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EDUCATION AND CLIMATE CHANGE

How to build skills for climate action in school-aged children and youth

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Education and Climate Change:

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Climate change threatens economic growth and sustainable development in Latin America and the Caribbean (LAC). In recent decades, greenhouse gas (GHG) emissions have triggered an unparalleled rise in temperatures. This trend has caused major climatic shifts, an increased likelihood of extreme events, and devastating socioeconomic impacts in the region. In 2015, countries signed the Paris Agreement on Climate Change, which commits them to keep the global average temperature from rising more than 2°C compared to preindustrial levels, and to make every effort to keep this average from crossing the 1.5°C threshold. This commitment involves setting ambitious targets to reduce GHG emissions, building resilience to cope with the inevitable impacts of climate change, as well as taking action to protect people, communities, the economy, and the environment from the consequences of a warmer world.

There are three main spheres of action in education that can support and add value to countries' decarbonization and climate change resilience efforts: (i) equipping children and youth with pro-environmental knowledge, values, and capacity for action, as well as the skills they need to secure and succeed in green jobs; (ii) ensuring the continuity of educational services as extreme weather events become more frequent, and providing comfortable classroom environments that are conducive to learning, even when temperatures are extreme; and (iii) implementing climate-sustainable practices in school infrastructure and educational services to help countries reach their GHG emission reduction targets.

This brief takes stock of the challenges that climate change poses for education systems, including how ready students are to tackle climate change, the level of resilience of education systems, and climate-sustainable strategies used in education system operations. It then presents a conceptual framework for how education can bring value to the climate change agenda. Next, the brief describes actions to develop school-age students' climate-related knowledge, values, and capacity for action, as well as their skills for green jobs. It also lays out strategies for making education systems more climate-resilient and reducing the systems' own GHG emissions.

1 THE CHALLENGES OF CLIMATE CHANGE FOR EDUCATION

To advance climate action in the region, people need the skills to truly live sustainable and environmentally friendly lives, to be agents of change for the environment, to cope with the effects of climate change in their daily lives, and to secure jobs that help countries transition to low-carbon economies. However, the limited evidence available suggests that children and youth are not gaining these skills. Instead, they graduate without the knowledge, values, and capacity for action needed to address climate change, or the skills they need to access green jobs. These educational gaps are compounded by increasingly frequent and intense extreme weather events and rising temperatures, which affect the continuity and quality of education students receive, since education systems are not ready to handle these threats. Meanwhile, education systems are not seizing opportunities to make their operations sustainable and environmentally friendly through green strategies that align with countries' GHG emission reduction targets. And the final challenge underlies all the others: countries do not include education as a priority sector in climate strategies, meaning that they do not always give priority to education-related climate actions.

Challenge 1: The limited evidence available suggests that children and youth do not have the knowledge, values, or capacity for action needed to tackle climate change

Children and youth in Latin America and the Caribbean perform poorly in science, which may mean they have little knowledge about the environment, biodiversity, and climate change. There are currently no comprehensive measurements of the climate-related knowledge, values, and capacity for action among children and youth. Science tests can be considered a proxy for knowledge about the environment, biodiversity, and climate change, since these topics are typically part of the science curriculum (UNESCO, 2020a; UNESCO, 2020b; UNESCO, 2022a). The results of the Regional Comparative and Explanatory Study (Estudio Regional Comparativo y Explicativo—ERCE)[1] show that only a small percentage of sixth-grade students in the region (21%) achieve minimum learning levels in science. Two

1. The ERCE science test covers five domains with significant climate change aspects: (i) human body and health, (ii) science, technology, and society, (iii) Earth and the solar system, (iv) energy and matter, and (v) living beings, ecology, and environment. It also includes three skill sets that are important for green citizenship: (i) recognizing scientific information, (ii) analyzing and applying scientific knowledge, and (iii) producing, sharing, and evaluating scientific knowledge.

PISA instruments can be used to measure two areas of knowledge about environmental issues in 15-year-olds: a selection of items from the PISA 2015 science assessment reflect knowledge of environmental science,[2] and a selection of items from the 2018 PISA Global Competence assessment measure knowledge of environmental sustainability.[3] In environmental science, 30.5% of 15-year-olds in Mexico and Chile[4] answered the questions correctly, compared to the OECD average of 41.5%. In environmental sustainability, 22% of students in Latin America and the Caribbean answered correctly about how temperature affects sea level rise, and 30% answered correctly about ethical clothing production and its effects on water use and environmental waste and pollution. LAC percentages were consistently below the average of all countries participating in the study.

Regarding environmental values and awareness, youth report knowing about and being familiar with climate change and global warming, and consider them to be key factors for the future of the planet. In the survey on the PISA 2018[5] Global Competence Assessment, 69% of 15-year-olds in Latin America and the Caribbean claimed to know about and be familiar with climate change and global warming. Although this proportion represents a majority, it is lower than the OECD average (78.5%). Students in the region also reported high levels of self-efficacy on environmental matters: For example, 75% of students said that they could easily or with some effort explain why global climate change impacts some countries more severely than others; 72% said they could discuss the environmental consequences of economic development; and 61% said they could explain how carbon dioxide emissions affect global climate change (OECD, 2020). These youth also claim to value the environment: 84% of students in Latin America and the Caribbean agreed or strongly agreed with the statement that "taking care of the global environment is important to me" (OECD, 2019). The level of importance that these students attribute to the environment aligns with the results of the seventh round of the World Values Survey, in which 61% of participants under age 29 said that environmental protection should be made a priority, even if it means

