




Climate change education and communication in global review: tracking progress through national submissions to the UNFCCC Secretariat

Marcia McKenzie


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Climate change education and communication in global review: tracking progress through national submissions to the UNFCCC Secretariat

Marcia McKenzie 

University of Saskatchewan, Saskatoon, SK, Canada

ABSTRACT

Despite recent intergovernmental commitments to advancing climate change education and communication (CCEC) internationally, there remains a lack of global data to enable tracking or target-setting on country progress. This article shares findings from an analysis of CCEC content in 377 submissions to the UNFCCC Secretariat. Submission types analyzed included National Communications reporting on recent activities, and Nationally Determined Contributions and National Adaptation Plans outlining future plans. Key findings about CCEC in primary to tertiary education, government, media, civil society, business, and public communications sectors are that: (a) while CCEC content appeared in submissions, little is currently suitable for monitoring purposes; and (b) there were notable gaps in CCEC activities, given a pronounced emphasis on cognitive knowledge over affective and action-oriented approaches. Regional variations were also found, with European countries on average including more content in relation to both Action for Climate Empowerment (ACE) elements and Sustainable Development Goal (SDG) indicator components. Recommendations for future UNFCCC submissions on the quantity and quality of CCEC are highlighted, as well as for research and research-policy collaboration to further monitoring of CCEC implementation and progress globally.

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Climate change education; climate change communication; UNFCCC; ACE; SDGs; monitoring

Introduction

In October 2018, the landmark Intergovernmental Panel on Climate Change (IPCC) *Special Report on Climate Change* warned that we have just over a decade to limit catastrophic climate change. Highlighted in this unprecedented message was the demand for increased climate change education and communication (CCEC) to “accelerate the wide scale behaviour changes consistent with adapting to and limiting global warming” (IPCC, 2018, p. 22).

The need for “education, training, public awareness, public participation, and public access to information” to mitigate dangerous human interference with the climate system, has been internationally recognized since 1992 in the United Nations Framework Convention on Climate Change (UNFCCC, 1992, Article 6). Education and communication were re-emphasized in Article 12 of the 2015 Paris Agreement (UN, 2015), and also are included in UN Agenda 2030 Sustainable Development Goal (SDG) 13 to “improve education, awareness-raising and human and institutional

capacity on climate change mitigation, adaptation, impact reduction and early warning” (United Nations General Assembly resolution 70/1, 2015, p. 23).

Reporting of country progress under the UNFCCC, including on education and communication, is required every four years, but guidelines are not specific, and most countries lack mechanisms for CCEC data collection. For example, the UN SDGs include one monitoring indicator related to climate change education; however, its value and scope are hindered by the exclusive focus on formal education and a lack of non-self-reported data. Despite intergovernmental commitments to advancing CCEC globally, there is a dearth of publicly available data that, on the one hand, might ensure greater transparency and better governance in meeting targets and goals (SDG 17), and on the other, will enable benchmarking and target setting on country progress in relation to sectors of primary to tertiary education, government, media, civil society, business, and public communications.

The findings that underpin this article offer a survey of recent progress in these regards. They originally derive from a 2019 project commissioned by the United Nations Educational, Scientific and Cultural Organization (UNESCO) in collaboration with the UNFCCC. A desk study team that I led examined education content in 377 submissions to the UNFCCC Secretariat that document activities and progress at the country level. These include National Communications which report on recent progress, and Nationally Determined Contributions and National Adaptation Plans which outline future plans and targets (see UNESCO, 2019a). This article offers further analysis of these materials in relation to: (i) determining the extent of existing data on countries’ progress that could potentially be used for global monitoring, (ii) highlighting general trends on the implementation status of CCEC globally, as indicated by the national submissions. As called for by the UNESCO Global Education Monitoring Report (2016), more extensive and systematic approaches to monitoring country progress could help support benchmarking and target setting by national and regional governments, as well as enable more ambitious negotiation on education at UNFCCC meetings and inclusion in future IPCC reports. This article focuses on results of interest to the research community, with discussion of potential future research foci to support monitoring and evaluation to advance global policy making on education and communication within the critical IPCC-recommended timeframe.

Background

Before introducing the key parameters and findings of the desk study, I offer a background on intergovernmental reporting processes related to CCEC, including how stronger monitoring and target-setting in this area could be helpful in advancing climate action.

The United Nations Framework Convention on Climate Change (UNFCCC) was one of three Conventions adopted at the Rio Earth Summit in 1992,¹ and since then has been overseen by the UNFCCC Secretariat, or UN Climate Change. Article 6 of the UNFCCC focuses on the role of education, training, and public awareness in avoiding dangerous levels of climate change (UNFCCC, 1992, p. 10). More specifically, the six elements of Article 6 of the Convention (education, training, public awareness, public participation, public access to information and international cooperation), are named as member Party commitments.

The UNFCCC came into force in 1994, and today has near-universal membership, with 197 countries that have ratified and thus are ‘Parties’ to the Convention. The Convention divides countries into Annex 1 Parties, which include industrialized nations that were members of the OECD in 1992, plus countries with “economies in transition”; and Non-Annex 1 Parties, which are less industrialized or “developing” countries (UNFCCC, n.d.c). Annex 1 and Non-Annex 1 countries have different reporting requirements under the UNFCCC.

Since 1992, Annex 1 Parties have submitted National Communications (NCs) every four years. Most recent NCs were due in January 2018 (NC7); while the previous round, due in 2014, preceded the Paris Agreement (NC6).² Current guidelines for the preparation of submissions for

Annex 1 Parties include providing information on progress in climate change education, training, and public awareness as the focus of Chapter 9 of countries' NCs (Decision 4/CP.5, UNFCCC, 2000).

Non-Annex 1 Parties are required to submit their first NC within three years of entering the Convention, and every four years following. Non-Annex 1 NCs differ in structure and do not have a full education chapter, but are required to include similar information as Annex 1 NCs (Decision 2/CP.17, UNFCCC, 2003).

The annual Conference of the Parties (COP) meetings, which along with also annual Subsidiary Body (SB) meetings, typically enable face-to-face negotiations among the Parties, along with observation and side-events involving Non-Party Stakeholders (i.e. Intergovernmental Organizations (IGOs) and Non-governmental Organizations (NGOs) including research institutions). At the SB37 meeting in 2012, an eight-year Doha Work Programme³ on Article 6 of the Convention was recommended, which included reaffirmed support for education, training, and public awareness; as well as launching an annual in-session dialogue on Article 6 as part of future SB meetings (UNFCCC, 2012). As part of the Article 6 Dialogue at the SB40 meeting in 2015, Article 6 was given a new name of 'Action for Climate Empowerment' (ACE) with a continued focus on the six elements of Article 6 in the original Convention (UNFCCC, n.d.a). Through the Doha Work Programme, work on ACE has progressed since, including in the development of ACE guidelines with recommendations for designating ACE national focal points and for developing national ACE strategies, including national monitoring of ACE activities (UNESCO & UNFCCC, 2016).

At the COP21 meeting in Paris, Party delegates negotiated the landmark Paris Agreement (2015). This Agreement has an overall mandate to keep "global temperature rise this century well below 2 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degrees Celsius," as well as to help countries manage the impacts of climate change (UNFCCC, n.d.b). The Paris Agreement implementation centers on Nationally Determined Contributions (NDCs), which are targets set by each country on their mitigation measures going forward. Initial NDCs have been submitted by most Parties, with subsequent rounds of target-setting underway for 2020, and again for 2025 and 2030. The six Article 6/ACE elements were also named as priorities in Article 12 of the Paris Agreement, further strengthening the mandate for Parties to advance education, training, and public awareness, including in target setting in their NDCs.

