into the primary social studies and science curriculum.[468] These efforts focus on integrating relevant examples into existing curriculum to ensure students are exposed to this critical and relevant information without needing to expand the already-complex curriculum. Activities such as capacity building and simulation drills can be implemented with low costs and resources and are effective at increasing student and school resilience to climate hazards. Similarly, the Ministry of Education in Thailand reformed the Basic Education Core Curriculum to embed disaster education. Lessons are based on a prominent community-based risk management framework and are mainstreamed to learners from elementary school to senior high school.[469]

As the people on the frontline, teachers have a critical role to play in risk management. Prior to extreme weather events, they can ensure students are aware of the climate risks and how to act in the event of one of them materializing. During and after climate shocks, teachers are instrumental in keeping students engaged in remote learning opportunities if access to school is disrupted. After climate shocks, they hold the key to ensuring learners have their needs met.

For teachers to play this role successfully, they need to be trained effectively on climate change risk reduction and resilience building. An education climate-adaptation policy will fail to deliver results if the messaging doesn't reach those at the frontline: teachers and students. Teachers need to be able to communicate fluently with their students on what climate change is, the risks affecting their region, what to do in case of an emergency, as well as the role students themselves could play in risk management. Novel data for this paper shows that across six LMICs[470] from three regions, nearly 87 percent of teachers claimed to include climate themes in their lessons but over 71 percent got at least one (out of six) basic climate change question wrong. Several countries are implementing this type of training. For instance, in Buenos Aires, Argentina, teachers in regions highly susceptible to flooding have been trained in flood resilience.[471] Teachers, government officials, and technical experts were brought together to design educational content and spaces that encourage children and young people to adopt more environmentally friendly habits. The initiative has given rise to more than 100 schools having teachers trained in flood resilience, with many more schools in the country expected to join.

BOX 3.6: EXAMPLE OF TEACHER AND STUDENT TRAINING PROGRAM ON DISASTER RESILIENCE

Disaster risk reduction through school training – Kyrgyz Republic

The Comprehensive School Safety Framework program in the Kyrgyz Republic is training students and teachers on safe behaviors during an emergency including floods, landslides and earthquakes. The program trains educators and students starting at the preschool level on how to understand and manage disaster risk. This also includes a mobile application and online course including interactive games for primary school children to explain safe behaviors during emergency situations. School-based disaster risk reduction training is being expanded to 1,800 schools across the country and is expected to reach 1 million school children.

Learn more!

To meet the needs of students after school closures, teachers will need to be equipped with the right knowledge and tools. The student that leaves the classroom before a climate shock will be very different from the student that returns after. Learning losses, emotional shock, and a likely less prosperous community will add stress to the learning process and limits to how much can be achieved in the classroom. To meet the needs of the students, teachers will need guidance and capacity building on key aspects. These are well-captured in World Bank's R.A.P.I.D. framework which was developed to tackle learning losses caused by COVID-related school closures and has tremendous relevance for climate-change related school closures. It is based on five evidence-based policy actions for learning recovering after education disruptions:[472]

- **R**each all children.
- **A**ssess learning.
- **P**rioritize the fundamentals.
- **I**ncrease the efficiency of instruction.
- **D**evelop psychosocial health and wellbeing**.**

Teachers have needs of their own, offering support to them after climate shocks will be important. Climate shocks will undoubtedly impact teachers directly. Their physical and mental health, food and water security and housing can all be impacted by weather extremes. In parallel, more of them will be expected in their classrooms as students cope with the direct and indirect impacts of the climate shock. In countries like in the Philippines, teachers are even expected to take additional responsibilities to coordinate schools as shelters and provide make-up classes on Saturdays following flooding events, without receiving any additional compensation or recognition.[473] This combination can easily lead to teacher burnout, absenteeism and for teachers to eventually leave their jobs.[474] To counter these risks, education systems can ensure teachers continue to be paid regularly, and that any additional responsibility is recognized either monetarily or through other means that may boost motivation. Programs active in the school to guarantee access to water and food to students can also be extended to teachers. Similarly, while teachers can play a role in offering mental health support to students, it will be important to offer services to them through either institutional support, peer support groups, or other interventions.[475]

How much will adaptation of education sector cost?

A **low-cost minimum adaptation plan** can cost about **US$18.51 per student.**

A low-cost package for adapting education systems for a changing climate can cost about US$18.51 per student. At the higher end it could cost between US$45.68 - US$101.97 per student. These adaptation packages include four key pillars - managing classroom temperatures; reducing climate-related infrastructure risks; ensuring learning continuity; and providing education resilience training to teachers and school leaders. The first two components of these packages will help reduce the likelihood of school closures due to climate events and all four components will help minimize climate-related learning losses. Costs would be lower for systems that already have some elements in place. For reference, low-income countries spend an average for USD 51.80 per student per year, while high-income countries spend USD 8,400 per student per year[476].