2. The PISA 2015 science assessment included 11 items designed to measure student performance in environmental science. In the PISA 2018, only 6 of these items were administered in all participating countries, which is why the OECD (2022) chose to measure environmental science using data from the PISA 2015.
3. As reported in an OECD study on the issue (OECD 2022), the PISA 2018 global competence assessment uses two instruments to measure students' proficiency in global issues, including environmental sustainability: (i) a cognitive test that assesses knowledge and skills needed to solve global problems. In environmental sustainability, this test measures natural resource use, environmental risks and policies, and practices and behaviors for environmental sustainability through 20 items organized into 5 units: rising sea levels, ethical clothing, oil exploration, palm oil, and the Blue River Dam (only the first two units have published items); and (ii) a self-reported questionnaire that collects students' assessment, awareness, and attitudes about global issues. Four countries in the region (Chile, Colombia, Costa Rica, and Panama) participated in the PISA 2018 global competence assessment (OECD, 2022; OECD, 2018).
4. Only Mexico and Chile have data on these items from PISA 2015.
5. These results should be analyzed with caution, since they are self-reported by the students themselves and may be biased or inconsistent. Also, they only reflect familiarity with global climate change concepts. For more information on potential self-reporting biases, see Galloway et al. (2017), Hoskins and Liu (2019), Kyllonen (2015), and Kyllonen and Bertling (2014).

slower economic growth and some job cuts (Haerpfer et al., 2022). This proportion is larger than the 55% reported for those over age 30.

Young people in the region report behaving in pro-environmental ways in their daily lives and being active and vocal in their demands for climate action. Among 15-year-olds in Latin America and the Caribbean, 78% said they reduce their home energy consumption by turning off the heating or air conditioning to protect the environment, 49% participate in activities to support environmental protection, 48% choose products for ethical or environmental reasons even if they are slightly more expensive, and 31% sign environmental or social petitions online (OECD, 2019). **But despite being active and vocal in their demands for climate action, young people report having little capacity to influence climate policy.** A UNICEF survey of young climate and environmental activists found that 7 out of 10 activists report not being included in public policy decisions on climate change and environmental protection, even though over half of them believe that their actions can impact decision-making in these areas. These numbers reveal a significant gap between young activists' desire to shape climate policy and the limited opportunities for them to actually participate (Restrepo and Méndez, 2021). The fact that today's climate decisions will have consequences for future generations makes the limited capacity of young people to influence public climate policy even more relevant (UNICEF,2012a; UNICEF, 2012b).

In terms of the technical skills required to transition to a green economy, current data suggests significant gaps between existing skills in the workforce and future needs. Projections by the Inter-American Development Bank (IDB) and the International Labour Organization (ILO) estimate that Latin America and the Caribbean will gain 15 million net new jobs by pursuing a net-zero economy instead of continuing its current trajectory. The region can gain an estimated 22.5 million jobs in agriculture, renewable energy, forestry, construction, and manufacturing. On the other hand, it could lose 7.5 million jobs in the fossil fuel industry (both extraction and power generation), and in livestock farming and food production. The new jobs will require technical skills in these industries: an estimated 13.5 million moderately skilled workers, 8.2 million unskilled workers, and 820,000 highly skilled workers. In addition to technical skills, these professionals will also need socio-emotional, interpersonal, and business skills, as well as lifelong learning capacities (Saget et al., 2020). The ILO has identified significant gaps and shortages of workers with the skills needed for environmentally sustainable industries, especially in developing countries.[6] In Costa Rica, for example, a study on skills for the green economy estimated that over 40,000 small and

6. According to the ILO, a number of skills are needed for green jobs. Some are specific new skills, such as knowledge about sustainable materials or environmental impact assessments, while others are not green skills per se, and are only as green as the context in which they are applied (e.g., construction skills are green only when applied in green buildings). Studies on this topic consistently mention a number of skills, including communication, management, innovation, entrepreneurship, environmental awareness, leadership, risk analysis, and decision-making skills (ILO, 2018a; ILO, 2019b).

medium-sized enterprises could have severe difficulty finding workers to adapt their facilities due to the low number of environmental management graduates (ILO, 2019a; ILO, 2018b). Finally, the environmental targets that countries set in their NDCs[7] and LTS[8] will create green skills demand[9] that the existing workforce may not be able to meet, so countries will need to identify these gaps and address them in educational and job training plans.

Children and youth do not seem prepared to tackle climate change, based on a superficial assessment using the limited data available about their climate-related knowledge, values, and capacity for action. Their skills in this area are poor in part because education systems are ill-equipped to build them. This shortcoming can in turn be attributed to the failure to fully include the climate agenda in policies and curricula for primary, secondary, and higher education; to teachers that are poorly trained to build these skills in their students; to ineffective teaching practices; and to the lack of data on current skill levels, data which could be used to inform decision-making. Even though education systems' progress on fostering green citizenship is still incipient, students already display certain levels of pro-environmental knowledge, values, and behaviors, which suggests that information and awareness about climate change is reaching them through other channels.

Educational policies and curricula for primary and secondary education give little attention to environmental, climate change, and biodiversity. A study on the education sector plans and national curricular frameworks of 100 UNESCO member states (16 of them in Latin America and the Caribbean) analyzed key words associated with climate change (greenhouse gases, global warming, climate change, climate crisis, and carbon) and found that almost half (47%) of these policies and curricula do not mention climate change. It also found that those that do include the topic generally do so in a minimal way. Of the LAC countries included in the study, only 19% mention climate change in their curricula (UNESCO, 2021b). Another study conducted as part of the ERCE also analyzed official curricular documents from 18 countries in Latin America and the Caribbean to determine whether they included broader concepts related to Education for Sustainable Development and Global Citizenship. It found that the key concepts of climate change (environment, sustainability, biodiversity, resources, disaster risk, critical thinking, health, ecology, participatory decision-making, pollution, and climate change, among others) appear in the documents of 60% of the countries (UNESCO, 2020b). However, these concepts are not necessarily reaching the classroom. They are mainly present at the declaratory level (i.e., in schools'

7. NDCs (Nationally Determined Contributions) are national climate action strategies established to implement the Paris Agreement and achieve its long-term objectives.
8. LTS (Long-Term Climate Strategies) are low-GHG-emission development strategies through 2050 that seek to link the near-term goals of NDCs with the long-term goals of the Paris Agreement.
9. They include work to develop green industries and the "greening" of existing jobs.

objectives, vision, and mission), rather than at the program level (i.e., in learning objectives and curriculum content). When these ideas do reach the classroom, the focus is on teaching scientific knowledge and valuing the environment instead of on developing skills for climate action (UNESCO, 2019). To truly understand the extent to which climate change is included in educational policies and curricula, additional studies will need to move beyond keyword searches and thoroughly analyze how students' knowledge, values, and climate action capacity are developed.

