Climate Change Education and Curriculum Revision

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Overview

Climate change is intensifying worldwide, and countries might be approaching a tipping point from which there will be no return to avoid extensive damages. While the impacts of climate change affect every country, nations like Indonesia are more susceptible to suffering its devastating consequences, such as irreversible resource loss and more frequent severe weather events. Preparing the next generation to mitigate and adapt to ongoing climate change requires systems transformation, including the integration of climate change education (CCE) across school curricula at all levels, from preschool to tertiary education, and the creation of a coalition of actors committed to climate action.

This World Bank is providing technical assistance and advice to the Ministry of Education, Culture, Research and Technology (MoECRT) and the Ministry of Religious Affairs (MoRA) of Indonesia through the Learning for Human Capital Development Programmatic Advisory Services and Analytics (PASA). This PASA’s areas of technical assistance include a support to the revision of the national curriculum, under which this policy note was prepared.

This policy note, which was prepared to inform the initial stages of the implementation of the revised Indonesian curriculum through the lens of climate change, includes three main sections: (a) an overview of the climate challenge and the country’s context; (b) the concept of CCE and related frameworks, including how these align with current Indonesian policies and programs; and (c) recommendations for promoting CCE in Indonesia through the revised national curriculum. The key recommendations outlined in this note for consideration of MoECRT and MoRA are: (a) develop teachers’ competence in CCE through an enhanced professional development system; (b) reorient the system’s culture toward education for sustainable development at the local and national levels; (c) promote partnerships to build capacity and design student-centered learning programs; and (d) design climate-friendly, resilient, and accessible education infrastructure.

1.0 The Climate Challenge

Climate change is the single greatest threat facing livelihoods and well-being. During the past decade, countries globally have faced catastrophic weather events such as record-breaking heat waves, massive wildfires, drought, and flooding, indicating that climate change impacts are accelerating more rapidly than previously predicted. Climate change threatens to destabilize Earth’s major biophysical systems that regulate the climate and support life-supporting biodiversity. In its 6th Assessment Report, the Intergovernmental Panel on Climate Change (2021) warns that “unless there are immediate, rapid and large-scale reductions in greenhouse gas emissions, limiting warming to close to 1.5°C or even 2°C will be beyond reach”. With numerous Earth system thresholds reaching tipping points, climate scientists, scholars, and policymakers are calling for transformational system change toward human and planetary well-being (Waddock, 2020).

While no country is immune, susceptibility to climate change varies significantly by geographical region and sector (Cardona et al., 2012). As a large and densely populated archipelago nation, Indonesia is highly vulnerable to climate change impacts. It ranks in the top-third of countries in climate risk with high exposure to hazards like flooding, extreme heat, landslides, and
drought that endanger the population, infrastructure, and pose challenges to sectors including agriculture, water management, energy, health, and education (World Bank Group and Asian Development Bank, 2021). A recent study suggests that Indonesia is 14 times more exposed to climate change threats than previously believed (Hooijer & Vernimmen, 2021). Within the country, there is also great variability and uncertainty in the estimated impacts of climate change. For example, low-lying coastal cities like Jakarta (ranked the highest globally in environmental risk [Verisk Maplecroft. 2021]), are most vulnerable to sea level rise, water contamination, and food scarcity posed by climate change.

Climate change exacerbates existing inequalities between and within countries, disproportionately affecting the poor, women and children, immigrant groups, indigenous peoples, and persons with disabilities (Levy & Patz, 2015). Because climate-driven natural disasters often result in displacement, loss of income, food and water insecurity, increased physical and mental health issues, and disruption to schooling, climate change threatens the most vulnerable people. UNICEF’s (2021a) Children’s Climate Risk Index, for example, reports that 1 billion children, or about half the world’s children, are at “extremely high-risk” of climate change impacts. Globally, such impacts are expected to place 100 million more people into extreme poverty by 2030 (World Bank Group, 2016). If no action is taken, the World Bank also predicts that by 2050 there will be more than 216 million internal climate migrants in six world regions (South Asia, Latin America, Sub-Saharan Africa, East Asia and the Pacific, North Africa, Eastern Europe, and Central Asia). In East Asia and the Pacific alone, 49 million are expected to migrate internally due to loss of livelihoods caused by water availability, agricultural production, sea-level rise, or storm surge (Clement et al., 2021).

Preparing for, and effectively responding to climate change necessitates a multi-pronged approach with mitigation and adaptation representing key strategies. The worst possible impacts of climate change, particularly for vulnerable populations, can be minimized if climate and development action is taken now to include: (a) cutting greenhouse gas emissions; (b) embedding climate mitigation in developing planning; and (c) investing to improve understanding of internal climate migration as an adaptation strategy, among other actions (Clement et al., 2021).