Table 3.1: Estimated costs of adapting education systems for climate change

	INTERVENTION	COST PER STUDENT (US$)	Percentage increase in total government education expenditure (2019): LOW-INCOME COUNTRY: MALI	LOWER-MIDDLE-INCOME COUNTRY: PAKISTAN	UPPER-MIDDLE-INCOME COUNTRY: COLOMBIA
Pillar 1: Managing classroom temperatures	1. Fans	1.83	1.50%	1.49%	0.12%
	2. Air-conditioning	11.00	9.04%	8.95%	0.72%
	3. Air coolers	10.00	8.22%	8.14%	0.65%
	4. Painting rooftops	0.66	0.54%	0.54%	0.04%
	5. Planting trees	0.33	0.27%	0.27%	0.02%
Pillar 2: Structural adjustments for climate shocks	6. Retaining walls	22.29	18.32%	18.14%	1.45%
	7. On-site water absorption (permeable pavements)	5.00	4.11%	4.07%	0.33%
Pillar 3: Ensuring learning delivery during climate-induced school closures[477]	8. Remote learning system*	6.50	5.34%	5.29%	0.42%
	9. Small group phone-based tutoring*	19.00	15.62%	15.46%	1.24%
	10. Small group one-on-one online tutoring*	52.00	42.74%	42.30%	3.39%
Pillar 4: Training for climate-resilient education delivery	11. Teacher training	4.19	3.44%	3.41%	0.27%
Low-cost package[478]	Interventions: 1 + 4 + 5 + 7 + 8 + 11	18.51	15.22%	15.06%	1.21%
Medium-cost package[479]	Interventions: 3 + 4 + 5 + 7 + 8 + 9 + 11	45.68	37.55%	37.16%	2.97%
High-cost package[480]	Interventions: 2 + 4+ 5 + 6 + 7 + 8 + 10 + 11	101.97	83.82%	82.96%	6.64%

Sources: see discussion below
*: Costs do not include student devices. It is assumed that students can access lessons using their parents' phones.

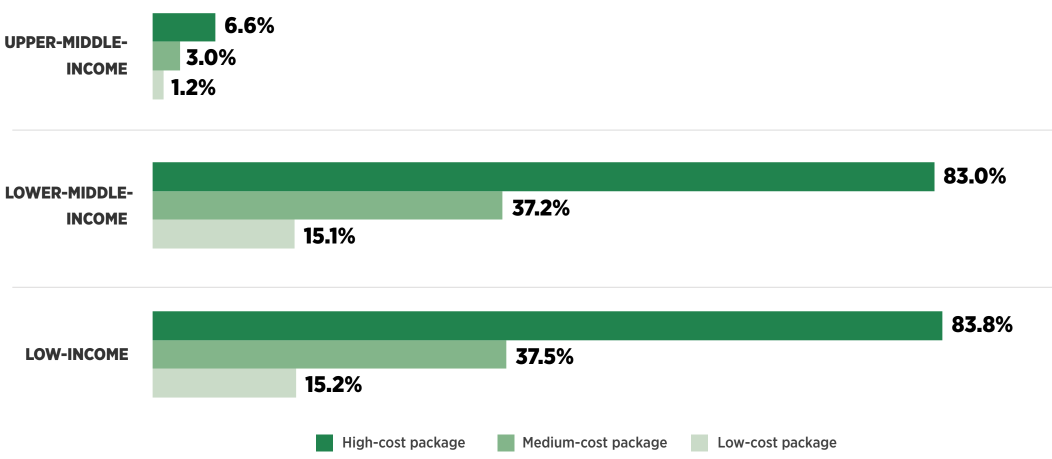
Within each of the four pillars we identify costs of the core solutions that are widely applicable. For each solution, the costing exercise details three steps: a) identify unit cost of each proposed element, b) convert unit costs to per student costs where relevant, c) approximate total element costs (by estimating total expected beneficiaries) to benchmark against overall education spending across contexts. Sources for unit costs are discussed below. For most solutions, costs are presented in terms of square feet. To contextualize, we then represent these as per student costs (in US$) where relevant, with the assumption that each student should be allocated at least 11 square feet of space.[481]

These estimates are only meant to be illustrative. Actual costs will vary depending on the context. Factors such as the severity of climate risks, which might necessitate additional structural reinforcements, local material and labor costs, which can fluctuate widely, and the availability and reliability of electricity, which impacts infrastructure requirements, will all influence choice of solutions and the overall expenses.

We contextualize adaptation costs for three different country scenarios, in terms of percentage of total education expenditure, for one low-income country (Mali), one lower middle-income country (Pakistan) and one upper middle-income country (Colombia). Beneficiary calculations and expenditure costs are based on 2019 data derived from UNESCO Institute for Statistics. We also examine percentage increase in per student spending on average, for low-income and high-income countries.