The underemphasis on building green job skills is a pattern that repeats in vocational and university education. Most countries do not include skill development for the transition to green economies in vocational education or university programs (ILO, 2018). A self-assessment by 40 universities from 9 countries in the region shows that their curricula do not cover the Sustainable Development Goals, including climate change (Ursula, 2019; Valleys, 2021). According to the Times Higher Education Impact Rankings, which evaluate how universities impact progress on the Sustainable Development Goals, only 3 of the 66 universities in the region included in the ranking are among the top 100 for goal 13 on climate action. The ranking takes into account universities' climate research, their energy use, and their preparations to deal with the consequences of climate change (Times Higher Education, 2023). Again, the size of the challenge is not clear because there are no studies that comprehensively analyze vocational and university curricula to determine their capacity to build green job skills, and there is even some ambiguity surrounding which skills will be needed for green jobs and for the mid- to long-term transition to zero-emission economies in the region.

Teacher training does not adequately cover environmental and climate change issues. In a UNESCO survey of teachers in 93 countries and territories (with 35% of the responses coming from Latin America and the Caribbean), teachers report having few opportunities to develop and expand their knowledge about the environment and climate change. For example, 36% say that environmental issues, including climate change and biodiversity, were never included in their initial or ongoing training (UNESCO, 2022b). And despite the fact that 93% of teachers consider teaching about climate change to be important or very important (UNESCO and Education International, 2021), only 40% say they can share knowledge on the subject, 20% believe they can explain how to take climate action, and 30% say they are not familiar with good methods for teaching about climate change (UNESCO, 2021b). This data is consistent with the findings of a systematic review of over 200 studies on climate change, which reveals that the topic is scarcely covered at all in teacher's professional development, and only in initial teacher training in the few cases in which it is present (Rousell and Cutter-Mackenzie-Knowles, 2020). This problem is compounded by the overall lack of certified science and environmental education teachers in the region, especially in the areas most affected by climate change (like rural and vulnerable urban ar-

eas). For example, in Chile, 57% of secondary-level science teachers at low-income schools are not certified in science (Bertoni et al., 2020).

Teachers in Latin America and the Caribbean generally use obsolete teaching methods that do not effectively build knowledge, values, and capacity for climate action. A study that analyzes teaching practices in math and science classrooms in three countries in the region finds a predominance of traditional teaching methods that aim to give students a procedural understanding of content by having them memorize facts and practical formulas. This approach is not an effective way to build skills for green citizenship (Naslund Hadley et al., 2014). The study shows that few teachers make a concerted effort to actively engage students in hands-on science activities that provide opportunities to build analytical and critical thinking skills.

BOX 1 THE IDB IN ACTION: GREENING BARBADOS' CURRICULUM AND EDUCATIONAL INFRASTRUCTURES

The IDB is partnering with the Government of Barbados to implement a loan operation (Skills for the Future II) to strengthen Barbados' education system and give the country's workforce the skills needed to implement its sustainable and resilient economic development plan and reach its climate goals.

The operation's first component involves reforming and developing a new curriculum that covers climate change and the blue and green economy, as well as sustainable agricultural sciences. This reform entails updating the standards for each subject, training teachers and teacher trainers, developing new teaching and educational materials, updating tests, and developing a mechanism for ongoing updates to the curriculum.

The operation also aims to upgrade schools' physical and digital infrastructure based on sustainable and resilient best practice standards and building code requirements. This upgrade includes a standardized renovation package with cost-effective measures to improve energy and water efficiency, following EDGE guidelines, and enhance resilience and sustainability by incorporating photovoltaic panels, rainwater harvesting, water storage, accessibility for disabled people, and upgrading local code requirements for all subsystems (electricity, water, sanitation, and security).

Challenge 2: Education systems have low climate resilience, making it difficult for them to continue operating during climate emergencies and impacting students' ability to learn

The region's educational infrastructure is vulnerable to the impacts of climate change. Over the last 50 years, climate-related disasters (like floods, extreme temperatures, droughts, fires, landslides, and storms) have more than tripled in the region (WMO, 2021). These events directly affect education when they damage or destroy school infrastructure, equipment, teaching materials, and other infrastructure that connects communities to schools, interrupting young peoples' education. In Latin America and the Caribbean, 9 out of 10 children live in places at high risk of at least two types of climate and environmental hazards, which jeopardizes their access to education (UNICEF, 2021a). For example, in 2021 hurricanes and tropical storms Eta and Iota damaged or destroyed nearly 1,000 schools in Honduras and Guatemala, and nearly 700 schools were used as shelters. In Honduras, the school year had to be ended one month early (IDB and ECLAC, 2021; Bello and Peralta, 2021). Hurricane Mathew damaged over 300 schools in Haiti in 2016, and more than 100,000 students missed out on learning because of this damage and the use of schools as shelters (UNICEF, 2016). Meanwhile, severe drought in Mexico forced schools in several areas of the state of Nuevo León to adjust and shorten their hours and end the school year early because it was impossible to guarantee the water supply (Carrizales, 2022; Delgado, 2022).

Education systems have not succeeded in implementing quality distance learning methods that would allow them to continue to provide services during emergencies. In response to the COVID-19 pandemic and unexpected school closures, countries in the region had to launch alternative strategies to continue their educational services until schools reopened. Almost all countries offered some form of distance education, like online learning or educational programs via television or radio, but evidence shows that the transition to distance learning was greatly complicated by the lack of digital infrastructure: only 22% of households in the region had Internet access and only 19% had access to a computer (Abizanda et al., 2022; Rieble and Viteri, 2020). This reality led to large learning losses of 1 to 1.8 learning-adjusted years of schooling (World Bank and UNICEF, 2022). The experience with COVID-19 illustrates the difficulties that the region's education systems face when trying to continue providing educational services in climate or other emergencies.