Finally, National Adaptation Plans (NAPs) are a third UNFCCC document type discussed in this article. The UNFCCC National Adaptation Plan (NAP) process was established in 2010 at COP16 under the Cancun Adaptation Framework (UNFCCC, 2011a). NAPs are intended to support least developed country (LDC) Parties in identifying medium and long-term adaptation needs, and outlining strategies and programmes to respond to those needs (UNFCCC, 2018). While relatively few NAPs have been submitted to the UNFCCC to date, as the effects of climate change continue to be more pronounced, there is likely to be an increase in NAPs, including potentially the role of CCEC, or ACE, in adaptation to climate change.

Most recently, the Doha Work Programme has been under review in 2020, and it is expected that a new ACE Work Programme will likely be launched by COP26 in 2021. Rounds of input and discussions on the details of this Work Programme have been underway. In addition, as part of the virtual 8th ACE Dialogue, UNESCO (2020) released guidelines for the inclusion of ACE in the target-setting NDCs of UNFCCC Member Parties. These guidelines in part respond to the results of the findings of the UNESCO (2019a) study (on which this article is based), regarding the lack of ACE target-setting in the first round of NDCs. The UNESCO (2020) Guidelines suggest ways that the 2020 round of NDCs can include "specific, simple and measurable targets" for each ACE element as part of a country's ambition to contribute to addressing climate change (p. 6).

Outside of the UNFCCC, but also in the UN family, two other current UN programs are also important background for the analysis offered here. The UN Agenda 2030 Sustainable Development Goals (SDGs) were launched in 2015 as the successors to the Millennium Development Goals (MDGs). With a 15-year agenda, they include 17 key goals with an associated 169 global targets, each with monitoring indicators. At the time of data analysis, indicator 13.3.1 addressed climate

change in formal education curricula, while 4.7.1 on education for sustainable development (ESD) and 12.8.1 on sustainable consumption education used the same indicator data on formal education. In 2020, the global indicator for 13.3.1 was changed to be the same as that of indicator 4.7.1/12.8.1, focused more generally on inclusion of ESD in formal education. UNESCO is responsible for monitoring global progress on these indicators, in alignment with its focus on Education for Sustainable Development (ESD) (UNESCO, 2014, 2020).

While the new CCEC-related SDG indicator is limited to formal education (and in relation to ESD more broadly), additional global datasets on CCEC available through stronger ACE NC reporting and external global data creation could enable the development of new 13.3 indicators in relation to other ACE elements beyond formal education, and in relation to climate change specifically. While UNFCCC national submissions are self-reported, if they include specific and measurable data (e.g. # or % of national level activities), the quality of data would extend beyond current mechanisms of data collection for indicator 4.7.1, which has mainly been based on a survey of national governments (UNESCO, 1974). Furthering the specificity of ACE content in UNFCCC submissions is one way to support the development of additional global datasets on CCEC, or ACE, to enable further SDG and ACE monitoring and target-setting.

This assumes that large-scale monitoring efforts can, indeed, be helpful in advancing national and global progress on critical issues, such as climate, biodiversity, and education (Bubb, 2013; Fischman et al., 2019; Walpole, McGeoch, Bubb, & Brummit, 2017). According to this view, stronger CCEC monitoring and target-setting can help propel national governments to increase their capacity and provision of CCEC, as a central component of global action on climate change. However, there is also a recognition that using global monitoring techniques, such as the use of indicators or comparative content analysis, across diverse human and geographic contexts has potential assimilative and other negative political effects. Recognizing the use of indicators and other global metrics in governance as politically and culturally rooted (Davis, Kingsbury, & Merry, 2012; Grek, 2020), it is key they be developed and judged not only for their technical rigor, but for the impacts they can cause (Gorur, 2017; Sellar & Lingard, 2014). Given the urgency of climate change, the stance taken in this article is that the careful and collaborative refinement and use of indicators and other large-scale monitoring efforts can be a valuable part of leveraging all potential political tools to mobilize greater governmental and intergovernmental action on climate change education and communication (Benavot, 2018; Komatzu & Rappleye, 2018). This analysis then, can help lay groundwork for next steps in this regard by assessing the current state of national submissions to the UNFCCC, including appraisal of their future monitoring and target-setting potential.

Methods

Methodologically, the underpinning desk study was designed and conducted with the assumption of using the research methods that are best suited to the audiences of the intended research, mindful of the constraints typical of commissioned research. In this case, the sponsors and intended audiences are the intergovernmental bodies of the UNFCCC and UNESCO, as well as their member Parties who are in positions to advance CCEC policy in and across their respective countries. In other words, onto-epistemologically, the study orients to the understandings and priorities of these audiences, in what can be considered a 'strategic methodology' (Tuck & McKenzie, 2015). Axiologically, it is strategic and critical research that aims to be of use in informing and advancing policy, or in other words, as research *for* policy (McKenzie, 2009; Rickinson & McKenzie, 2020). As a result, a post-positivistic orientation of being as objective as possible was brought to activities such as document collection, codebook development, data analysis, and the interpretation of results; in order for the results to be most aligned with needs and approaches of governmental and intergovernmental policy makers. The study methods also built on prior research

commissioned by UNESCO and experiences in conducting document review and international comparative analysis (e.g. UNESCO MGIEP, 2017; UNESCO, 2019b; SEPN 2017, 2018a).

The desk study examined countries' UNFCCC submissions for their ACE and associated SDG indicator content in relation to a range of factors, including the UN SD *regions*⁴ to which countries belong, *scale* of focus, target *audience*, and emphasized *learning dimensions*. 'Scale' as a category of analysis is used to refer to the municipal (city or town), local (sub-sub-national), regional (sub-national), national, or international scope of reported or planned country activities, recognizing that these levels of policy making are constituted and operationalized through policy practice, rather than being naturally occurring units or permanent boundaries (McKenzie & Aikens, 2020; Moore, 2008; Papanastasiou, 2017).

The scope for 'audience' of CCEC activities corresponds to those suggested by the ACE elements and SDG indicators that comprised the focus of the study: formal education in regard to the SDG indicators, and a broader range of formal education levels (primary to tertiary), industry, government, NGOs, the scientific community, and the public and other audiences in relation to ACE elements.

'Learning dimensions' is a heuristic mobilized in a number of recent UNESCO publications to refer to interrelated 'cognitive', 'social and emotional', and 'behavioral' learning processes and outcomes (e.g. UNESCO, 2015, 2017). These three dimensions correspond to the pillars of learning from the prior UNESCO Delors Report, "learning to know, to do, to be and to live together," as well as the metaphor of 'head, heart, and hands' commonly used in environmental education (e.g. Inan, Zeynep, & Inan, 2015; Singleton, 2015; Tilbury, 1997). While recognizing the holistic and integrated nature of learning and pedagogy, these dimensions are typically distinguished to encourage a focus beyond cognitive learning 'about' the environment or the science of climate change, to also engaging in affective, social, participatory, and place-based ways that further engagement and 'action competence' both within and after educational experiences (e.g. Jensen & Schnack, 2006; Greenwood, 2003; Lundholm, Hopwood, & Rickinson, 2013; Leicht, Heiss, & Byun, 2018; McKenzie & Bieler, 2016; Ojala, 2012; Reid, Jensen, Nikel, & Simovska, 2008; Wals, 2007).