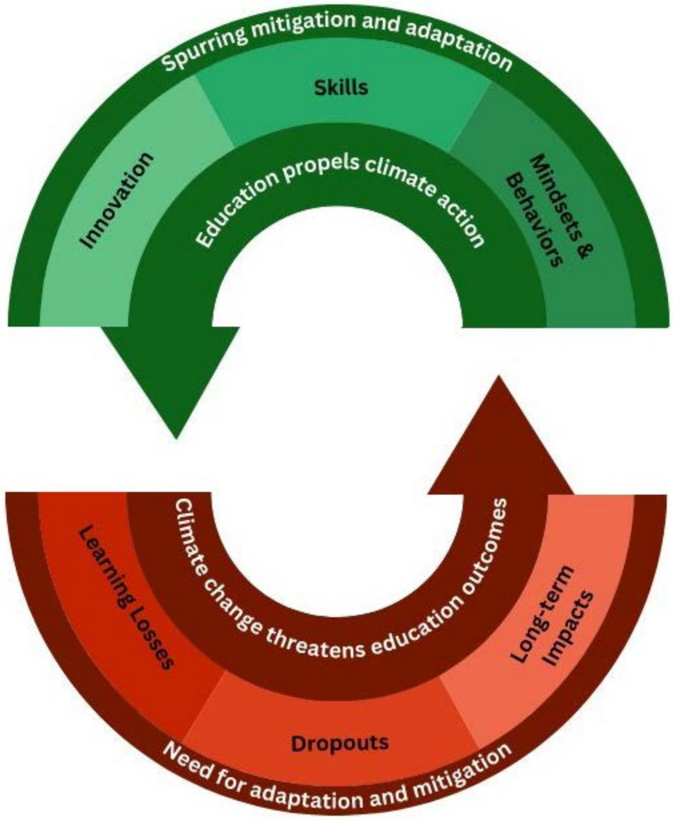
Figure 3.6: To adapt their education systems for climate change, low- and lower-middle-income countries would need greater percentage increases in their education expenditures compared to upper-middle-income countries

PERCENTAGE INCREASE IN GOVERNMENT EDUCATION EXPENDITURE (IN 2019 US$)



While high-cost elements can provide the most immediate and effective adaptation solutions, their viability depends on context and available financing. As Figure 3.6 shows, certain elements would represent a large share of total education expenditures in low-income countries, compared to lower-middle- and upper-middle-income countries. Taking the example of lowering classroom temperatures, installing air conditioners could increase per student spending in low-income countries by approximately 21 percent compared to less than 1 percent in high income countries. In a low-income context (Mali), this would constitute an increase of 9 percent of total education expenditure, whereas in an upper-middle-income country (Colombia), this share would increase by less than 1 percent.

Figure 3.7: The bi-directional relationship of climate change and education



Pillar 1 - Managing classroom temperatures

The most effective solution for cooling classrooms in the face of extreme heat is air conditioning. In Guyana, the installation of a wall-mounted air conditioner can lead to a cost of approximately US$11 per student.[482] On the lower range, fans can be used to improve comfort in less extreme heat scenarios (below 35 degrees C).[483] While fans cannot lower room temperatures, they can improve body temperatures by facilitating sweat evaporation. Evidence from India suggests that electric ceiling fan installation can cost approximately US$1.83 per student[484]. In South Asia, evaporative air coolers[485] are also a commonly adopted mid-range technology, used as an alternative to air-conditioning and fans. In India, such coolers may cost approximately US$10 per student.[486]

Fans and air conditioners require electricity and incur electricity costs. Low-cost alternatives that can be used alone or can help to reduce energy, include painting rooftops white and planting trees. New white roofs are typically 28 to 36 degrees Celsius (50 to 65 degrees Fahrenheit) cooler than dark roofs in afternoon sunshine, while aged white roofs are typically 20 to 28 degrees Celsius (35 to 50 degrees Fahrenheit) cooler.[487] Depending on the setting, this can lead to a reduction of indoor temperatures by 2 to 5°C (3.6

- 9°F) as compared to traditional roofs.[488] In India, under the Ahmedabad Heat Action Plan 2017, an initiative to incorporate solar reflective paint coatings in household, amounts to approximately US$0.66 per student.[489] Similarly, trees can also prove to be effective by reducing air temperature, glare, and UV radiation. Shade provided by mature trees could also reduce surface temperatures by as much as 60 degrees F.[490] For each student, trees can cost approximately US$0.33.[491]

When considering solutions to lower classroom temperatures, decision-makers should evaluate a combination of strategies to maximize both comfort and cost-effectiveness. Integrating high-tech solutions like air conditioning with low-cost measures such as white roof painting and tree planting can create an effective approach to temperature management. For instance, a combined strategy involving air conditioning, roof painting and tree planting could cost approximately US$11.99 per student.

Pillar 2 - Structural adjustments for climate shocks

For adaptation, it is essential to implement school infrastructure resilience strategies to protect educational facilities and ensure the continuity of learning. In low- and middle-income countries, floods are the most common type of natural disaster[492] with their risk increasing significantly, affecting over 23 percent of the world's population.[493]

The most common solution for infrastructure resilience in the face of flooding risks is to invest in retaining walls. Retaining walls can help to mitigate damage from flood- and rainfall-related landslides and prevent water infiltration. In Rwanda, retaining walls in schools were set up at an average cost of approximately US$22.29 per student[494]. Estimating the per capita cost of retaining walls is challenging due to their context-specific nature, which depends on factors such as flood risk level, school boundary size, site topography, and design variations.