Within this context, CCE emerges as an essential strategy for climate change mitigation and adaptation, as well as sustainable development at local and global levels (Anderson, 2012), by nurturing resilient, innovative, and action-oriented citizens. CCE can have long-term impacts on students’ attitudes and decision-making, reducing their individual carbon emissions and furthering their pro-environmental behaviors (Cordero et al., 2020). In Indonesia, CCE can promote human capital accumulation and strengthen climate resilience by preparing/reskilling citizens for working in green economy jobs, including by leveraging both technological and nature-based solutions such as regenerating mangrove forests to protect against coastal flooding and erosion.

2.0 The Why and What of Climate Change Education

**Education is critical to change behavior and promote climate action.** Taking this into account, CCE may be understood as “learning in the face of risk, uncertainty, and rapid change” (Stevenson et al., 2017, p. 1). It aims to build understanding of and the ability to address climate change, climate injustice, and the effects of global warming on biodiversity (UNESCO and Education International, 2021). High quality CCE helps to prepare students who understand the “social and economic consequences and complexities of change” and are able to adapt to such change (McKeown & Hopkins, 2010, p. 89). Thus, CCE is essential to preparing a climate-resilient workforce and to actualizing human potential.

CCE is a powerful lever for social equality, inclusive growth, and climate resilience, which should be helpful for governments to address the disproportionate impacts of climate change on those who are disadvantaged. Closing gender gaps by investing in girls’ CCE, for example, builds more resilient communities against future crises like droughts, flash floods, and storms, events that impede girls’ access to schooling (Malaia Fund, 2021). Further, expanding
girls’ access to science, technology, engineering and mathematics education enhances not only their economic prospects, but also their leadership skills, as well as adaptive capacities to devise sustainable solutions to climate change issues (Chigwanda, 2016). For vulnerable groups like smallholder farmers, the ability to interpret and use climate data and to understand how to implement sustainable practices and innovative solutions is critical (Perdinan et al., 2021). For countries dependent on climate-sensitive resources like Indonesia, CCE can thus strengthen all citizens’ capacity to adapt to natural disasters that are increasing in frequency, intensity, and social and economic impact, as well as promote the development of skills for working in green economy jobs.

Effective CCE demands a holistic approach so that all learners are prepared to promote sustainable development as underscored in Sustainable Development Goal 4.7. Box 1 below presents relevant information about education for sustainable development and its intersection with CCE.

**Box 1. Education for Sustainable Development**

Adopted by the United Nations Educational, Scientific, and Cultural Organization (UNESCO) in 1997, Education for Sustainable Development (ESD) is an educational framework that “empowers learners with knowledge, skills, values and attitudes to take informed decisions and make responsible actions for environmental integrity, economic viability, and a just society” (UNESCO, n.d.). ESD integrates economic, social, and environmental dimensions of sustainability in the curriculum (Hedefalk, Almqvist, & Östman, 2015), underscoring the interconnected nature of human development and well-being, equity, and environmental stewardship. Because education is “the most vital input for every dimension of sustainable development,” ESD is a key response to addressing global challenges like climate change, biodiversity loss, and social inequalities as reflected in UN Sustainable Development Goal Target 4.7: by 2030, ensure all learners acquire knowledge and skills needed to promote sustainable development, including among others through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship, and appreciation of cultural diversity and of culture’s contribution to sustainable development. (UN General Assembly, 2015. p. 17)

As an educational approach, ESD is holistic, participatory, action-oriented, and transformational, calling for the reorientation of the content, educational aims, pedagogy, and learning environment. Key competencies fostered through ESD include: systems thinking, strategic thinking, collaboration, critical thinking, self-awareness, and integrated problem-solving (Rieckmann, 2018). ESD pedagogies are typically place- or issue-based, and focus on improving the local community (Laurie et al., 2016). Such experiences not only develop students’ knowledge and skills, but also their disposition to make reasoned decisions and consider alternative, more sustainable, ways of living. Due to its holistic nature, ESD is considered an optimal framework for advancing CCE (Mochizuki & Bryan, 2015).