The document analysis focused on a total of 377 UNFCCC submissions from 194 Parties, with the most recent submission of each type included for each member country at the time of data collection in 2018. As shown in Table 1, the document set comprised a range of document types, most notably: 194 National Communications, with 44 from Annex 1 countries (40 NC7 reports, as well as 4 NC6 reports from Annex 1 countries that did not submit NC7s), and 150 'most recent' NCs from Non-Annex 1 countries. 172 parties had submitted Nationally Determined Contributions (NDCs), all of which were included in the analysis. The study also analyzed education content in the total of 11 National Adaptation Plans (NAPs) that had been submitted at the time of the desk study. As a result of the interconnections between ACE and the global SDG targets 13.3

Table 1. Documents reviewed and sections coded.

Document type	Description	Sections coded	# of docs
National communications (NC)—Annex 1 parties	Submitted at 4-year intervals, with NC7 due in January 2018	Education Chapters (Ch. 9), manually coded	44
National communications (NC)—Non-Annex 1 parties	Submitted within 3 years of joining Convention, then at 4-year intervals	Education Sections, identified by keyword searches then manually coded	150
Nationally determined contributions	Parties to Paris Agreement report on emissions and implementation efforts	Education content identified by keyword searches then manually coded	172
National adaptation plans	Identify adaptation needs and support development and implementation of strategies and programmes to respond to those needs	Education content identified by keyword searches then manually coded	11

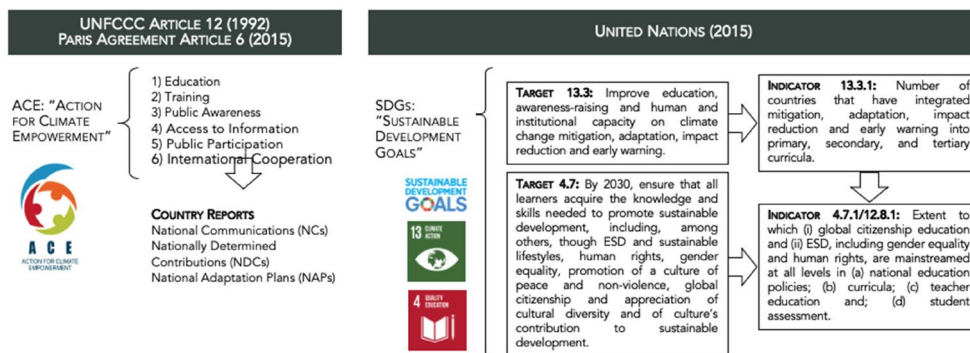


Figure 1. ACE elements and SDG indicators 13.3.1 and 4.7.1/12.8.1.

Table 2. NVivo keyword search terms.

English	French	Spanish	Russian
<ul style="list-style-type: none"> Education for Sustainable Development Environmental Education Education Training Public awareness Public access to information Public participation International cooperation 	<ul style="list-style-type: none"> Éducation au développement durable Éducation environnementale Éducation Formation Sensibilisation L'accès de la population à l'information Participation du public Coopération internationale 	<ul style="list-style-type: none"> Educación para el desarrollo sostenible Educación ambiental Educación Formación Sensibilización Acceso público a la información Participación del público Cooperación internacional 	<ul style="list-style-type: none"> образование в интересах устойчивого развития экологическое образование потребление изменение климата образование стажировка or профессиональная подготовка информированность общественности and общественная осведомленность общественный доступ к информации; участие общественности; международное сотрудничество

and 4.7, this article draws on an analysis of UNFCCC country submissions for content related to both ACE and these climate change education-related SDG targets (see Figure 1).

Study documents were uploaded into a networked version of the qualitative data management software NVivo 11/12, which enabled research assistants and me to collaborate on the coding and analysis of the data. For Annex 1 Party NCs, the Education chapters were analyzed in full, and for Non-Annex Party NCs, NDCs, and NAPs we used keyword searches (see Table 2) to identify relevant sections of the documents and then read in full and manually coded those sections. Relevant sections of documents written in UN languages other than English were translated for coding using available translating software, other than the Russian documents which were coded in Russian using the English coding scheme.

The close reading and manual coding of document text was undertaken in NVivo using a collaboratively developed coding scheme (Appendix). In applying the coding scheme to the documents, the manual coding focused on the 'meaning of the key concepts rather than [the exact] keywords and terms' (UNESCO MGIEP, 2017, p. 232). This allowed for flexibility in the variety of terms that might be used across regional, cultural, and language differences to refer to the shared global goals of ACE and the SDGs. The intercoder reliability function of NVivo (i.e. all coders coding same portions of text, with analysis then run on the comparability of the coding, and

adjustments made as needed), was used to help ensure that the coders were applying the codebook in similar ways (Bazeley & Jackson, 2013). (For further information, see UNESCO, 2019a).

Due to the challenges of analyzing and representing findings from large amounts of qualitative data, numerical counts of the qualitative references corresponding to various codes were calculated (N numbers). NVivo's functionality also enabled the easy viewing of text associated with a given code to review specifics and provide sample text excerpts.

To address research objective 1 on monitoring CCEC activities, the coding process identified any quantitative or quantifiable (hereafter referred to as 'quantitative') data available in existing national submissions (code 1 in coding scheme, see the Appendix; e.g. # or % of primary and secondary education grade level curricula with inclusion of climate change content; # or % of government employees receiving training in relation to climate change mitigation, adaptation, impact reduction, or early warning; etc.). Matrix coding queries were then used to analyze the extent of this quantitative content (coding category 1) in relation to other coding categories, such as specific ACE elements and SDG indicator 13.3.1 components (coding categories 3 and 4) (see the Appendix). Numerical index scores were also developed based on whether countries included data on each of the four indicator sub-categories for 4.7.1 (coding category 4): (i) national education policies, (ii) curricula, (iii) teacher education and/or (iv) student assessment.

In relation to research objective 2, to determine patterns, trends, progress and gaps, NVivo matrix coding queries were used to examine the relationships between coding categories—for example, the extent of focus on each education level in each country, and in relation to each ACE element or SDG indicator component.

Limitations of the study included that the documents analyzed represent a point in time of country reporting on their ACE progress and future commitments. The documents analyzed do not include any NDCs submitted for 2020, or additional NCs or NAPs that have also been submitted in the interim. All of the documents are self-reported materials, that reflect how countries choose to represent their action on ACE to intergovernmental audiences. The documents provide selective representations of country action, and may be more or less critical of actions still needed. As secondary versus primary data, they are not necessarily an accurate representation of activity on the ground. Particularly given the current lack of specific reporting requirements for ACE, they do not offer a full comparative analysis of actual country activity in relation to CCEC.

Findings

A summary of the main findings of the desk study, drawn from UNESCO (2019a), is presented in Table 3. In what follows, we focus on findings in relation to: (i) determining the extent of existing

Table 3. Key findings on country progress on climate change education, training and public awareness (Source: UNESCO 2019a).