Rising temperatures makes classrooms less comfortable, which negatively affects children's ability to learn. Higher classroom temperatures cause children to lose focus, become lethargic, and achieve lower scores on learning tests. These negative effects disproportionately affect students from lower socioeconomic backgrounds.[10] When temperatures are

10. There is ample evidence of how high temperatures negatively affects students, particularly those of lower socioeconomic status. Examples can be found in REL (2018), Park (2017), Park et al. (2020); Foy et al. (2021), Mendell and Heath (2005), Wargocki and Wyon (2007), Wargocki and Wyon (2013), Wargocki et al. (2005) and Pérez et al. (2014).

extreme, schools let children out early or cancel classes, which decreases the amount of time they have for learning (UNICEF, 2019a; UNICEF, 2015). An IDB study in six countries in the region found that thermal conditions in 70% of classrooms analyzed are not conducive to learning.[11] This percentage is expected to grow in coming years as average and extreme temperatures rise (WMO, 2022; Castellanos et al., 2022). Climate change also affects other determinants of health that are preconditions for learning, like access to water, nutrition, and clean air (UNICEF, 2019b; Wodtke et al., 2022; Gaihre, et al. 2014).

In addition to extreme weather and climate events, other factors also negatively affect people mental health and emotional well-being, and children and youth are at highest risk. The negative impact of climate change can take a toll on people's emotions and well-being: many report feeling overwhelmed by anger and anxiety, and particularly feeling that they have no control over their planet (Lawrance et al., 2021). This is especially true for children and youth, who in the wake of extreme weather events report stronger emotions like post-traumatic stress, depression, and sleep disorders. Young adults also report higher levels of climate anxiety, affecting their ability to function (Clayton, 2020; Clayton and Karazsia, 2020). A study that was groundbreaking due to its size and use of international data surveyed 10,000 young adults ages 16 to 25 from 10 countries (including Brazil) and found that respondents in all countries were concerned about climate change: 84% were at least moderately concerned and 59% were very or extremely concerned. Over half of the youth reported experiencing sadness, anxiety, anger, helplessness, and guilt about climate change. In addition, over 45% of respondents said that their feelings about climate change were negatively affecting their daily lives and ability to function, and many reported having a large number of negative thoughts about the issue (75% thought the future is frightening and 83% said people have failed to take care of the planet). The countries where the most concern and impact on functioning was recorded tended to be poorer and more directly affected by climate change (Hickman et al., 2021). However, this issue has not been prioritized in schools, even in developed countries, where schools lack staff to provide the mental health support that students need (Will, 2022), despite evidence that anxiety affects students' ability to learn (Moran, 2016; Hashempour and Mehrad, 2014; Rosenfeld, 1978). These climatic factors exacerbate others that are already undermining the mental health of young people in the region, such as violence in their environments, addiction, or lack of prospects (Pupo-González et al., 2018; UNICEF, 2021b).

11. San Juan et al. (2014) studied 117 classrooms in 39 buildings in six countries (Argentina, Chile, Colombia, Costa Rica, Mexico, and the Dominican Republic) during two seasons (winter/summer, autumn/spring or rainy/dry). Their results match those of Wargocki and Wyon (2013), who find that ambient conditions in elementary schools almost universally fail to meet relevant standards and building codes, even in developed countries.

Challenge 3: Education systems have not yet managed to systematically incorporate green strategies for decarbonizing economies into their operations

Education systems do not appear to systematically use sustainable practices in their services, so their GHG emissions are higher than they could be. These systems serve over 150 million school-aged children and young people in the region, and the school buildings, food, water, and transportation they use have an impact on the environment. The lack of exact estimates of educational institutions' carbon footprint suggests that sustainable infrastructure and resource use in education services has not yet been systematically prioritized (UIS UNESCO, 2022; K12 Climate Action Commission, 2021).

BOX 2 THE IDB IN ACTION: GREEN SCHOOL INFRASTRUCTURE

The IDB has launched several initiatives to incorporate sustainability and climate resilience strategies into how schools are designed, built, and used. It has published studies on how school buildings can contribute to decarbonization and climate resilience, including guidelines for infrastructure, as well as practical advice on applying those guidelines in specific regions. It has also conducted research to determine how comfortable schools in different countries in the region are.

Additionally, the IDB has partnered with different countries in the region to design and execute loan operations for building and renovating infrastructure to make it sustainable and resilient. For example, the Program to Support the Expansion of Secondary Education, currently underway in Guatemala, funds the expansion or construction of 500 new classrooms. All of them will meet sustainability and climate resilience criteria for water and energy efficiency, and 60% are being equipped with solar panels, complying with EDGE certification requirements. The operation also includes financing to improve physical learning environments in eco-efficient ways that boost decarbonization and climate resilience. It will therefore fund solar panel installation and measures to save energy and water and boost climate resilience, such as LED lighting and water-saving bathroom faucets and toilets. And through the program Improvement of the quality of services for higher and technical education at a national level in Peru, the IDB will finance a comprehensive overhaul of nine schools. The process will include designing and building infrastructure according to sustainability, energy and water efficiency, and climate risk resilience criteria.

Cross-cutting challenge: Countries' climate goals and strategies place little emphasis on education

Globally, only 24% of new or recently updated national climate change action strategies—that is, Nationally Determined Contributions (NDCs)—mention the role of education for youth and children in the climate agenda. Only 21% specifically mention climate change education, and none establish it as a mandatory climate change strategy (Kwauk, 2021a). In Latin America and the Caribbean, less than 10% of NDCs mention education as a priority area for climate change adaptation (WMO, 2022). Additionally, Action for Climate Empowerment (ACE),[12] which includes education for climate action, has not had enough funding for countries to implement their national ACE strategies, leaving this agenda low on the priority list (Kwauk, 2021b). Finally, although target 4.7 of the Sustainable Development Goals (SDGs) commits countries to promoting education for sustainable development and global citizenship, including education for climate change, most countries do not even measure this aspect, which suggests that they do not give the issue priority. On the website that monitors progress toward SDGs,[13] only seven countries in LAC report that they have included sustainable development and global citizenship in teacher training, and only five report having added these topics to curricula. Meanwhile only 7 of the 21 countries in the region that have performed a Voluntary National Review[14] make any mention of target 4.7. Because education is not part of countries' climate agenda, the education sector barely participates in decarbonization or climate resilience strategies.