**As a whole earth system science, climate change science involves the intersection of disciplines like geography, meteorology, biology, physics, earth sciences, and chemistry.** Stated succinctly, CCE is “about learning in the face of risk, uncertainty, and rapid change” (Stevenson, Nicholls, & Whitehouse, 2017, p. 67). *Educating for change* draws from the social sciences and humanities and includes: “(a) issue analysis; (b) community and personal decision-making; (c) political processes; (d) social justice; (e) inter-cultural sensitivity and inter-cultural competence; and (f) behavior change” (McKeown & Hopkins, 2010). Thus, CCE encompasses more than climate literacy alone (focused on knowledge of climate system science); it also includes effective communication skills about climate and climate change, attitudes, motivations, and beliefs needed to make informed and responsible decisions (Azevedo & Marques, 2017). The holistic nature of CCE and its components, which might be taken together, is presented in a bicycle model developed by Cantell and colleagues in 2019. This model, which is illustrated in Figure 1 below, notes that knowledge and thinking skills support and “drive” effective CCE.
Knowledge that should be addressed in CCE includes:
(a) natural causes and changes in the climate system;
(b) atmosphere and pollution; (c) amounts of snow and ice; (d) sea level, temperature, and life; (e) soil and vegetation; and (f) impact on humans (Sheppard, 2012). It should develop students’ skills needed in the green economy. As an intersectional field entangled with social issues, effective CCE also addresses climate justice, including how groups like women and girls and indigenous peoples are differentially impacted (Kwauk, 2021). CCE should include learning experiences and resources on climate science, disaster risk reduction (see additional information in Box 2 below), environmental change, and solutions and action (UNICEF, 2021a).

Box 2. Disaster Risk Reduction Education

Indonesia is vulnerable to many types of natural (e.g., earthquakes, flooding, droughts) and anthropogenic (e.g., pollution, deforestation, groundwater extraction) hazards (UNDRR, 2020). Disaster risk reduction (DRR) is a comprehensive and systemic approach to analyzing and managing risks associated with such hazards and includes preparedness and response to adverse events (UNDRR, 2009). DRR education is complementary to CCE as both include “building understanding in students of the causes, nature and effects of hazards and threats, while also fostering a range of competencies and skills to enable them to participate and take leadership roles in disaster prevention and mitigation” (Kagawa & Selby, 2012). To build risk knowledge (e.g., which hazards may impact their home, school, or community), reduce vulnerabilities to disaster (e.g., how to be safe from disasters), and strengthen resilience (e.g., to overcome fears) among children and youth, the MoECRT of Indonesia integrated DRR in the curriculum in 2010. In order to strengthen its overall risk management, Indonesia also signed an agreement with the UN Office for Disaster Risk Reduction (UNDRR) in 2019 to follow the Sendai Framework on Disaster Risk Reduction (2015-2030), a major global plan of the post-2015 development agenda to reduce disaster risk and loss (UNDRR, 2020).

In a review of 30 case study countries, Selby and Kagawa (2012) concluded that few DRR-related curricula incorporate CCE, revealing a missed opportunity. In their research on Indonesia, the authors determined DRR is integrated in the curriculum in three ways: (a) DRR themes and topics are integrated into existing subjects; (b) DRR content and resources are made relevant by educators to the local and school context; and (c) DRR is taught through extracurricular activities. Challenges in DRR curriculum development included lack of teacher training and beliefs about teaching and learning (UNDRR, 2007). When teacher training emphasized child-centered methods and materials, such as with the 2005-2008 Disaster Awareness in Primary Schools (DAPS) project, which was implemented in eight provinces with 58,000 primary school students, teachers were better equipped to use child-friendly pedagogies via visuals, role play, readings, and exploring meaningful questions (UNDRR, 2007).

In another study of DRR education in Indonesia, Amri et al. (2017) identified supporting factors and barriers to implementation in schools located in Jakarta. This study found that the availability of teacher training and resources for developing or delivering DRR to children was essential to successful implementation. In contrast, a lack of proper monitoring of DRR education and weak partnerships between schools, disaster management agencies, and local councils were deterrents. Nearly all children reported wanting to learn more about DRR and to become actively involved in preparedness at home and in schools. Recommended DRR education pedagogies include youth-led participatory research and advocacy to facilitate dialogue and knowledge sharing about climate change adaptation and DRR in vulnerable communities (Haynes & Tanner, 2015).
Relevant dimensions of climate change can be broadly categorized as causes, impacts, mitigation, and adaptation. Through CCE, students could acquire the knowledge mentioned by Sheppard in 2012 (see above) and take individual and collective actions in response to climate change. This could be achieved by using case studies illuminating causes, effects, and solutions as pedagogical tools. The interplay between climate change and CCE is presented in a diagram developed by Hicks in 2019, which is illustrated below.