-
1. Climate change education is addressed by almost all countries in their UNFCCC country submissions
 2. For those countries that reported a target audience, over 50% of the references were to formal education settings
 3. 'Public awareness' is the most common climate change education approach reported in country submissions, both in reports concerning previous actions (National Communications) and in those on future plans (Nationally Determined Contributions)
 4. Cognitive learning was more commonly discussed in relation to climate change education than social and emotional or action-oriented learning, regardless of education level
 5. Countries tend to report more on 'Environmental Education' than 'Education for Sustainable Development'
 6. 13% of country submissions included specific climate change responses in relation to climate change education, with a stronger focus on 'adaptation' and 'mitigation' than on 'impact reduction' or 'early warning'
 7. UNFCCC Annex 1 countries were less likely to address 'impact reduction' in relation to climate change education than non-Annex 1 countries
 8. UNFCCC Annex 1 and non-Annex 1 countries included similar shares of content on the six approaches to climate change education
 9. Countries included more climate change education content with a focus on 'mitigation' in the reports concerning previous actions on climate change than in their future plans where the focus is more on 'impact reduction'
 10. Relatively few of the country submissions included quantitative data that could be used in global monitoring of progress
-

data on countries' progress that might be used for global CCEC monitoring (aka ACE tracking), and (ii) highlighting general trends in the implementation status of CCEC globally, as represented in study documents. For a full set of study figures, including all results referred to in this article, please see the [supplemental material](#); for the UNESCO published results, see UNESCO (2019a).

Possible CCEC monitoring data

A key reason that UNESCO commissioned the desk study of education-related content in the UNFCCC Party submissions was to understand whether there were existing comparative data that could be used in future monitoring and evaluation processes (i.e. as data for SDG targets and in accessing country progress on ACE; study objective 1). Of the total of 377 country submissions in the study, we found that only 30% included quantitative data on ACE elements and/or SDG indicators that could be considered for ACE and/or ESD monitoring purposes (see [Figure 2](#)). Of that, most was focused on ACE, with 84 or 22% of documents including some quantitative data on one or more ACE elements and/or regarding a national ACE strategy: 74/194 NCs, 8/172 NDCs and 2/11 NAPs. Nearly half of all quantitative ACE data focused on the ACE element of 'public awareness', such as content from the Cambodian NC reporting that "Since 2000, there have been about 80 training, workshop, public awareness and other capacity building activities related to climate change conducted in Cambodia" (2015, p. xxxiv).

Six or 2% of the documents included some quantitative data on prior SDG indicator 13.3.1, all in National Communications. The number of references to indicator 13.3.1 data was lower than to ACE elements due to the specificity of the indicator 13.3.1 components (e.g. 'mitigation' indicated by reference to reducing greenhouse gas emissions, versus referencing climate change more broadly). The relative focus on the indicator 13.3.1 components varied considerably, with almost all of the quantitative 13.3.1 data focusing on 'mitigation', and none focusing on 'early warning'.

Twenty-four or 6% of the documents included some quantitative data on indicator 4.7.1/12.8.1 (and the new 13.3.1) indicator. These included: 23/194 NCs, 1/172 NDCs and 0/11 NAPs. The emphasis on the indicator components ranged widely, with over half of the quantitative data focusing on 'teacher education', and much of the rest focused on 'national education policies'. For example, the Dominican Republic NDC indicated the country has developed a strategy "to strengthen human resources, with emphasis on youth and future generations. To date, it has initiated the training of program trainers (120) and teachers (1200), as well as measuring the impact of the effectiveness of the strategy" (Dominican Republic NDC, 2015, p. 3).

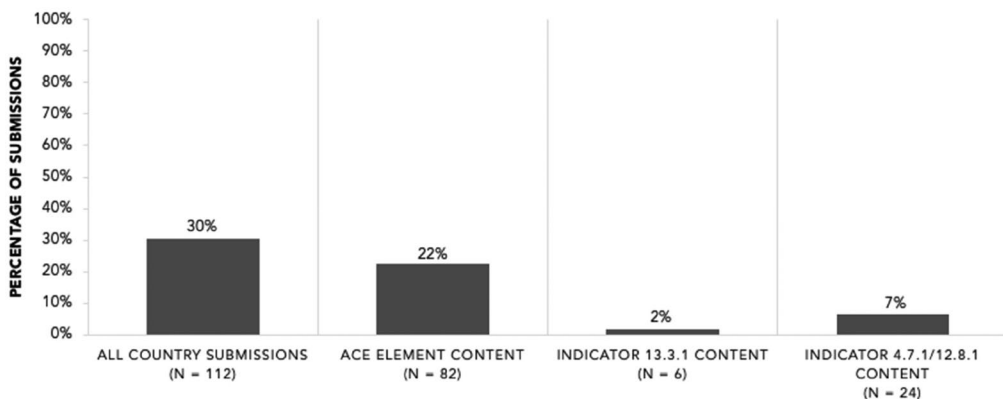


Figure 2. Available quantitative data on ACE elements and SDG indicators 13.3.1 and 4.7.1/12.8.1 in country submissions.

Table 4. Average index scores by UN SD region.

UN SD region	Average index score
Africa	0.25
Americas	0.80
Asia	0.36
Europe	1.13
Oceania	0.53
All countries	0.61

To further assess the extent of potential quantitative monitoring data on ESD in the study documents, we also examined whether countries included data on each of the 4.7.1/12.8.1 (and new 13.3.1) indicator components in one or more of their document types. Each country was assigned a point if there was evidence in their respective documents of CCEC activity in relation to: (a) national education policies, (b) curriculum, (c) teacher education and/or (d) student assessment, resulting in a total possible 'index score' of 4 points per country. Only 1 country had a score of 4 (Belarus), 4 countries had a score of 3 (Belgium, Greece, Kazakhstan and Panama), 25 countries had a score of 2, and 52 countries had a score of 1. The remaining 112 countries did not mention any of these four aspects specifically in their UNFCCC submissions, and thus had scores of 0. Average index scores are compiled by UNESCO region in [Table 4](#), with an overall global average of .61.

Trends in global CCEC implementation

Despite the lack of quantitative data in the submissions that are currently available for monitoring of progress, the broader data represented by these documents provide a sense of trends in achievements and gaps in the implementation of CCEC globally (study objective 2). While perhaps unsurprising given expectations to address ACE in NCs, it is encouraging to find that 95% of the 194 reporting countries had some focus on CCEC in one or more of their UNFCCC submissions. This ranged from 100% of countries in Europe and North America, to 76% of the Arab States. Examining the focus on ACE elements and SDG indicators content specifically, 291 or 77% of documents included content on ACE elements: 172/194 NCs, 108/172 NDCs, and 11/11 NAPs. [Figure 3\(a\)](#) breaks down the proportion of focus on various ACE elements and within each document type, with 'public awareness' being by far the most common ACE element discussed in the country submissions, followed by 'training' and then 'education'. For example, the Belize NDC indicated the general aim to "develop education awareness program to educate population on adaptation measures" (2015, p. 13), while Chile's NDC outlined somewhat more specific plans:

Chile has begun to introduce the challenges and opportunities of Climate Change in school curriculums. It has also created platforms for the management and distribution of information on Climate Change. These efforts should be continued, increased and spread as part of south-south cooperation. The country aspires to have its citizens educated on sustainable, inclusive, resilient and low-carbon development. (Chile NDC, 2015, p. 25)