12. This term was adopted by the United Nations Framework Convention on Climate Change (UNFCCC) to describe work in six areas (climate change education, capacity building, public participation, public access to information, and international cooperation on climate change) with the aim of empowering all members of society to take climate action.

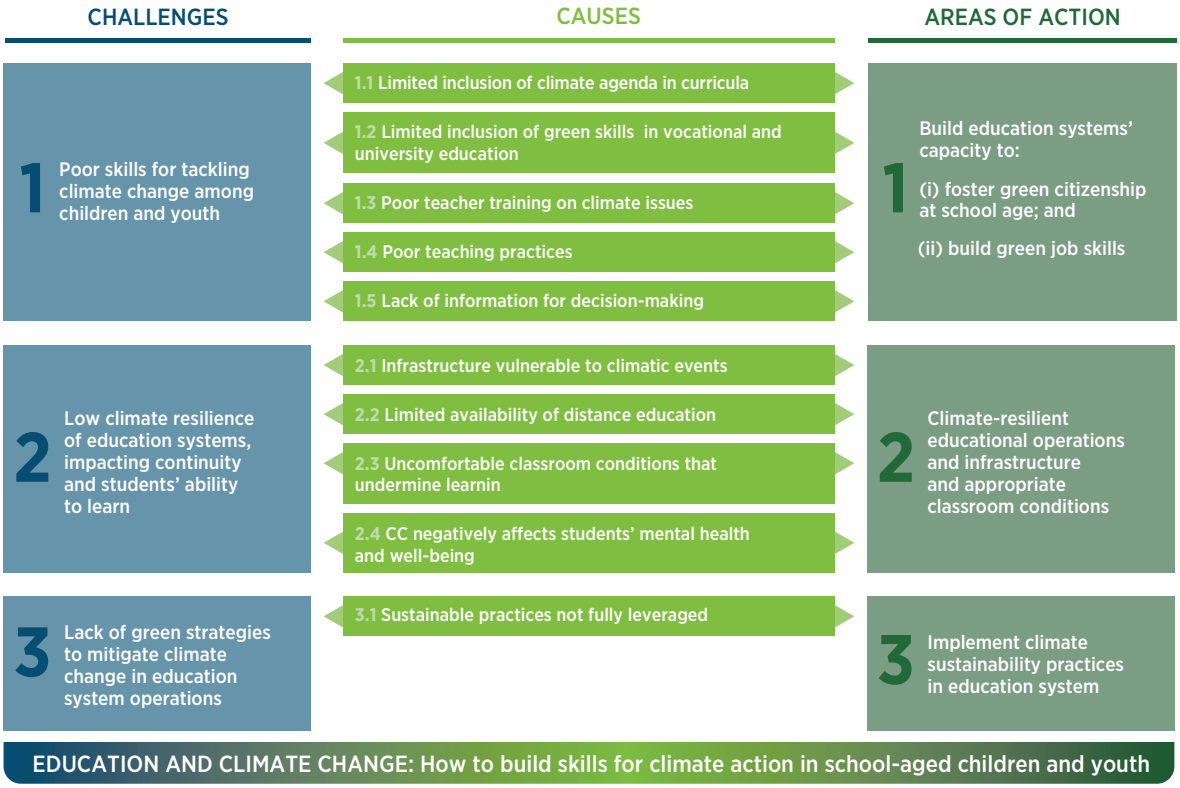
13. For more information, see: https://sdq-tracker.org/quality-education#targets and http://sdg4-data.uis.unesco.org/.

14. Process by which countries assess and present their progress on implementing the 2030 Agenda to the High-Level Political Forum on Sustainable Development.

2 THE VALUE EDUCATION BRINGS TO THE CLIMATE CHANGE AGENDA

There are three main spheres of action in education that can support and add value to countries' decarbonization and climate resilience efforts: (i) equipping children and youth with pro-environmental knowledge, values, and capacity for action, as well as the skills they need to secure and succeed in green jobs; (ii) ensuring the continuity of educational services as extreme weather events become more frequent, and providing comfortable classroom environments that are conducive to learning even when temperatures are extreme; and (iii) implementing climate-sustainable practices in school infrastructure and educational services to help countries reach their GHG emission reduction targets. Comprehensive action in these spheres can cultivate green citizenship in students, helping them become global citizens who are prepared to respond to the ways climate change poses a challenge for sustainable development and our ability to thrive on the planet. And to maximize action in the three spheres above, education must be included in climate change strategies.

FIGURE 1 CONCEPTUAL FRAMEWORK FOR EDUCATION AND CLIMATE CHANGE



Source: Prepared by the authors

1 Developing green citizenship among school-age students, as well as green job skills

Education plays a fundamental role in fostering green citizenship among children and youth. It can give them key knowledge about the environment, biodiversity, and climate change; the capacity to understand and address the impacts of the climate crisis; and the skills, values, and habits needed to individually and collectively bring about change to protect the environment, adapt to climate change, live a pro-environmental life, and build sustainable, resilient, and adaptable societies. Education also equips students to adapt more quickly and effectively, which improves their climate resilience. Also, education can reduce vulnerability to climate change by ensuring that students have the skills they need to respond and adapt to climate disasters, have more resources to meet their needs, and are more empowered and equipped to innovate and find solutions

(UNICEF, 2021a).[15] In addition, more educated people have greater awareness of the challenges of climate change, behave in more pro-environmental ways, and show a stronger preference for climate policies (Angrist et al., 2023). To become green citizens, school-age students need skills in three key dimensions: [16,17]:

1 Knowledge: Students should learn up-to-date scientific information about the environment, biodiversity, and climate change, including its impacts and trade-offs (economic, social, environmental) and potential solutions (for reducing emissions and adapting to climate change). Students need this knowledge so they can make data- and evidence-based decisions, evaluate different decarbonization and climate resilience options in order to thrive on a changing planet, and differentiate opinion-based claims from those supported by scientific evidence.