**Figure 2. Elements of Climate Change**  
(Hicks, 2019, adapted from Sheppard, 2012)

Individuals’ perceptions of climate change and its impacts are shaped by socio-cultural, psychological, geographical, and other factors (Wolf & Moser, 2011). In a recent study covering 119 countries, educational level and beliefs about the causes of climate change were found to be the strongest overall predictors of climate change awareness. Researchers, however, underscore that education attainment interacts with political ideologies and, thus, climate communication strategies must be tailored to each country’s unique context (Lee et al., 2015). In Indonesia where only one-third of the population views climate change as a major issue (Verisk Maplecroft, 2021), CCE must engage students in a critical examination of their own and others’ assumptions, beliefs, norms, as well as power structures. The media should play a role in shaping perceptions, the spread of climate change misinformation and disinformation, and sourcing, so that children develop critical literacy skills in order to discern truth from falsehoods (Oberman & Sainz, 2021). Acquiring factual knowledge about climate change is insufficient to promote sustainable behaviors (Laurie et al., 2016; McKeown & Hopkins, 2010). CCE is a “means to an end”; critical analysis of, and reflection on factual information is necessary for deeper understanding and action (Cantell et al., 2019).

CCE affirms and supports a whole child approach. It considers the role of emotions, sense of hope, future orientation, motivation, and participation in students’ capacity and desire to take action on climate change (Cantell et al., 2019). Sobel (2007) warns that premature exposure to overwhelming issues like the climate crisis may result in ecophobia, feelings of helplessness and hopelessness, and inaction. When students demonstrate readiness, however, acquiring knowledge about climate change causes and impacts coupled with stories of action can promote students’ agency and belief that individuals and groups can make a positive difference (Jie Le & Monroe, 2019).

“Premature exposure to overwhelming issues like the climate crisis may result in ecophobia, feelings of helplessness and hopelessness, and inaction.”
Pedagogies of hope and action, such as storytelling, youth-led projects, global collaborative projects, and citizenship education, can support students’ futures thinking, optimism, and personal and collective actions to mitigate climate change, as highlighted by Dolan in 2021. Importantly, using an action-oriented approach to CCE does not imply superficial or “one-off” individual actions; rather, it suggests the on-going cultivation of one’s identity, values, and worldview that supports responsible citizenship and collaboration. Students may take many types of action on issues related to climate change, including direct, indirect, advocacy, and research for action (Berger Kaye, 2010).

A comprehensive approach to CCE reflects the interconnectedness of home, community, and schooling. Students’ participation in climate change adaptation and mitigation initiatives in diverse contexts can enhance the formal curriculum, as well as shape the school culture toward sustainability (Selby & Kagawa, 2013). Similarly, research suggests that children can influence parents’ beliefs and climate change awareness, even in the presence of ideological barriers (Lawson et al., 2019). By equipping young people with the tools to facilitate conversations with their parents and other adults, CCE can create a “public mindset shift on climate change and climate action” (Kwauk & Winthrop, 2021, para. 24).

Recent Policies and Programs Aligned with CCE in Indonesia

Over the past two decades, the Government of Indonesia (GoI) has adopted policies and implemented programs centered on climate change and DRR. For instance, Law No. 20/2003 Article 36 of the National Education System for preprimary to higher education emphasizes the inclusion of “the diversity of the region’s potential and development” in the design of curriculum (Republic of Indonesia, 2003, p. 21). In 2013, the National Curriculum Framework was revised to include climate knowledge, skills, and attitudes as a core competence. Moreover, a National Climate Change Learning Strategy was developed to build human capacity and institutional resources to address climate change through the national education system. At that time, it was determined that a curriculum for CCE was lacking; the country then established as a priority the development of models of CCE at all educational levels and training programs for teachers on climate change (UN CC: Learn Pilot Project in Indonesia, 2013). The Ministry of Education and Culture (MoEC, now MoECRT) began to offer various climate change events and opportunities for schools and educators to learn about CCE (UNESCO, 2021a). In 2021, MoEC, MoRA, and other key stakeholders began the process of revising the national curriculum to address, among other things, climate change, natural hazards, and disaster preparedness at age-appropriate levels.

In order to prepare an “adaptive, productive, innovative, and competitive” citizenry during an era of rapid social and ecological change, the GoI is committed to a comprehensive reform under the Merdeka Belajar (Freedom to Learn) policy (World Bank, 2020). This policy promotes a shift from pedagogical practices that emphasize teacher-directed instruction and rote memorization of content to approaches focused on personalized learning and flexibility. Teachers are encouraged to adopt innovative, child-centered, and problem-based methods that develop students’ critical and creative thinking skills, as well as abilities to solve real world problems. These approaches are aligned with the aims and pedagogies of effective CCE.