Another solution is to enhance on-site water absorption. Permeable pavements, including previous concrete, asphalt, or interlocking pavers, allow rainwater to infiltrate directly where it falls, thereby reducing stormwater runoff. With installation costs of US$5 per student,[495] some applications have demonstrated a 90 percent reduction in runoff volumes.[496]

For schools in coastal areas, flood protection can also take the form of restoring coastal wetlands, such as mangroves and salt marshes to reduce wave heights and velocity. Median restoration costs for salt marshes are US$0.10 per sq. ft, and US$0.01 per sq. ft for mangroves.[497] In fact, in cases where wave heights are lower, it can be two to five times cheaper to restore coastal wetlands than to construct submerged breakwaters.[498]

Pillar 3 - Ensuring learning continuity during climate-induced school closures

Ensuring that students continue to learn during climate-induced school closures is critical for maintaining educational outcomes. In Turkïye, the immediate response to COVID-19 involved significant investment in a sustainable IT infrastructure designed to be resilient against future disruptions, including climate-related events. This effort costed approximately US$6.50 per student[499] and laid the groundwork for a robust distance learning system. Such investments are crucial as they ensure that schools are equipped with the necessary technology to support remote learning during periods of crisis.

Once a strong IT infrastructure is in place, countries can choose between various distance learning approaches such as self-guided learning, instructor-led lessons or small group tutoring via phones or tablets. In Botswana, low-tech phone-based tutoring amounted to US$19 per student, with a 0.12 standard deviation improvement in learning.[500] This approach can be particularly effective in areas with limited access to advanced technology and provides a cost-efficient way to support students remotely.

On the other hand, higher-cost solutions may offer more comprehensive support. One-on-one tutoring, for instance, has been shown to significantly enhance academic performance. In Italy, this approach improved students' academic performance by an average of 0.26 standard deviations at a cost of US$52 per student,[501] covering organizational and pedagogical support.

Pillar 4 - Training teachers and school leaders for climate-resilient education delivery

As climate events become more frequent and severe, it is crucial to equip educational staff with the skills and knowledge needed to adapt their teaching methods and manage educational disruptions effectively. To achieve this, comprehensive support for teachers and school leaders is essential, encompassing aspects of student safety, management, and pedagogy. Teachers and school leaders require adequate training on disaster preparedness, evacuation, remote learning, and remediation /catch-up in the event of school closures.

One program puts the cost per student of mainly teacher training, as well as materials and monitoring as approximately US$4.19[502]. At the same time, establishing mentorship programs or support networks can facilitate knowledge sharing and provide educators with ongoing guidance and support. These can be zero- to low-cost solutions, such as teacher WhatsApp groups. Such investments are crucial for maintaining the quality and continuity of education, ensuring that students continue to thrive despite the growing challenges posed by climate change.

Governments must act now to protect education from climate change

"We can't be oblivious to the fact that we are facing a global crisis... at some point, we're going to have to take a back step and acknowledge we're in a crisis and we need to address it accordingly."

Boitumelo Molete, Youth Activist, South Africa

Education generates enormous returns for people and societies. For individuals, education promotes employment, earnings, resilience, and health. For societies, it drives economic development, reduces poverty, promotes social cohesion, and nurtures a more informed and innovative citizenry. Spending on education is thus not a mere government expenditure, but a powerful investment in the well-being and progress of societies. Each additional year of learning is estimated to generate a 10 percent increase in earnings annually.[503] These higher incomes result in significant improvements in health outcomes, especially for mothers and their kids.[504] Combined, these benefits lift people out of poverty in large numbers. If all children got basic reading skills from school, 171 million people could be lifted out of extreme poverty which would be a 12 percent decrease in extreme poverty globally.[505] For nations, these benefits translate into stronger and more sustainable economic growth. Over the period 1960–2000, three-quarters of the variation in growth of GDP per capita across countries can be explained by differences in international measures of math and science skills.[506]

Children and their communities are more resilient to shocks and transitions when they have access to quality education. More educated individuals are better able to prepare for, cope with, and recover from shocks, including those related to extreme weather events. Studies from Brazil, Cuba, Dominican Republic, El Salvador, Haiti, Mali, Senegal, and Thailand provide robust evidence on the positive impact of education on vulnerability reduction.[507] In these studies, people with higher levels of education exhibit greater disaster preparedness and response, experience reduced adverse effects, and recover more quickly from disasters. Education attainment directly influences risk perception, skills, and knowledge, all of which empower individuals to be better prepared against extreme weather events and thus reduce impacts. Improving educational outcomes could reduce the climate risks borne by 275 million children globally.[508] Higher levels of education attainment can also contribute to climate resilience indirectly through reduced poverty, improved health, and slower population growth, all of which are linked with higher community-level adaptive capacity.[509]