2 Values: If students are to act as agents of change, they have to first value nature, the environment, and biodiversity. They need to be shown how these values apply in their reality and context to enhance their sense of connection to the environment and see how local actions can have a global impact. Solidarity, empathy, and a sense of justice are a few of these values. Education should foster a sense of responsibility and awareness of environmental challenges, as well as a sense of belonging to a common humanity that is connected to nature. These personal qualities are key to the behavioral changes needed to tackle environmental and climate change challenges (Cordero et al., 2020).

3 Behaviors: Students should be empowered to play an active role in fighting climate change and addressing environmental challenges. It is crucial for students to develop cross-cutting skills so they can act individually and collectively to innovate and find solutions to the problems posed by climate change. These skills include problem solving, collaboration, communication, decision making, critical thinking, and teamwork, among others.

Students' skills should be reinforced through an attitude of lifelong learning to ensure that they can continue to acquire and update the skills needed for decarbonization and climate resilience and for overcoming current and future environmental challenges.

To support the transition to green economies and make sure students can tap into the new job opportunities brought about by decarbonization, education systems—especially secondary technical and higher education—should identify and develop technical

15. Schultz (1975) argues that education reduces people's vulnerability to external shocks by increasing their ability to adapt.

16. This section is based on IDB (2020), Mochizuki and Bryan (2015), Ferguson (2019), Kwauk and Casey (2021), Reimers (2021), Hadjichambis and Paraskeva-Hadjichambi (2020), UNESCO (2020), Ardoin et al. (2017), and OECD (2022).

17. The distinction between these three dimensions is relevant because empirical evidence shows that having environmental knowledge does not necessarily lead to environmentally supportive attitudes or pro-environmental behaviors (Heimlich and Ardoin, 2012; Hungerford and Volk , 1990; Hines et . 1987).

skills specific to green jobs, in coordination with countries' growth and decarbonization strategies (NDCs and LTS), the productive sector, and job training systems (Kwauk and Casey, 2021; Chemonics, 2022). It is also essential that students develop a life-long learning mindset, since jobs are constantly changing, technologies to combat climate change continue to evolve, and future climate-related events are so unpredictable. These technical skills, coupled with green citizenship skills, will also lead young people to value green jobs and want to be part of a sustainable economy.

2 Making education systems more resilient to climate change

As the threat of climate-related natural disasters grows, it becomes more urgent to boost the resilience of school buildings and develop distance education strategies that ensure that educational services can continue operating. School buildings should apply climate resilience and adaptation measures that focus on reducing vulnerability and risk. These buildings should be designed, constructed, and maintained in such a way that they can continue to operate even during extreme weather events. School facilities should also be able to cope with water shortages and drought and provide comfortable classrooms even as climate change pushes temperatures into more extreme ranges. Schools can also be used as community shelters during extreme weather events, making their resilience doubly important. Education systems can leverage technology to implement distance models that allow them to continue providing services during climate emergencies until students return to the classroom. Similarly, classrooms need to offer comfort levels that are conducive to learning, and schools should address the affect the climate change is having on students' mental health and emotional well-being so they can be ready to learn.

3 Implementing climate sustainability practices in school infrastructure and education system operations

School buildings should be designed, constructed, run, maintained, renovated, and even torn down in ways that mitigate climate change by reducing and/or eliminating GHG emissions, while conserving natural resources, reducing operating costs, and contributing to national climate goals.[18] Certain aspects of how education systems operate can also be adjusted to reduce GHG emissions. These mitigation-oriented changes include transitioning to electric school buses, providing locally-grown, sustainable food, using water efficiently, cutting down on paper, disposing of waste properly, using distance methods for teacher training,

18. When school buildings incorporate these types of measures, they are considered "green" (K12 Climate Action Commission, 2021; Minoja et al., 2018).

using digital books, and managing certain educational services using digitized Educational Management Information Systems (EMIS) (K12 Climate Action Commission, 2021; Arias Ortiz et al., 2019). Also, students can learn from these sustainable practices at schools. They can draw connections between their school's sustainable physical space and daily practices and what they are learning, which gives them an experiential learning opportunity and helps them develop green citizenship skills. In addition, well-designed school spaces allow formal learning to extend beyond the walls of the classroom, increasing spaces and opportunities for learning (Rieckman, 2018; Malone and Tranter, 2003; K12 Climate Action Commission, 2021).

4 Cross-cutting opportunity: including education in climate strategies

To maximize action in the three spheres above, education must be incorporated into climate change strategies. Adding education-related objectives, actions, and indicators to these strategies makes it easier to plan, fund, and monitor a more consistent and coordinated response, improving the sector's response to the challenges of climate change and boosting its adaptability. Education's relevance to the climate agenda and its contribution to sustainable development is now recognized in several international climate change strategies. The United Nations Framework Convention on Climate Change Article 6 of the United Nations Framework Convention on Climate Change (UNFCCC) states that countries shall promote and facilitate "the development and implementation of education and public awareness programmes on climate change and its effects," as well as the "training of scientific, technical and managerial personnel" to achieve climate objectives. The Paris Agreement also recognizes the importance of education and training in Article 12: "Parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information" on climate change. To facilitate and formalize the implementation of these two articles, the UNFCCC adopted the term Action for Climate Empowerment, an effort that includes an action plan, focal points, and a regular agenda of dialogues, seminars, and youth participation. Similarly, all United Nations member countries have committed to meeting target 4.7 of the Sustainable Development Goals, which calls for all students to acquire the knowledge and skills needed to promote sustainable development, including education for sustainable development and sustainable lifestyles, human rights, gender equality, a culture of peace and nonviolence, global citizenship, and an appreciation of cultural diversity and culture's contribution to sustainable development. More recently, education and climate change has gained prominence in the climate agenda, particularly at the annual meetings of the Conference of the Parties on Climate Change (COP). For example, the Greening Education Partnership, coordinated by UNESCO, seeks to ensure that students have the knowledge, skills, values, and attitudes to confront the challenges of climate change and promote sustainable development.