An additional emphasis in the mentioned education reform is character education, one that “harmonizes” the whole individual—heart, mind, and body—and strengthens “national unity, democracy, and social justice” (Library of Congress, 2017). CCE-related character values include human rights, responsibility, creativity, and independence. Internalizing such values requires the creation of humanistic communities and opportunities for students to apply them in everyday life as opposed to memorization of content and performative activities (Abdullah et al., 2019).

Current approaches and resources dedicated to DRR across the primary to secondary levels also afford seamless integration of CCE content, skills, and dispositions. For example, as DRR themes and topics are incorporated into social studies, science, and physical education disciplines at grade-appropriate levels following the Indonesian Local Content Curriculum, educators can adapt the content and methods to their local context. Steps include: (a) analyzing local social, cultural and natural needs; (b) developing standard and basic competencies; and (c) developing guidelines, a syllabus and lesson plans (Harianti, 2011, as cited in Selby & Kagawa, 2012).
This section presents recommendations to MoECRT and MoRA for integrating CCE in their initiatives for the implementation of the revised national curriculum. Building resilient education systems and learners will create a positive ripple effect to help shape Indonesia’s development. As Jeffrey Sachs emphasizes, research supports that “better education leads to greater prosperity, improved agriculture, better health outcomes, less violence, more gender equality, higher social capital, and an improved natural environment” (UNESCO, 2016b). In this regard, the following recommendations are proposed for consideration of MoECRT and MoRA:

(a) developing teachers’ competence in CCE through an enhanced professional development system;
(b) reorienting the system’s culture toward ESD at the local and national levels;
(c) promoting partnerships to build capacity and design student-centered learning programs; and
(d) designing climate-friendly, resilient, and accessible education infrastructure.

3.1 Developing teachers’ competence in CCE through an enhanced professional development system (long-term recommendation)

Teachers often lack the necessary content knowledge (Plutzer, McCaffrey, Hannah, Rosenau, Berbeco, & Reid, 2016), resources, and pedagogical training (Kagubare, 2019) to effectively implement CCE in the classroom. For example, a recent survey of 58,280 teachers in 144 countries shows that fewer than 40% of them feel confident teaching about climate change, though nearly 95% of them believe it is important or very important to teach it (UNESCO and Education International, 2021). Moreover, teaching climate change is considered “pedagogically demanding,” given the related socio-scientific matters (Oberman & Sainz, 2021).

To ensure Indonesian teachers are knowledgeable and well-prepared, the quality of both teacher training institutions and the teacher candidates is paramount. This entails updating the curriculum and methods and strengthening practicum supervision, as well as being selective about the quality of teacher candidates who are admitted (World Bank, 2020). Once candidates enter the profession, hiring the most qualified teachers, including those with backgrounds in climate-related fields as appropriate (e.g., science, agriculture, health, technology, engineering, political science, social sciences, conservation, economics, finance and business), should be prioritized.

However, it is worth noting that, as Stevenson et al. (2017) underscore, teachers do not require extensive knowledge of climate change before integrating ESD in the curriculum. In cases where content and pedagogical practices are limited, teachers can be supported in the short-term through professional development that models quality curricular examples and provides background information in order to build teachers’ confidence. Continuous development of teachers’ competencies, including through coaching and the provision of resources, can ensure that Indonesia’s students are taught by the most qualified educators (World Bank, 2020). Building an online platform for resources on climate change lessons and materials would help to ensure that CCE is accessible across the nation. Promising pedagogical examples from diverse international contexts are presented in Box 3 below.
Box 3. International Pedagogical Practices Regarding CCE

Effective pedagogies for CCE reflect experiential, constructivist, and relational learning that engage students cognitively, physically, socially, and emotionally. These include inquiry- and project-based learning, simulations, storytelling, systems thinking, youth participatory action research, and more (see Monroe et al., 2019). Reflection on one’s emotions and thinking process is recommended throughout CCE learning experiences. Examples are presented below.

Bali

Green School Bali is a “school without walls” that aims to cultivate in learners a sustainability mindset that results in responsible citizenship. Green School Bali’s educators demonstrate emotional intelligence, a passion for relationships, experiential, authentic and local teaching and learning, as well as a commitment to community. The curriculum is grounded in education for sustainability, nature- and place-based learning, and student-led inquiry as approaches for developing students’ abilities to think, act, and reflect as local and global citizens striving to create a more sustainable world.