Education attainment also fosters pro-climate behaviors. An additional year of education can increase pro-climate beliefs by 6.3 percent, increase pro-climate behavior by 8.5 percent, and produce a 35 percent increase in green voting across 16 European countries.[510] In China, education attainment is associated with a 2 percent increase in pro-environmental attitudes and behaviors.[511] Similarly, in Thailand, a study found that additional years of schooling are associated with knowledge-based environmentally friendly actions such as increasing regular use of cloth bags by 5 percent and energy-efficient appliances by 7.7 percent.[512] Globally, the level of education attained emerges as the most influential factor in predicting climate change awareness.[513] Education also exhibits a robust correlation with environmental concern and support for policies that benefit the environment.[514] The education sector can play a catalytic role in climate change mitigation and adaptation by reshaping mindsets, behaviors, skills, and innovation.

But climate change is threatening these benefits. Extreme weather events – high temperatures, tropical cyclones, droughts, floods, and wildfires – harm children and their future through their impacts on education. This is especially true for children in the most vulnerable settings, who need education the most. As climate change increases the frequency and intensity of extreme weather events, climate related learning losses are likely to grow. Today's students could lose not just learning but also a significant share of their future average annual earnings. Beyond reducing incomes, these learning losses will lead to lower productivity, greater inequality, and possibly greater social unrest for decades to come. But these trends can be reversed if countries act quickly and decisively, guided by evidence on what works.

Adaptation within the education sector is urgently needed to protect the benefits of education. To minimize impacts of climate change on education outcomes, it will be important to promote adaptation and resilience in the education sector. This is particularly urgent because these adverse impacts will continue to become more severe. Even if the most drastic climate mitigation strategies were implemented, we will continue to observe extreme weather events having detrimental impacts on education outcomes. For the millions of children that need to attend school over the next 50 years, the results of climate mitigation will simply come too late. Actions can be implemented now to increase the capacity of educational systems to adapt and cope with these increasingly prevalent climate stressors.

Despite the risks and opportunities, education remains overlooked in climate discourse. While climate-related official development assistance (ODA) increased from 21.7 percent in 2013 to 33.4 percent in 2020, education made up less than 1.3 percent of this change.[515] In terms of action plans, less than 1 in 3 Nationally Determined Contribution (NDC) plans mention climate education, and less than 1 in 4 NDCs mention green skills. More broadly, only half of NDCs have any child-sensitive education commitments.[516] Education is mentioned 9 times less frequently relative to energy and infrastructure in World Bank Country Climate Development Reports.[517] Out of 15 review articles on the economic impacts of climate change published since 2010, only three mention the impacts of climate change on education.[518] Of the research on the impacts of climate on education that does exist, nearly 78 percent comes from high-income countries.[519]

The education sector must become more active in climate discourse. This includes focused policy action to protect education systems from the impacts of climate change. Without this, both large-scale poverty reduction and climate action are at risk.

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[303] Tandon, 2021
[304] Government of Canada, 2023
[305] Kraft et al., 2023
[306] UNICEF, 2024
[307] U.S Department of Commerce, 2010
[308] van der Rhee, 2019; Granta and Posadas, 2023
[309] Doan et al, 2023
[310] European Commission, 2022
[311] ESCO classification identifies 570 green skills, of which 521 green skills are mapped onto supply side workers in Egypt and India, and 499 onto workforce in Kenya.
[312] This is at the three-digit occupational code level.
[313] Lightcast™, 2024
[314] Sribhashyam et al., 2024
[315] Granata & Posadas, 2023
[316] Schady et al., 2024
[317] Ebi et al., 2021; Stott, 2016
[318] Theirworld, 2018
[319] UNICEF, 2021a
[320] Venegas Marin et al., 2024
[321] Thiery et al., 2021
[322] Data extracted from Climate Change Knowledge Portal. For the purpose of this graph, only Landslide, Flood, Storm, Wildfire, and Drought events are included
[323] Mugo, 2023
[324] David et al., 2018
[325] Baron et al., 2022