Fifty or 13% of documents included content on indicator 13.3.1: 38/194 NCs, 9/172 NDCs, and 3/11 NAPs. 'Adaptation' was the most common indicator 13.3.1 component discussed in the country submissions in relation to CCEC content, followed by 'mitigation' and 'impact reduction', as shown in [Figure 3\(b\)](#). For example, Côte d'Ivoire reported in its NC, "various programs in Côte d'Ivoire's public and private universities, in which the environment component plays a very important role. The effects of adaptation to climate change are taught in all these programs so that it awakens public awareness" (Côte d'Ivoire NC, 2017, p. 23). Finally, 120 or 32% of documents included content on the components of indicators 4.7.1/12.8.1: 120/194 NCs. 'Curriculum' was by far the most common indicator 4.7.1/12.8.1 component discussed in the

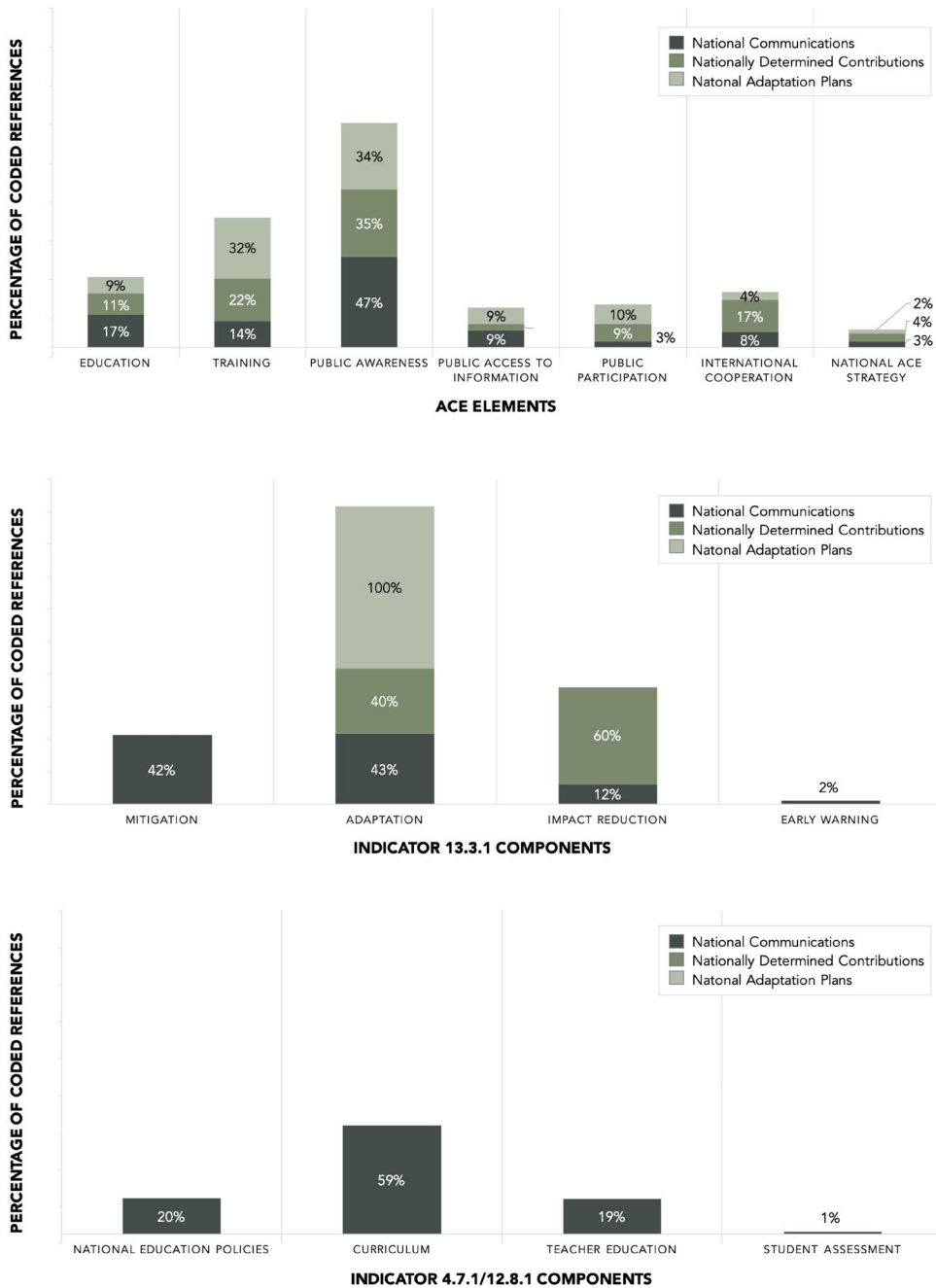


Figure 3. (a–c) Proportion of focus on various ACE elements, indicator 13.3.1 components, and indicator 4.7.1/12.8.1 components, and within each document type. (Note: Percentages total to 100% across each document type).

country submissions, followed by ‘teacher education’ and ‘national education policies’, as can be seen in [Figure 3\(c\)](#). Morocco outlined plans for its in-progress NAP in its NDC, including “Introducing academic curricula specializing in climate risk and climate change in training and learning institutions” (Morocco NDC, 2015, p. 25).

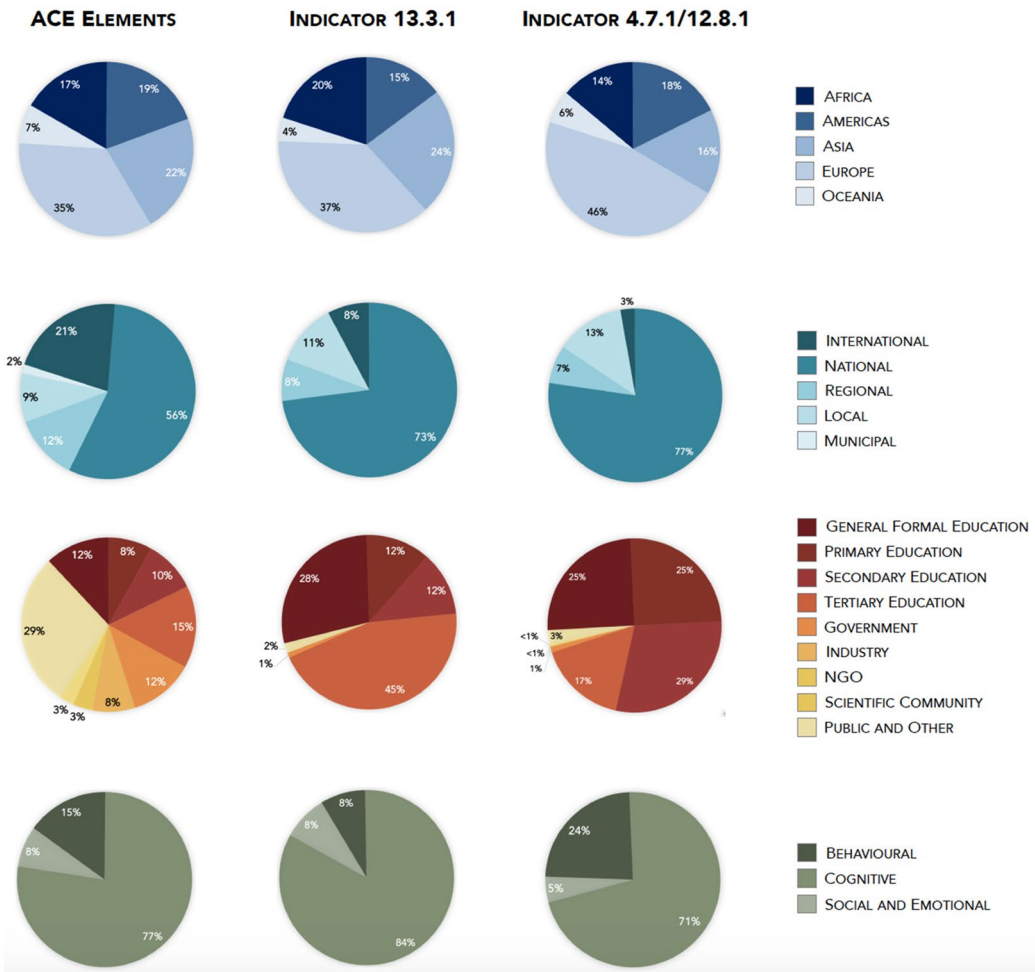


Figure 4. Proportion of focus on ACE elements across documents by UN SD region, geographic scale, target audience and learning dimension. (Note: Learning dimensions data is from Annex 1 NCs only).