Finland

As part of the revised 2016 National Curriculum Framework, Finland mandated phenomenon-based learning, a constructivist approach to teaching and learning that emphasizes interdisciplinary, real-world challenges or topics as an entry point for investigation. Phenomena like climate change, food production, and water quality are contextualized, studied authentically and holistically without disciplinary or traditional subject area boundaries. Working in teams and guided by teachers, students acquire knowledge and skills through field observation, interviewing stakeholders, data collection and analysis, and responsible action (Lähdemäki, 2018).

Zimbabwe

Runesu Primary School in rural Zimbabwe employs project-based learning to engage students in experiential lessons on engineering, aquaponics, project planning and management. Located in a drought-prone region, the community installed a solar-powered water system and aquaponics facility to afford an authentic context in which to build students’ knowledge of climate-smart agriculture. This initiative has increased girls’ school attendance and performance, leadership skills, and sense of empowerment (Matyanga, 2019).

Indonesian pre-service and in-service teacher professional development can institutionalize ESD by creating a framework for teacher training curricula across the country, as well as tools for monitoring classroom interactions on sustainable development (see examples in UNESCO, 2016b). Recommended content and competencies to include in teacher education ESD curricula include:

- child development, including current neuroscience research and the role of emotions on learning;
- integrated curriculum design;
- educational technology, including synchronous and asynchronous teaching tools and best practices during times of crisis;
- environmental literacy and place-based learning;
- experiential learning such as problem-based, inquiry learning and other constructivist methods (see Karpudewan & Khan, 2017);
- indigenous knowledge across the disciplines;
- systems thinking (see Ballew et al., 2019); and
- trauma-informed practices, including culturally responsive practice and social-emotional learning, particularly how to support students who have been impacted by climate-driven disasters and forced migration.
Integrating CCE throughout grade levels and education systems is recommended to develop capacities for addressing the climate challenge (Stevenson et al., 2017). Such efforts often require a revisioning of the primary and secondary curriculum and an examination of the school culture itself. Importantly, reorientation towards ESD (and climate change specifically) does not imply adding more to the formal curriculum, but rather identifying natural connections between students, school learning, and the outside social and natural world, as well as creating the conditions that promote transformative action in students and staff. In short, reorientation reveals what to preserve and what to transform in an education system. These include: (a) using a values-based approach; (b) mapping ESD across the primary and secondary curriculum; (c) committing to diversity, equity, and inclusion, and (d) supporting transformative action.

**Use a values-based approach:** an education system’s vision reflects its members’ set of shared values. Because values drive emotions and behaviors, including teachers’ enactment of the curriculum, national and local-level school leaders should engage all stakeholders in reflecting on their individual and collective values as they relate to the education system and local school’s mission (see box on Green School Bali). This may be employed in conjunction with existing processes like the Character and Learning Environment Survey. Collective thinking, collaboration, and a vision of hope are necessary for effective CCE within each school community and system (Lehtonen et al., 2019). Local-level action is particularly impactful as research suggests that school systems are an ideal size for scaling climate action (Kwauk & Winthrop, 2021). The school community’s values can then inform the school’s vision and mission statement, including how it underpins ESD in the curriculum. Ongoing monitoring of progress toward the vision should be implemented.

**Map ESD across the primary and secondary curriculum:** to ensure an integrated and holistic national approach to CCE, MoECRT and MoRA could create a scope and sequence of sustainability themes, standards, and performance indicators for each grade level and discipline (e.g., see the Cloud Institute Education for Sustainability K-12 Scope and Sequence). Identifying specific integrating themes (e.g., ethics and well-being, global citizenship, environmental stewardship, social justice), as well as disciplinary and interdisciplinary climate change related knowledge, skills, perspectives, values, and issues can empower students and promote sustainable behaviors (McKeown, 2006). Mapping such ESD themes and values affords the natural integration of existing education system initiatives like DRR education and character education (e.g., the Pancasila Student Profile). Mainstreaming CCE can be transformative - “It would help develop a strong sense of agency and empowerment, impacting young people’s lifestyle choices and decision-making to reduce their carbon footprint, as well as improving their capacity to become pioneers in climate solutions” (UNICEF, 2021a).