[326] Azevedo et al., 2022; Schady et al., 2023
[327] Shady et al., 2023
[328] Santana et al., 2013; Thamtanajit, 2020
[329] Zhang et al., 2022
[330] Akhtar, 2024
[331] Hyndman & Button, 2023; Evans et al., 2022; Gruppo & Krahnert, 2016
[332] Groppo & Krahnert, 2016
[333] Akhtar, 2024; Halpert, 2024
[334] To estimate the number of students impacted by school closures, the authors: 1) identified extreme weather events that took place between January 2022 and June 2024 through EM-DAT; 2) compiled school closure information for each extreme weather event based on press releases of the United Nation's Office for the Coordination of Humanitarian Affairs (OCHA) ReliefWeb, World Vision, UNICEF, the BBC, and other local outlets; 3) data on the number of students impacted was available for 25 countries. To avoid double counting of students impacted by multiple shocks, if a country/region suffered shocks in multiple years, the total number of students is comprised of the maximum number of students affected in a year plus 10 percent of the number of students impacted in the overlapping country/region in the earlier/later year (to account for the approximate 10 percent of students who enter / leave the basic education system in any given year). The total number of students impacted in those 25 countries as reported in media and adjusting as necessary to avoid double counting was 208 million; 4) For 56 countries, data on the number of students impacted was not available. To project the number of students impacted in those countries, the team: a) calculated the share of students enrolled impacted in the 25 countries with available data, b) projected the number of students impacted in the 56 countries where there was information about school closures but no information on the number of students affected. This was done based on data on students enrolled by country and the share of students impacted as calculated in previous step. The resulting number of impacted students was 404 million.
[335] Considering the lack of universal databases and peer reviewed sources on climate-related school closures and its impacts, global estimates for this report were arrived at based on press releases, media reports, and news articles. A country-by-country search was done (using Google Search Engine) to identify countries and climate events that had directly led to school closures or affected schools. The search period was restricted from January 2022 to June 2024 to avoid overlap with school closures due to COVID-19. The public EM-DAT data on natural disasters was also referred to identify events that had led to school closures. This preliminary search helped identify 81 countries and 123 events that had led to school closures. Among these, the event duration data that was available for 88 events (for 57 countries) from the EM-DAT database was also recorded.
Based on this assessment, a deeper dive into media reports and news articles was done to record the duration of the school closures for each event. This search helped establish the exact duration of school closure for 41 events across 20 countries. On average, affected schools in those countries lost 26 days of instruction due to climate shocks over the 2.5 years covered in the analysis. The school closure duration for these 41 events was compared to the event duration (from EM-DAT database) and the average difference between the school closure and event duration was computed (3 days). This computed difference was then used to estimate the school closure duration for the 88 events where event duration data was available, and the average school closure duration of 28 days was arrived at.
For expressing the number of days of instruction lost as a fraction of a typical academic year, the team assumed an average of 180 instructional days per academic year. This number is based on the upper end of school calendars in Europe but is consistent with school calendars in other parts of the world (e.g., Pakistan, where the number of school days averages 180).
[336] World Bank, 2022a
[337] Zimbabwe Education Cluster, 2019
[338] UNICEF, 2022c
[339] UNICEF, 2016
[340] Kawasaki et al., 2021
[341] UNICEF, 2023
[342] Perry, 2023
[343] Cadag et al., 2017
[344] Perry, 2023
[345] Cadag et al., 2017
[346] Santana et al., 2013
[347] Santana et al., 2013
[348] Lagmay & Rodrigo, 2022
[349] Nübler et al., 2021; Shah & Steinberg, 2017
[350] Grau et al., 2018
[351] Schady et al., 2023

[352] Park et al., 2021. Methodology to translate standard deviation into learning losses assumes students learn on average 0.3 standard deviations per year and that a typical academic year has 180 days (See Sabarwal et al., 2023 and Bau et al., 2021 for more information). The formula is thus:

$$Days\ of\ learning\ lost = \frac{SD_{change}}{0.3\ LAYS} * 9\ months * 20\ days$$

[353] Garg et al., 2020
[354] Park, 2022; Zivin et al., 2020; Vu, 2022; Melo & Suzuki, 2021; Zhang et al., 2024
[355] Zhang et al., 2024
[356] Vu, 2022
[357] Hermann et al., 2020
[358] Cho, 2017
[359] Schady, et al., forthcoming
[360] Park et al., 2020
[361] Roach & Whitney, 2022
[362] Brink et al., 2020
[363] Dupont et al., 2023
[364] Simmons et al., 2008
[365] Davis, Cannon, & Fuller, 2021
[366] Davies & Maconochie, 2009
[367] Yeganeh et al., 2018
[368] Franca Barbic et al., 2022; F Barbic et al., 2019; Brink et al., 2021; Porras- Salazar et al., 2018; Wargocki et al., 2019; Studies ranging from elementary to college/university level students. Assumes effect of temperature on achievement is linear. Two studies observed no effect of temperature.
[369] Roach & Whitney, 2022
[370] Johnston et al., 2021
[371] Schady et al., 2024
[372] Climate Change Knowledge Portal, 2024b
[373] Climate Change Knowledge Portal, 2024b
[374] Randell & Gray, 2018
[375] Duque et al., 2019
[376] Caminade et al., 2019
[377] Ryan et al., 2020
[378] Aguilera et al. 2021; Reid et al. 2016; Chen et al., 2024
[379] Bernardi and Keivabu 2023 ; Gilraine and Zheng 2022; Amanzadeh et al. 2020; Carneiro et al. 2021; Miller and Vela 2013; Zhang et al. 2018; Balakrishnan and Tsaneva 2021
[380] Fiore et al., 2015
[381] Silva et al., 2017
[382] Silva et al., 2017
[383] Requia et al., 2022
[384] Chen et al., 2018
[385] Weems et al., 2009
[386] Ritchie et al., 2021
[387] Crandon et al., 2022
[388] UNDP, 2022
[389] Schmidhuber & Tubiello, 2007
[390] Opoola et al., 2016
[391] Nübler et al., 2021
[392] Asadullah, Islam, & Wahhaj, 2021
[393] Hsiang et al., 2013
[394] Bakaki et al., 2023
[395] FCDO report, 2023
[396] Caruso et al., 2024; WBG, 2023a
[397] Wen & Burke, 2021
[398] Dell, Jones, and Olken 2012
[399] Jerrim and Macmillan 2015