The study also examined ACE, 13.3.1, and 4.7.1/12.8.1 data in relation to UN SD region, geographic scale, target audience, and learning dimensions (see Figure 4). Further to the findings below, the [supplemental material](#) provides greater break-down of the findings in relation to these four components of analysis.

In terms of UN SD *region*, European countries were most likely to include discussions of ACE elements and indicator 13.3.1 and 4.7.1/12.8.1 components. For ACE elements and indicator 4.7.1/12.8.1 components, this was followed by countries in Asia, the Americas and Africa. For indicator 13.3.1 components, Europe was followed by countries in Asia, Africa and the Americas.

In terms of geographic *scale* of focus, most references to ACE elements and indicator components were in relation to national contexts, which is not unexpected given these are national-level documents. Relative to the indicator components where over three quarters of the content was focused at the national level, content on ACE elements was slightly more likely to focus on other scales of activity of international, regional, local, and infrequently, municipal.

A range of target *audiences* were discussed in relation to ACE elements, with the largest proportion being the 'public and other' audiences, with a high proportion also indicated for formal education contexts (primary to tertiary or more generally). In contrast, formal education

is the largest component of references for indicator 13.3.1, as would be expected given the indicator's focus on formal education curricula, but with particular emphasis on tertiary education. Government is also a significant target audience for indicator 13.3.1 content, indicating the roles of ministries of education and other educational administration in including climate change action in formal education systems. Almost all of the references to target audiences for 4.7.1/12.8.1 are to formal education contexts, from primary to tertiary or more generally.

In terms of *learning dimensions*, cognitive learning was by far the greatest focus across ACE and indicator content (e.g. references to 'understanding' or 'awareness' or 'knowledge of' climate change), versus emphasis on social and emotional or action-oriented ('behavioral') learning processes or outcomes (see the Appendix for coding explanations). Indicator 4.7.1 content had relatively more emphasis on action-oriented learning than either ACE element or indicator 13.3.1 content. As an example, the United States NC discusses a US-published document on *Climate Literacy: The Essential Principles of Climate Sciences—A Guide for Individuals and Communities*, commenting that the guide,

presents important information for individuals and communities to understand Earth's climate, impacts of climate change, and approaches for adapting to and mitigating climate change. Principles in the guide can serve as discussion starters or launching points for scientific inquiry. The guide can also serve educators who teach climate science as part of their science curricula. A guide is available to help individuals of all ages understand how climate influences them—and how they influence climate. (United States NC, 2014, p. 257)

Discussion

The study results suggest a number of implications and possible next steps for both policy making and research spheres, and their intersections. The lack of comparable, quantitative data currently in UNFCCC national submissions indicates the role more specific UNFCCC reporting guidelines could play in enabling better benchmarking and target setting on CCEC within and across the 197 Parties in relation to ACE/Article 6 of the Convention (1992), Article 12 of the Paris Agreement (2015), and the Cancun Adaptation Framework (2011). Annex 1 and Non-Annex 1 countries are currently required to include education content, but the scope and details of that are content are left open-ended. For NDCs, Parties are invited to include education content, but it is not currently a requirement. New reporting guidelines which required specific verifiable data, such as extent and type of inclusion in formal education, extent and type of national public awareness campaigns, and extent and type of government employee training, and relative focus of these activities on mitigation or adaptation, for each of NCs, NDCs, and NAPs, would quickly advance the state of global monitoring and target setting on CCEC.

While UNESCO (2020) has developed guidelines to support countries in reporting on ACE in their NDCs, including recommendations informed by the desk study summarized in UNESCO (2019a), it remains the case that these are only suggestions. This situation contrasts markedly with what would be possible if Parties were asked to include specific ACE reporting information in their national submissions, a proposition which could be advanced by member Parties in future ACE negotiations. A reasonable expectation here would be for countries to report on whether the components of SDG indicator 4.7.1/12.8.1 (and new 13.3.1) (i.e., national education policy, curriculum, teacher education, student assessment) in their country address climate change, and to what extent this is embedded, and illustrative of high quality CCEC (e.g. Hargis & McKenzie, 2020; Monroe, 2019). The fact that 112 countries did not report or target-set in relation to any of these aspects in any of the three document types, is disheartening and suggests room for strengthened reporting on ACE in future submissions (see Table 1). Whether this means that the same proportion of countries do not have national level initiatives on these aspects is unknown, but it suggests scope for greater ambition on both ensuring climate change is addressed in these ways nationally, as well as reported on in UNFCCC country submissions.

Education: Adaptation of SDG indicator 4.7.1 (same as 12.8.1 and new 13.3.1), “Extent to which [climate change education is] mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment”. Add components regarding extent of inclusion of climate education i) in all grades and subjects, ii) in ways that includes cognitive but also socio-emotional and behavioral learning, and iii) in a whole-institution approach (i.e., across institutions in each of teaching and learning, governance, facilities and operations, and community partnerships).

Training: Proportion of government employees at a) national and b) sub-national levels who receive training on climate change, both scientific and cultural mitigation/adaptation strategies.

Public Awareness: Extent to which a) national and b) sub-national governments have implemented public awareness programs and policies in relation to climate change mitigation and adaptation, and where possible, collect data on the impact of such activities on individuals and communities.

Public Participation: Extent of i) membership in non-governmental civil society organizations focused on climate education, awareness, and public participation, and ii) number of these organizations nationally.

Public Access to Information: Adaptation of SDG indicator 16.10.2 to measure the “number of countries that adopt and implement constitutional, statutory and/or policy guarantees for public access to information” in relation to climate change mitigation and adaptation. Also, the extent to which accurate information related to climate change is included on a) national and b) sub-national government websites, and the presence of national media guidelines supporting accurate reporting on climate change in news outlets.

International Cooperation: Extent of international collaboration on ACE implementation, and in which of the five areas mentioned above (i.e., education, training, public awareness, public participation, and public access to information).

Figure 5. Examples of specific and measurable ACE content in national submissions to the UNFCCC Secretariat (i.e. NCs, NDCs, NAPs). (Source: SEPN, 2018b)

This and other examples of possible items to include in more specific requirements for reporting (NCs) and target-setting (NDCs, NAPs) are listed in [Figure 5](#) (see also SEPN, 2018b).