**Green School Bali’s values - “As a school community we subscribe to a set of values - I RESPECT. These are the values of integrity, responsibility, equity, sustainability, peace, empathy, community, and trust. At all times we teach and model these values and support our students in doing the same. We encourage all teachers to honor and recognize these values in our students at all times with on-going dialogue, discussions, and reinforcement.”**

Curriculum mapping ensures that sustainability remains at the core of the school curriculum, is appropriate to each school’s sociocultural context, and is implemented in developmentally appropriate ways. For example, Sobel’s (2007) Ladder of Environmental Responsibility presents a developmental school model illustrating concrete learning experiences that gradually increase in complexity (see Figure 3 below). These experiences align with the curriculum and afford nature-based experiences to nurture caring for, and responsibility to the environment. These principles can serve as a guide for schools to design their own ladder of environmental responsibility suitable for their curriculum and context.
**Ladder of Environmental Responsibility: A Model for Elementary Schools**

<table>
<thead>
<tr>
<th>Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>K</td>
<td>Seasonal School Beautification: Teachers and students responsible for weekly displays of flowers, rock gardens, winter twigs, and the natural displays that fit with seasonal celebrations of the solstices and equinoxes.</td>
</tr>
<tr>
<td>1st</td>
<td>Flower Garden Maintenance: Teachers and students weed the gardens, put them to bed for the winter, start seedlings in the late winter, run the plant sale in early spring, bring the garden to life, install new plantings.</td>
</tr>
<tr>
<td>2nd</td>
<td>Schoolyard Vegetable Gardens: Teachers and students install raised beds, test and amend the soil, harvest vegetables, arrange for the harvest festival, put the garden to bed, put up the pickles, order the seeds in the spring, plant the garden, organize the volunteers for summer maintenance.</td>
</tr>
<tr>
<td>3rd</td>
<td>Maintaining the Schoolyard: Teachers and students keep the nature area or schoolyard clean, devise graffiti and vandalism prevention programs, help to teach schoolyard games, work with school maintenance staff, create homes for wildlife, keep the bird feeders full, keep the running record of birds that visit the feeders.</td>
</tr>
<tr>
<td>4th</td>
<td>Running the Recycling Program: Teachers and students design and run the paper-recycling program. They collect the paper and bring it to the collection site, and they monitor classroom and school use in hopes of decreasing paper usage. Systems for other materials such as glass, aluminum cans, and inkjet printer cartridges are developed as the system matures.</td>
</tr>
<tr>
<td>5th</td>
<td>Tending the Composting Program: Teachers and students work with school lunch staff to first design a pre-consumer composting program and eventually a post-consumer program. Fifth graders educate new students about what's compostable and what isn't. They also staff the post-lunch separation process. When the system matures, post-snack systems are developed as well.</td>
</tr>
<tr>
<td>6th</td>
<td>Climate Change Team: Teachers and students are responsible for minimizing the carbon dioxide output of the school. They accomplish this with yearly projects to monitor and reduce electricity, heating fuels, and water consumption in the school. Students suggest changes in student/teacher/staff behavior to reduce consumption. Students and teachers work with building maintenance staff to use the healthiest cleaning products with the least emissions.</td>
</tr>
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**Commit to diversity, equity, and inclusion:** reorientation of the system toward ESD honors many ways of knowing and being. It values contemporary technologies to solve sustainability challenges and traditional ecological knowledge that can be adapted to contemporary living (McKeown, 2006). Climate change curriculum should include many cultural perspectives and reflect the diversity of the school community. Creating an inclusive environmental and sustainable education setting includes using multicultural materials, co-planning learning experiences with students that draw from their assets and interests, and embedding local knowledge and stories of community resilience in the curriculum. Where appropriate, materials based on the local culture and context, including the local mother tongue, should be provided (World Bank, 2020).

**Support transformative action:** transformative action, which is a core focus of ESD, entails different stages - awareness, understanding of complexities, empathy, compassion, and empowerment. CCE should include learning experiences at different stages, recognizing that the stages are not necessarily linear, nor occur at the same pace for each learner (UNESCO, 2019). Whereas the conditions that shape pro-environmental behaviors and responsible actions are “complex and context specific” (Goldman et al., 2020), research suggests that experientially derived knowledge and perception of control are more likely to cultivate positive behaviors. UNICEF (2021a) underscores that honor student voice and agency is integral to climate change mitigation and adaptation. Thus, it is recommended that young people are afforded opportunities to participate authentically,
including in school leadership capacities and climate-related decision making at local and national levels. Likewise, the development of school staff capacity to shape a sustainable school is essential to guide children’s transformative action. Examples include establishing positions like a School Sustainability Lead Officer who could oversee progress toward the school’s vision and sustainability goals, and collaborate with student leaders, key stakeholders, and community partners.