[400] Duncan and Murnane 2011
[401] Leichenko et al., 2014
[402] Hanushek & Maximilian, 2021
[403] World Bank, 2022b
[404] UNICEF, 2014
[405] Hickel, 2020
[406] Dell et al., 2012
[407] Ford, 2022
[408] Benevolenza et al., 2019
[409] GPE, 2023
[410] Joshi, 2019
[411] Fruttero et al., 2023
[412] Swaine, 2018
[413] Asadullah et al., 2021
[414] Onyango et al., 2019
[415] Fruttero et al., 2023
[416] Park et al., 2021
[417] GPE & Save the Children, 2023
[418] UNFCCC, 2023
[419] IRC, 2023
[420] World Bank, 2024a
[421] David et al., 2018
[422] GPE, 2023
[423] MacEwen et al., 2022
[424] UN, 2018
[425] Kumer, 2022
[426] Aranda, 2022
[427] Adelman et al., (forthcoming)
[428] Bobonis et al., 2020
[429] World Bank, 2022c
[430] World Bank, 2022d
[431] Macks, 1987
[432] Alves et al., 2018
[433] World Bank, 2024a
[434] World Bank, 2024a
[435] Sakti et al., 2021
[436] Wargocki et aal, 2019
[437] Porras- Salazar et al., 2018
[438] Chalupka et al., 2019
[439] Odera et al., 2020
[440] UNICEF, 2018
[441] Singh & Shah, 2022
[442] World Bank, 2023b
[443] World Bank, 2024a
[444] Cadag et al., 2017
[445] Angrist et al., 2023
[446] Santana et al., 2013
[447] Munoz-Najar et al., 2021
[448] World Bank, 2015
[449] World Bank, 2022b
[450] Citi news, 2021
[451] MBSSE, 2020
[452] Attanasio et al., 2012; De Brauw et al., 2015
[453] Muralidharan & Prakash, 2017; IPA, 2020
[454] Swaine, 2018
[455] Sims, 2021
[456] Asadullah et al., 2021

[457] Onyango et al., 2019
[458] World Bank, 2022b
[459] World Bank, 2023c
[460] Schady et al., 2023; WBG, 2022b
[461] WFP, 2023
[462] Chakraborty & Jayaraman, 2019
[463] Glewwe et al., 2001
[464] Murphy et al. 2015; Agnafors et al. 2021; Bas 2021
[465] Sanchez et al., 2018 ; Guzmán et al., 2015
[466] Lundeberg, 2021
[467] UNICEF, 2021b
[468] Chet et al., 2023
[469] Juwitasari, 2022
[470] Bangladesh, Chad, Gabon, Jordan, Pakistan, Uganda
[471] Hernandez, 2019
[472] Sanchez, 2023
[473] Cadag et al., 2017
[474] Pellerone, 2021
[475] UNICEF, 2020
[476] Chanduvi et. al, 2023
[477] For remote learning solutions, we are excluding hardware costs for phones, tablets, and laptops, operating under the assumption that students will have access to at least one smart device within their households.
[478] The low-cost package includes the following interventions: Fans, painting rooftops, planting trees, permeable pavements, IT infrastructure, teacher training.
[479] The medium cost package includes the following interventions: Air coolers, painting rooftops, planting trees, permeable pavements, IT infrastructure, phone-based learning and teacher training
[480] The high-cost package includes the following interventions: Air conditioning, painting rooftops, planting trees, retaining walls, permeable pavements, IT infrastructure, one-on-one tutoring, teacher training
[481] Central Board of Secondary Education, 2023
[482] Calculated at a cost of US$0.05 per BTU, assuming 1 BTU = 20sq. ft.; Estimates generated from expert interviews using actual school improvement plans in Guyana
[483] Unless used well and in conditions where temperature is below average human body temperatures, fans may be non-effective or worse, counter-productive for temperature management; United States Centers for Disease Control, 2021
[484] Estimates generated from expert interviews using actual school improvement plans in India
[485] Evaporative air coolers, also known as water coolers, are devices that cool air through the evaporation of water. Coolers draw in warm air and pass it through water-saturated pads, which absorb the heat from air and evaporate, leaving a cooling effect.
[486] Estimates generated from expert interviews using actual school improvement plans in India
[487] Global Cool Cities Alliance, 2012
[488] Garg, et. al, 2016
[489] Calculated using cost of US$0.75/m^2; ESMAP, 2020
[490] Vanos et. al, 2016
[491] Assuming 1 tree will offer shade to a classroom of 30 students; Third Millenium Alliance, 2021
[492] World Health Organization, 2024
[493] Rentschler et al., 2022
[494] Calculated using average cost per school of US$10,700, assuming an average school has 12 grades with approximately 40 students each; Estimates generated from expert interviews using actual school improvement plans in Rwanda.
[495] Ozment et. al, 2022
[496] Low Impact Development Center, 2007
[497] Ozment et. al, 2022
[498] Ozment et. al, 2022
[499] World Bank, 2020a
[500] Angrist et. al, 2020
[501] Carlana and La Ferrara, 2021
[502] Calculated as GHS 1 = US$0.064; Turkson et. al, 2020
[503] Psacharopoulos and Patrinos, 2018
[504] World Bank, 2017
[505] GPE, 2016