These recommendations are offered with due recognition that there are often profound challenges to delivering on more specific reporting requirements, including the potential absence of capacity within countries to collect or access quality national-level data, as well as the technical and supranational challenges associated with modifying UNFCCC processes and procedures. In terms of the first, even if some countries were to indicate in future NC reporting that data on these items were ‘unavailable’, their inclusion in reporting requirements would signal more specific goals that countries could be aiming towards, as well as including as targets in NDCs and NAPs during the coming decade. While to date ACE activity under the Doha Work Programme has made progress in outlining steps for countries to develop context-specific national strategies, including recommending developing national ACE Focal Points and internal monitoring processes (UNESCO & UNFCCC, 2016)⁵; the key findings summarized here ([Table 2](#)) equally suggest more ambitious supports and expectations are needed for ACE progress within and across UNFCCC Parties.

To that end, UNFCCC Non-Party Stakeholders including NGOs and universities have important roles to play in facilitating stronger negotiating ambitions in UNFCCC processes. With a mandate allocated by national government consensus, the UNFCCC Secretariat’s role is to support inter-governmental negotiations through convening meetings and undertaking related assigned tasks (Kolleck, Well, Sperzel, & Jörgens, 2017; Reinicke et al., 2000). In other words, decisions towards a new ACE Work Programme or additional reporting requirements in relation to ACE need to be made on the negotiating floor at annual SB or COP meetings, where ACE negotiations take place, rather than being able to be made by the Secretariat. While only national governments are ‘Parties’ to UNFCCC negotiations, country negotiating teams can be open to and appreciative of Non-party Stakeholder input. Non-Party observers can attend open negotiations and request to speak to country delegates at these negotiations or arrange meetings during or between SB and COP meetings. Country negotiating teams may not have existing expertise in ACE and can be open to expertise and suggestions, including from researchers with expertise in ACE, or CCEC.

Other opportunities for researchers, students, and scholars include via participation in Non-Party observer coalitions. These coalitions can partner with the Secretariat to create capacity and momentum involving country delegates, which can lead to change on the negotiating floor, such as has been the case in relation to Gender UNFCCC negotiations in recent years (e.g. <https://unfccc.int/news/gender-equality-on-the-rise-at-un-climate-meetings>). A Non-Party Stakeholder coalition of particular note for education is the new Education, Communication, and Outreach Stakeholders (ECOS) group, which is now holding information and strategizing meetings throughout the year and at UNFCCC events. The UNFCCC constituency groups focused on research (RINGO, or Research and Independent Non-governmental Organizations Constituency) and youth (YOUNGO, or the Youth Constituency) are also networks with meetings, listservs, and capacity aimed at advancing intergovernmental and governmental policy regarding climate change through UNFCCC processes. Climate Action Network (CAN)-International is also very active at UNFCCC meetings, as a network of NGOs strategizing with national delegations, holding information sessions, and otherwise convening lobbying and strategic action across Non-Party Stakeholders at and between UNFCCC meetings, including with student and activist networks and participation. As the UNFCCC recognizes in the original Convention (1992), and in Secretariat activities since, Party and Non-Party activity and collaboration are essential to moving forward global climate action, including on ACE. This can encompass collaboration and shared initiatives among researchers, governmental and intergovernmental policy makers, NGOs, children and youth, and other Party and Non-Party stakeholders.

In terms of the broader global trends on CCEC suggested by the country content in UNFCCC submissions, some items of particular note for researchers include the overwhelming focus on the cognitive, versus social and emotional and action-oriented dimensions of learning (to use the UNESCO heuristic introduced earlier). Similar to the results of another recent UNESCO commissioned study which focused on engagement with learning dimensions in ESD and global citizenship education across 10 countries (UNESCO, 2019b), the still dominant focus on cognitive learning in relation to climate and environmental concerns in national policy and curricular materials calls for attention and involvement by researchers. The research literature has well established that more knowledge of environmental science or issues does not necessarily lead to increased concern or action (e.g. Kollmuss & Agyeman, 2002). This is particularly the case in relation to climate change perceptions, where explicit engagement with ideological and emotional barriers has been found to be key to increasing motivation to act (e.g. Brownlee, Powell, & Hallo, 2013; Hornsey, Harris, Bain, & Fielding, 2016; Kahan et al., 2012; Norgaard, 2011; Randall, 2009; and in a recent Environmental Education Research special issue on climate change, for example, Cantell, Tolppanen, Aarnio-Linnanvuori, & Lehtonen, 2019; Kunkle & Monroe, 2019; Verlie, 2019). Given the history of CCEC as the foray of climate scientists and science educators, there is a need for greater research, and sharing of that research with policy makers, to facilitate country approaches that go beyond increasing science literacy to engage affective and action-oriented dimensions towards both individual and societal change (see a Primer for policy makers and educators, Hargis & McKenzie, 2020).

Finally, and relatedly, there was more focus on 'adaptation' than 'mitigation' when indicator 13.3.1 components were specifically mentioned in national UNFCCC submissions. However, to date in the climate change education research literature, there has been relatively little emphasis on educating for adaptation, particularly in formal education (Davidson & Lyth, 2015). Humans are now facing rapidly shifting conditions of migration, species extinction, climate-related disease and deaths, rapid land changes, grief, and other social and psychological impacts of climate change, especially individuals and communities already marginalized by poverty, racism, gender, or other factors. While in addition to a continued focus on education for mitigation, we also need further research on how CCEC can help in coping and responding to already shifting existential conditions spanning and disrupting human and the more-than-human worlds, and in the years to come (Clayton, Manning, Krygsman, & Speiser, 2017). Thus, further research-informed

understandings of quality CCEC in terms of both addressing multiple “learning dimensions” and “mitigation, adaptation, impact reduction, and early warning” components, could better inform discussions and contribute to intergovernmental and national reporting and target-setting for climate change-related education in the decades ahead.

Conclusion

Collaboration and communication between researchers and policy makers, whether at the level of the UNFCCC, or at regional or organizational levels, is central to strengthening both the quality and quantity of CCEC globally. The literature on knowledge mobilization and evidence use underscores the centrality of relationship building and collaboration between researchers and policy partners in facilitating research design and outputs that support research use in decision-making about education, including in relation to environment, sustainability and climate change (Bennett & Jessani, 2011; Rickinson, Sebba, & Edwards, 2011; Rickinson & McKenzie, 2020, 2021). Collaboration also maximizes benefits from non-academic partners and collaborators, be that as change enablers in various sectors and regional contexts, or as knowledge brokers in sharing research outputs (Cooper, 2014; Simon, Olssen, & Peters, 2009). As reflected in the recent desk study (UNESCO 2019a), whether it is in partnership projects that develop and deepen analysis, mobilize and stimulate CCEC research and practice via coalitions, or broaden the scope and understanding of the role of CCEC in addressing the climate crisis globally, jointly undertaken benchmarking studies invite further reflection on the state of the art, and priorities for the future.