3 INTERVENTIONS TO BUILD CLIMATE ACTION SKILLS IN SCHOOL-AGED CHILDREN AND YOUTH

In response to the climate-related challenges that education systems in Latin America and the Caribbean face, and considering the three spheres of action in education for decarbonization and climate resilience, this section presents a menu of interventions that countries in the region can undertake to ensure their students are empowered to be true agents of change who take care of the environment and combat climate change with their knowledge, values, and skills, and to ensure that education systems include sustainability strategies and can continue to operate despite climate emergencies.

INTERVENTIONS
1 Developing green citizenship among school-age students, as well as green job skills
Reform national curricula and syllabi to incorporate the following aspects throughout students' school career: (i) knowledge about the environment, bio-diversity, and climate change; (ii) appreciation and respect for nature, the environment, and biodiversity; and (iii) pro-environmental behaviors. Curricula and syllabi should be designed to give students knowledge, but also to develop values and behaviors that give them the capacity to take responsibility for climate change and work productively with others to address it. These three dimensions should be woven throughout the curriculum instead of being limited to science, since an interdisciplinary approach is required to change attitudes and behaviors related to climate change. In addition, curricular reforms to integrate climate change education should be contextualized to meet each community's specific needs and be relevant to students. These new curricula and syllabi should be supported by updated educational materials about climate change (UNESCO, 2021a; González-Gaudiano and Meira-Cartea, 2020; Reimers, 2021; Rousell and Cutter-Mackenzie-Knowles, 2020).
Offer more vocational and higher education programs that build green job skills, in coordination with the countries' growth and decarbonization strategies (NDCs and LTS), the productive sector, and job training systems. To move towards green economies, vocational and higher education institutions need to make sure people gain the skills required for green jobs, both in emerging sectors and in those being transformed to minimize their emissions, and at all qualification levels (ILO, 2019b; UNESCO, 2021a). Since jobs, technologies, and innovations to address climate change are constantly evolving, students must develop the ability to continue learning throughout their lives.
Train teachers (initial teacher training and professional development) to give them the knowledge and skills to teach about climate change. To successfully provide this type of education, teachers must have knowledge about climate change, biodiversity, and environmental protection, as well as the capacity to cultivate values and behaviors in their students. They need access to relevant and up-to-date teaching materials that support their work (UNESCO, 2022b; Reimers and Chung, 2018; Reimers, 2021).

INTERVENTIONS
1 Developing green citizenship among school-age students, as well as green job skills
Encourage effective teaching practices based on projects and problem solving and that promote lifelong learning. Climate change education must be based on teaching methods that translate knowledge into action and behavioral change and also foster a life-long ability to acquire skills. These methods should be participatory, project-based, and centered on problem-solving. They should also create spaces for discussion so students can analyze scientific knowledge about climate change in a critical and productive way and search for possible solutions. These teaching practices should also address the climate challenges students face in their own communities in order to motivate them, encourage their participation, and make the content more relevant. The process of adapting teaching practices goes hand in hand with teacher training, since these methodologies radically transform the role of teachers, making them facilitators of learning (Mochizuki and Bryan, 2015; Reimers, 2021; Fullan and Langworthy, 2013).
Promote extracurricular programs that allow students to round out, deepen, and contextualize their climate change education. Recycling programs, park cleanup activities, or field trips to visit environmental organizations have proven to be effective ways to increase students' environmental awareness and actions. These measures also complement what students learn at school and allow them to connect this knowledge to their local context. The activities also help cultivate partnerships with environmental organizations (UNESCO, 2016; K12 Climate Action Commission, 2021). Moreover, basing climate change education on students' lived experiences can also increase their civic engagement and encourage behaviors that combat climate change (K12 Climate Action Commission, 2021).
Leverage schools' sustainability practices and strategies to promote learning about sustainability and the environment. Students can draw connections between their school's sustainable physical space and daily practices— like solar arrays and school gardens—and what they learn in the classroom. This experiential learning opportunity can help them develop green citizenship skills. In addition, well-designed school spaces allow formal learning to extend beyond the walls of the classroom, increasing spaces and opportunities for learning (Rieckman, 2018; Malone and Tranter, 2003; K12 Climate Action Commission, 2021).
Develop and adapt instruments for measuring green citizenship skills in order to monitor what students have learned and inform educational policies related to climate change. To ensure the quality of teaching about climate change, countries need instruments to measure green citizenship among students and graduates of compulsory education to make sure their policies and programs on education and climate change are effective and relevant. Several instruments can be developed to measure: (i) the green citizenship knowledge, values, and behaviors of children and youth; (ii) the impact of school and extra-curricular programs in Latin America and the Caribbean on cultivating green citizenship; or (iii) the effect of policies like including green citizenship in curricula, developing educational materials, teacher qualifications, and teacher training strategies on how wells students learn about green citizenship.