[506] Hanushek & Woessmann, 2021
[507] Muttarak & Pothisiri, 2013; Pichler & Striessnig, 2013; Van der Land & Hummel, 2013; Wamsler et al., 2012
[508] UNICEF, 2022a
[509] Muttarak & Lutz, 2014
[510] Angrist et al., 2024
[511] Wang et al., 2022
[512] Chankrajang & Muttarak, 2017
[513] T. M. Lee et al., 2015
[514] Chankrajang & Muttarak, 2017
[515] GPE, 2023
[516] UNICEF, 2022b
[517] Authors own analysis based on a review of the CCDRs made publicly available as of April 2024
[518] First three pages of google scholar search of search terms climate AND impact AND economic including only articles published 2010 and onwards that are review articles on the broad impacts on economy/social and excluding articles on a specific sector or with a methods focus or that have a specific regional focus.
[519] A Web of Science search on the topic "climate and impact" with the search terms, health resulted in 24,980, economic produced 31,243 and education produced 5,732. From these results, we can conclude that there is four times more research on the economic impacts of climate and five times more research on health impacts of climate than there is research considering the educational impacts of climate. Out of the 5,732 results from Web of Science of climate impacts on education, 1903 (33 percent) are based in the United States and 4,467 (78 percent) are from high-income economies (based on WBG classifications). This is based on web of science classifications and may not describe where the research for the manuscript it based.
[520] Spindelman, 2024

BOX IMAGE SOURCES

Box 1.2 (left) – Alliance for World Change (Photo: Clement Kaponda)

Box 1.2 (middle) – Sandwatch Foundation (Photo: Sandwatch)

Box 1.2 (right) - HEROES Climate Data Collection Initiative (Photo: Karuna Foundation)

Box 2.3 (left) – Welding / construction worker (Photo: ClimateScorecard.org)

Box 2.3 (middle) – YSEALI Program Logo (Photo: U.S. Mission to ASEAN)

Box 2.3 (right) – Workers walking by solar panels (Photo: Clean Energy Finance Corporation)

Box 2.4 (left) – Mirim Meister High School in Seoul (Photo: Education Commission)

Box 2.4 middle) – Workers installing solar panels (Photo: Center for American Progress)

Box 2.4 (right) – Solar photovoltaic panels (Photo: Power Technology / Zhengzaishuru)

Box 3.2 (left) – Indonesia Disaster Risk Map (Photo: Badan Nasional Penanggulangan Bencana)

Box 3.2 (middle) – Screenshot InaRisk Logo (Photo: GooglePlay Store)

Box 3.2 (right) – Screenshot InaRisk Application (Photo: GooglePlay Store)

Box 3.3 (left) – Indonesia White Rooftop (Photo: Clean Cooling Collaborative/ClimateWorks Foundation)

Box 3.3 (middle) – Kenyan students planting trees (Photo: Trees for the Future)

Box 3.3 (right) – An illustrative photo of an air conditioning unit (Photo: Carlos Lindner on Unsplash)

Box 3.4 (left) - Gando Primary School (Photo: Simeon Duchoud)

Box 3.4 (middle) - Sections of Gando Primary School (Photo: Kéré Architecture)

Box 3.4 (right) - Detail of roof of Gando Primary School (Photo: Kéré Architecture)

Box 3.5 (left) – Bangladeshi Student (Photo: Tapash Paul/The World Bank)

Box 3.5 (middle) – Screenshot Luminos Results as of August 19, 2024 (Photo: Luminos Fund)

Box 3.5 (right) – Mozambique (Photo: @UNICEF/Mozambique/2019/Potter)

Box 3.6 (left) – Online Course on Safety for School Children (Photo: Ministry of Education and Science of the Kyrgyz Republic and UNICEF)

Box 3.6 (middle) - School children are trying firefighter clothing (Photo: World Bank / Batken)

Box 3.6 (right) – Manual: Disaster Risk Reduction for Public Schools of the Kyrgyz Republic (Photo: UNICEF)