Coda

The research reported here aims to contribute to a growing trajectory of research-policy collaboration towards the global advancement and monitoring of quality CCEC. A newly funded six-year Monitoring and Evaluation of Climate Change Education [MECCE] (Social Sciences and Humanities Research Council, Canada) project involving over 80 partners and collaborators from around the world is one vehicle for extending such work, as well as the arguments and insights on progress and monitoring priorities for CCEC at sub-national, national and international levels. The MECCE⁶ project seeks to advance the collection and analysis of global data that member countries can access to support their target-setting and monitoring activities, including in UNFCCC national submissions, with an aim of increased *quantity and quality* of CCEC globally. Key to this work (which I have the privilege of directing), is efforts to further our shared and scholarly understandings of what constitutes effective and progressive CCEC, including in relation to diverse learning dimensions within and beyond current models and practices of CCEC, those activities of mitigation and adaptation that fit with or disrupt current practices and policies for CCEC, and regional and cultural considerations. Through collaboration with the UNFCCC, UNESCO, and other partners and advisory committee members, the project is committed to working across the research-policy interface in ways that aim to support global CCEC/ACE activity and progress tracking. This, among other initiatives, and the growing momentum of CCEC within and beyond the UNFCCC system, suggests ways forward for better monitoring and more action on ACE and CCEC-related SDGs in the critical years to come.

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Notes

1. Its linked sister conventions are the UN Convention on Biological Diversity and the UN Convention to Combat Desertification.
2. NCs, NDCs, and NAPs are publicly available on the UNFCCC Secretariat website.
3. The Doha Work Programme was launched in Doha, Qatar, in December 2012, to advance Article 6 of the Convention. It “sets out the scope of, and provides the basis for action on, activities related to Article 6” (UNFCCC, 2012, p. 5).
4. The UN Statistics Division (SD) regions are used for the analysis in this paper and the supplemental material. See <https://unstats.un.org/unsd/methodology/m49/> for a listing of the countries in each region.
5. The results of the study point to the minimal uptake to date of national ACE strategies (only 1% of countries mentioned having ACE strategies) in response to the ACE Guidelines developed in 2016.
6. For more information on the MECCE Project, including how it intersects with intergovernmental monitoring and target-setting processes, please see <https://sepn.ca/mecce/> or #mecce.

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ORCID

Marcia McKenzie  <http://orcid.org/0000-0002-8037-8059>

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Appendix A. Coding scheme and keyword search terms.

Coding scheme

Category	Code	Operational definition
Data type	Measurable evidence	Quantitative or quantifiable information on ACE programmes or activities.
Geographic level	International	Indications that the ACE programme or activity is occurring at the international level.
	National	Indications that the ACE programme or activity is occurring at the national or federal level.
	Regional	Indications that the ACE programme or activity is occurring at the state, provincial, territorial, or school division level. May require additional analysis to separate out state, provincial, and territorial references from school division references.
	Local	Indications that the ACE programme or activity is occurring at the municipal or local level.
Elements & strategies of climate change education/ACE (UNFCCC, 1992; UNESCO & UNFCCC, 2016)	Education (Formal)	Formalized programmes or activities that seek to achieve profound, long-term changes in understanding of climate change, particularly among young people, resulting in greater national action and commitment. Delivered via educational curricula, training of trainers and teachers, and adequate pedagogies.
	Training	Programmes or activities designed to teach specific practical skills to individuals, communities, and organizations that have an immediate practical application.
	Public awareness	Outreach programmes or activities that use targeted, systematic communications to inform the public.
	Public access to information	Offered by governments, non-governmental organizations, intergovernmental organizations, UN agencies. Programmes or activities that ensure climate information, data, and statistics is freely available to all citizens via technology such as databases and the Internet, and including accessibility in multiple languages, to support development of effective policies and citizen engagement in enacting policies.
	Public participation	Programmes or activities that ensure citizens are able to participate in climate change policy decision-making to implement climate mitigation and adaptation activities.
	International cooperation	Programmes or activities for sharing success stories, exchanging personnel, and strengthening institutional capacity amongst governments and relevant stakeholders to enhance capacity for climate-change related expertise as well as financial and technical resources.
	National ACE strategy	A long-term, strategic set of activities comprising a national strategy for achieving action for climate empowerment (ACE).
	Mitigation	Primary to tertiary education designed to reduce climate change.
	Adaptation	Primary to tertiary education designed to develop the skills, capacities and attitudes for adaptation in the face of already evident and looming climate impacts.
	Impact reduction	Primary to tertiary education designed to reduce the impacts of climate change related to natural disasters.
Early warning	Primary to tertiary education designed to encourage the development of early warning systems for severe and/or abrupt climate change (e.g. flash floods, heat waves, severe storms).	
13.3.1 Indicator components		
Number of countries that have integrated mitigation, adaptation, impact reduction and early warning into primary, secondary and tertiary curricula (UNESCO & UNFCCC, 2016)		



4.7.1 and 12.8.1 Indicator components* Extent to which education for sustainable development is mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment	National education policies	ESD (including climate change education) in national education laws, national strategic plans, and/or national curriculum frameworks.
	Curriculum	ESD (including climate change education) in curriculum—i.e. included in the design, planning and sequencing of teaching and learning processes. May include subject-specific curricula; excludes national curriculum frameworks.
	Teacher education	ESD (including climate change education) in formal teacher training (pre-service or in-service), for example, equipping teachers with the knowledge, attitude, behaviour and skills required for teaching climate change education.
* <i>Keyword searches of text for the terms (1) 'consumption' will identify references specifically related to indicator 12.8.1 and (2) 'climate change' will identify references specifically related to climate change</i>	Student assessment	Evaluation of individuals' achievement of ESD (including climate change education) learning objectives (e.g. written, oral and practical tests/examinations, projects and portfolios).
(UIS, n.d.; UNESCO MGIEP, 2017; UNESCO & UNFCCC, 2016)		
Learning dimensions for indicator components (UNESCO, 2017)	Cognitive	Aimed at developing knowledge and thinking skills necessary to better understand.
	Socio-emotional	Aimed at developing social skills that enable learners to collaborate, negotiate and communicate as well as self-reflection skills, values, attitudes and motivations that enable learners to develop themselves.
	Behavioral	Aimed at developing action competencies.
	Primary education	The customary or legal age of entry is usually not below 5 years old nor above 7 years old. This level typically lasts six years, although its duration can range between four and seven years. Primary education typically lasts until age 10 to 12 (often Grades 1-6).
	Secondary education	Secondary education is typically attended by youth aged 12/13 through to age 17/18 (often Grades 7-12).
	Tertiary education	Tertiary education builds on secondary education, providing learning activities in specialized fields of education. Students are typically aged 18 or older. Also known as higher or post-secondary education.
	General formal education	References to formal education or schooling not including references to primary, secondary, or tertiary education; can be holistic references to the overall formal education system within a country, or references to a formal education programme without specifying level.
	Industry	Programmes or activities designed to develop responses to climate change in sectors that process raw materials and manufacture goods (e.g. resource extraction, energy, construction, transportation, technical).
	Government	Programmes or activities targeted to share information on climate change with policy decision-makers including government staff, ministries, departments, and politicians at municipal, regional (e.g. state, provincial, territorial), and federal levels.
	Non-governmental organization	Programmes or activities designed to provide non-governmental organizations (also known as non-profit organizations, civil society organizations) with information to develop their own climate change education and/or communication programs.
	Scientific community	Programmes or activities designed to increase climate change research by targeting scientists, researchers, thought leaders, think tanks, and innovators.
	Other	Other audiences targeted by a climate change education programme (e.g. lobbyists, banking sector).
	Other data	Other interesting data not captured by the above coding scheme.

NB: Unless otherwise specified, these codes were applied to all text related to climate change education, training, public awareness, public access to information, public participation, and international cooperation (i.e. 'action for climate empowerment programmes or activities').