INTERVENTIONS
2 Making education systems more resilient to climate change
Enhance the resilience of school buildings to extreme weather events and ensure comfortable classroom conditions that are conducive to learning. Schools should be designed, built, and run to minimize disruptions to education by extreme weather events and to provide classrooms that are as comfortable for learning as possible when temperatures are extreme. In addition, schools should be prepared for use as community shelters in extreme weather events. They should therefore be designed, built, and run according to the following strategies for resilience to the main climate-related threats: ▶ **Droughts or water shortages:** install rainwater collection and treatment systems (to use the water for irrigation or to flush toilets, for example), water-saving showers and faucets in kitchens and bathrooms, and dual flush toilets. ▶ **Rising sea level, floods, increased rain and storms:** improve properties' drainage systems; raise the level the ground floor and build embankments or levies to protect against flooding, river scour, avalanches, or landslides caused by heavy rains; use materials and construction systems that are resilient to rain, flooding, and strong winds; use permeable paving materials; and design outdoor spaces to include flood areas (squares, gardens). ▶ **Higher temperatures:** design buildings to guarantee natural cross ventilation; take solar protection measures; use thermal insulation in walls and roofs, reflective paint and tiles for roofs and exterior walls, and reflective or low-emissivity glass; install ceiling fans and efficient air conditioners; and build schoolyards with sustainable materials that do not trap heat, and with vegetation and shade.
Have emergency plans to prepare the education system for climate events, including an analysis of its risk and vulnerability to climate change, as well as agreed-upon procedures to follow if a climate risk does materialize, including drills at schools and contingency and educational continuity plans (GADRRRES, 2022; Chuang et al., 2018).
Temporarily implement distance education models to continue providing educational services during climate emergencies until students are able to return to the classroom. Readying education systems to temporarily provide remote educational services requires four basic elements (Arias Ortiz et al., 2022): technological infrastructure (devices like energy-efficient tablets and computers, broadband Internet, electricity, and technical support); online platforms and content; trained human resources (teachers, school principals, Ministry of Education officials); and a system of governance and institutions (regulatory frameworks that define roles, data protection, financing).
Increase socio-emotional support to students before, during, and after extreme weather events, in tandem with health sector initiatives. Schools can do this by training educators and school staff on effective practices for trauma and eco-anxiety or by partnering with local organizations that work with children and youth on these issues. Equipping students with the knowledge, values, and capacity for climate action also helps them manage and mitigate climate anxiety (Pihkala, 2022).

INTERVENTIONS
3 Implementing climate sustainability practices in school infrastructure and education systems
Incorporate climate sustainability strategies into how school infrastructure is designed, built, and used. These measures should be taken into account throughout the entire life cycle of school buildings, from their location, design, construction, operation, and maintenance, to their renovation and demolition (Minoja, Hernández, & Yurivilca, 2018). ▶ **Passive design and building strategies that capitalize on the local climate and setting:** (i) design buildings to take into account local climatic conditions (solar radiation, wind, humidity, rainfall, etc.) and the building's surroundings (vegetation, adjacent infrastructure, available materials, etc.) to save energy; (ii) orient buildings to maximize lighting and heating gains; (iii) use exposure to sunlight and solar protection, like sunshades and vegetation, to take advantage of solar radiation in winter and protect from it in summer in order to use less heating and air conditioning; (iv) use cross or selective ventilation that circulates air or pulls new are in from outside of the building; (v) use thermal insulation strategies like reflective paint/ reflective roof and exterior wall tiles, a lower proportion of glass in the facade, and low-emissivity and/or high performance glass, along with thermal insulation for roofs exterior walls, windows, and doors; and (vi) build with energy-efficient materials with a low environmental impact (local, recycled, and/or produced using less energy). ▶ **Active use and maintenance strategies that minimize demand for energy and water:** (i) generate and use renewable energy (with solar panels, for example); (ii) use energy saving strategies: LED lamps, occupancy sensors in indoor areas, and photoelectric sensors in outdoor areas, as well as thermostats so users can regulate the temperature in each room; (iii) use strategies to save and/or store water (e.g., faucets that shut off automatically, water collection cisterns, harvesting rainwater for flushing toilets or irrigation); (iv) treat wastewater in a sustainable way by separating black and gray wastewater and installing systems for purifying gray water to use for flushing toilets or irrigation.
Expand the use of technology and digital systems for educational management. By using technological solutions like Educational Management Information Systems (EMIS) to manage educational processes, education systems can reduce transportation needs and paper use in educational procedures and resources management processes (student and teacher registration, school censuses). For an EMIS to achieve these goals, it needs functionalities to help automate key educational processes for management and make them more efficient, using green data centers and energy-efficient computers and tablets (Arias Ortiz et al., 2019). Likewise, distance education for certain situations (flexible secondary education, teacher training, and remote tutoring modalities) also reduces the need for students and teachers to travel. Finally, systems can cut down on paper consumption by relying more heavily on digital workbooks and notebooks.
Ensure the packaging, recycling, and final disposal of electronic devices are environmentally friendly. People in charge of procurement should consider whether the packaging is environmentally friendly when purchasing electronic devices. For example, educations system should aim to make FSC (Forest Stewardship Council) certified purchases, which means that the paper/cardboard used for packaging and transporting the devices comes from sustainably and responsibly managed forests. They should also make sure the products are packaged without foam/expanded polystyrene and as little nylon as possible. In addition, electronic devices, batteries, and peripheral devices should be disposed of responsibly at the end of their life cycle. This includes, for example, recycling and reusing them as raw materials for other goods or helping students repair devices to minimize waste.
Decrease the environmental impact of transportation to and from school by encouraging people to use public transportation, providing electric school transportation, and improving the safety of school access roads so students can walk or ride bicycles to school.
Decrease the environmental impact of school meals programs by promoting nutritionally rich and environmentally sustainable diets. For example use as much local and sustainably-grown produce as possible, and use fruits and vegetables from school gardens. Minimize single-use plastic plates and cutlery by using reusable water bottles and water fountains. Reducing waste by donating leftover food to soup kitchens (or having students take it home at the end of the day), and by composting organic waste.

INTERVENTIONS
4 Integrating education into climate strategies
For the education sector to fully contribute to the climate change agenda, it needs to be included in climate policies and agreements, including NDCs, LTS, and National Adaptation Plans (NAPs).[19] In particular, these strategies should focus on building the workforce skills needed for the green transition, as well as the role of the private sector, education, and job training in identifying and developing these skills.
In parallel, the challenges of climate change and strategies for overcoming them need to be included in educational strategies and strategic plans for the education sector. The aim of this integration is to facilitate collaboration between the education and environment sectors, as well as to allocate funds, assign staff, set targets, monitor results, and mobilize education systems to take environmental action (UNESCO, 2022b; UNESCO, 2020c; UNICEF, 2019a; UNICEF, 2019b; Kwauk, 2021a).
To integrate agendas and take climate action in education, leaders at the central, local, and school levels have to politically commit to making these policies and strategies a cross-cutting priority in national and local government programs and even within schools.

Source: Prepared by the authors

19. NAPs identify adaptation needs based on the latest scientific climate information and develop strategies to meet those needs. NAPs can be used to update NDCs.

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