3.3 Promoting partnerships to build capacity and design student-centered learning programs (short-term recommendation)

Multistakeholder partnerships are critical to achieve equity and sustainable development (UNESCO, 2016b). Because mitigating and adapting to climate change demands collective efficacy—the “sense that one’s actions, in combination with the actions of one’s community and those with whom values are shared, have the capacity to make the desired impact” (Allen & Crowley, 2017, p. 300)—collaboration with families and community members in CCE should be prioritized. Leveraging such partnerships helps to build a more resilient society by being responsive to unique family and community needs and strengths in the design of learning experiences and climate action plans (Aspen Institute, 2021).

Intergenerational partnerships with businesses, community-based organizations, advocacy groups, and experts on climate-related issues afford valuable curriculum supports on climate change, sustainability, and the environment (Aspen Institute, 2021). Such partnerships also afford synergy and mutual learning reflective of a whole-school approach to CCE (Mathie & Wals, 2022). Connecting students to the local community and natural environment promotes a sense of place that correlates with improved student performance (UNESCO, 2016b) and enhanced civic responsibility and social cohesion (UNICEF, 2021). Nurturing environmental behaviors and a love for the natural world is also more likely to develop students’ knowledge and attitudes that correlate with future adult environmental behaviors (Sobel, 2007).

It is recommended that educators co-design community-based experiences to enhance the relevance of learning and afford inquiry- and project-based and action-oriented learning. Building a diverse coalition of governments, organizations, and other actors who have expertise in climate-related fields can be helpful in Indonesia for (a) developing teaching and learning materials, (b) building teacher and student networks to share resources and activities, (c) conducting research and communicating findings on educational interventions, and (d) funding climate mitigation and adaptation activities (Kwauk & Winthrop, 2021).

3.4 Designing climate-friendly, resilient, and accessible education infrastructure (short-term recommendation)

School infrastructure underpins the capacity of educators to effectively address ESD and CCE in the curriculum (UNESCO, 2021a). Building a climate-resilient school system includes investing in online teaching and learning capacities, as well as data storage systems to support remote schooling when needed (World Bank, 2020). Improvements to physical structures, such as school buildings and medical facilities, are also critical to reduce children’s risk of climate disasters and disruption to education (UNICEF, 2021), as well as accessible infrastructure and equipment for students with disabilities (World Bank, 2020). Both social and physical infrastructure are critical to promote sustainability and climate action (Kwauk & Winthrop, 2021).

Whereas school infrastructure improvements may require investment in the long-term, there are immediate opportunities to use school infrastructure as a valuable teaching tool to support CCE. School leaders, teachers and students can collaborate to transform unsustainable school practices and school buildings into climate-resilient structures, thereby enhancing student learning (Selby & Kagawa, 2013). For example, the UNESCO Green Academies initiative empowers youth to identify specific needs related to four pillars (water security, clean energy, biomass production, and waste management), and develop a plan with their teachers (UNESCO, 2021b). Engaging children in such participatory design—where they co-create solutions to real world challenges—is an approach that values children’s contributions and prepares them to shape sustainable development in their communities (Smith & Iversen, 2018). Developing solutions and taking climate action at school alongside supportive adults can also reduce students’ eco-anxiety and prepare
them for future careers in green infrastructure and the clean economy (The Aspen Institute, 2021).

In partnership with teachers, students, and families, school leaders should also seek to reduce energy usage, “rewild” the school grounds, and create beautiful school campuses (UNICEF, 2016a). Where possible, creating natural, green spaces for play and learning support students’ holistic development, social cohesion, and a community’s climate resilience (UNICEF, 2021b). Green schoolyards can have ripple effects across systems by mitigating climate change effects like heat waves and flooding, increasing park space for the community-at-large, and promoting sustainability throughout society (Flax et al., 2020).

Conclusion

In closing, climate change is an urgent challenge facing humanity and the future of the planet. Investment in ESD, including CCE, will enable students to become informed about climate science, develop the skills needed in the green economy, and shape attitudes and behaviors needed to engage effectively with climate solutions. Creating a sustainable future begins with the youngest learners by cultivating a reverence for nature and a responsibility to care for it, attitudes and habits that develop sustainable behaviors that balance environmental, social, and economic needs so that all can prosper. It promotes inclusion and equity, recognizing that marginalized populations are often most vulnerable to climate change impacts.

CCE nurtures flexible thinking to solve complex problems so that students can respond to climate change impacts and prevent future disasters. Building students’ capacities to promote sustainable development necessitates a reorientation of the curriculum and a system-wide commitment from the national to local levels. From teacher preparation and on-going training to school infrastructure and partnerships with state and non-state actors, Indonesia can build a sustainable, climate-resilient future.
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