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Orit Ben Zvi Assaraf[a], Vaille Dawson [b], Efrat Eilam [c], Tuba Gokpinar[d], Daphne Goldman[e], Nofar Naugauker [a], Gusti Agung Paramitha Eka Putri [f], Agung Wijaya Subiantoro [g], Sakari Tolppanen[h], Peta White [i], Helen Widdop Quinton [c] and Justin Dillon [j]

[a]School of Education, Ben-Gurion University of the Negev, Beer-Sheva, Israel; [b]Graduate School of Education, The University of Western Australia, Perth, Australia; [c]The College of Arts and Education, Victoria University, Melbourne, Australia; [d]Institute of Education, University College London, London, UK; [e]Beit Berl College, Tel Aviv University, Tel Aviv, Israel; [f]Nossal Institute for Global Health, University of Melbourne, Melbourne, Australia; [g]Department of Biology Education, Universitas Negeri Yogyakarta, Yogyakarta, Indonesia; [h]School of applied Educational Sciences an Teacher Education, University of Eastern Finland, Joensuu, Finland; [i]Faculty of Arts and Education, Deakin University, Burwood, Australia; [j]Science and environmental education (Curriculum, Pedagogy and Assessment), University College London, London, UK

ABSTRACT

Climate change (CC) is the most significant global issue facing humanity, yet research addressing the perspectives of the key players influential in developing and implementing school-based CC curricula at a cross-country national level is scarce. This study examined the perceptions of policymakers, teacher professional development providers and CCE teachers in relation to: CC knowledge, representation in the curriculum, content and pedagogy, and support for teaching. The voices of these educators were gathered across five countries (Australia, England, Finland, Indonesia, and Israel) through semi-structured interviews. Analysis revealed much commonality across the countries and across role types. Although participants agreed that CCE is multidisciplinary and expressed widespread support for including CC in the curriculum through a cross-curriculum approach, their conceptualisations of CC knowledge were inconsistent. Participants recognised the importance of a science basis in CCE, and of student action, with some participants also emphasising emotional, ethical and value-based inclusions. Most suggested active learning focused pedagogies. Variations in approaches to CC implementation between countries suggest that CCE is in a transitional phase. In all five countries, the interviewees called for the curriculum to make more explicit connections to CC and for governmental leadership in supporting CCE, professional development and provision of resources.

CONTACT Orit Ben Zvi Assaraf ✉ ntorit@bgu.ac.il 🖃 Ben Gurion University of the Negev. P.O.B 653 Beer-Sheva 84105, Israel

Introduction

Climate Change (CC) is currently considered a 'Code Red' threat (UN, 2021), confronting global societies, natural ecosystems, and the fabric of life on Earth as we know it, with 'projected long-term impacts … up to multiple times higher than currently observed' (Intergovernmental Panel on Climate Change [IPCC], 2023, p. 14). Climate change education (CCE) is being advocated as a crucial focus for teaching and learning amongst experts, citizens, educators and activists (Reid, 2019). Students in today's world need to be equipped with knowledge, skills, values and attitudes that will enable and motivate them to cope with CC challenges. Accordingly, education systems are expected to address these needs by developing and implementing effective CCE programs (UNESCO, 2021).

This study extends on our previous study, which compared middle-school science and geography curricula of six countries (Australia, Israel, Finland, Indonesia, Canada and England) in terms of their inclusion of CC (Dawson et al., 2022). Our cross-country comparisons showed that the curricula of all six countries contained CC content but varied widely in CCE requirements and structuring. These findings raised a number of questions, such as: What is the nature of CCE? What are appropriate approaches for implementing and engaging students in CCE? What are the challenges associated with implementing CC curricula? What types of resources are necessary for effective CCE implementation?

In response to these questions, we assembled a further cross-country comparison, this time focusing on examining the perceptions of the key players that engage in CCE in five countries. Research rarely addresses the perspectives of policymakers, professional development (PD) providers and teachers involved in implementing CCE at a cross national level. In the present study, we selected representatives from these three educational roles in five countries, with the aim of comparing and contrasting their perspectives and reflections on their active involvement in CC curricular implementation in their countries. Such comparative information is important for gaining insiders' views into CCE practices, and thus identifying opportunities and challenges for effective CCE implementation.

Climate change education implementation

Against the backdrop of escalating climate impacts, education is intended to play a major role in educating citizens (students and communities) about CC (UN, 2023). While this seems to be self-explanatory in this time of multiple crises, evidence suggests that globally, schools could do more (Dawson et al., 2022; UNESCO, 2021). Studies have shown a gap between teachers' perceptions concerning the importance of teaching CC, and their ability to implement CCE (Plutzer et al., 2016). Research indicates that the factors influencing teachers' efficacy in implementing CCE are primarily related to teacher knowledge and skills, and uncertainty in the curricular positioning of CCE (Clayton et al., 2023; Enke & Budke, 2023).

Liu and Roehrig (2019) reason that teachers need strong argumentation skills to teach CCE, and to foster such skills in their students. Dawson and Carson (2020) recommend using professional development (PD) in argumentation to develop science teachers' repertoire of strategies for teaching argumentation skills in the context of CC as a

socioscientific issue or socioecological challenge. Effective PD can improve educators' confidence and attitudes toward teaching science and offer opportunities to learn science content related to CC (Ennes et al., 2021). In turn, such enhanced teacher training is expected to improve their students' CC-related scientific understanding (Drewes et al., 2018).

Where and how CCE should be positioned in the curriculum is contested. In many countries CCE is not included in the primary/elementary school curriculum, yet teachers support its inclusion, as well as cross-curricular inclusion in secondary/high school subjects, with an emphasis on an action-based approach (Howard-Jones et al., 2021). However, Eilam (2022) argues that one reason for the limited representation of CC in school curricula worldwide may be its poor epistemological conceptualisation as a body of knowledge, noting that questions such as what constitutes CC knowledge, what the organising principles of that knowledge are and how it should be included in the curriculum require in-depth consideration. Compounding CCE curricular uncertainty, Nation and Feldman (2022) note that the perception of CC as a controversial topic may be causing teachers to be hesitant to address CC in their classrooms. Finally, the apparent gap between teachers' aspirations for CCE and their CC teaching practices is influenced by each teacher's unique personal and professional history with CC. These impact their repertoire of capacities, beliefs, and values (Dawson et al., 2022).

Building on an earlier cross-country comparative study of CC in middle school science and geography curricula (Dawson et al., 2022), this study compares the perceptions of policymakers, PD providers, and teachers involved in CCE in Australia, England, Finland, Indonesia, and Israel.

Method

A qualitative-phenomenographic research methodology enabled our 'mapping the qualitatively different ways in which people experience, conceptualise, perceive, and understand various aspects of, and phenomena in, the world around them' (Marton, 2005, p. 143). The mapping process was facilitated through in-depth, semi-structured interviews with participants. Here we present the main aspects related to the methodological approach. A more detailed summary of the methodological procedures is presented in Table 1, in following the Consolidated Criteria for Reporting Qualitative Research (COREQ) (Tong et al., 2007).

Participants

The research was conducted with a total of 36 participants, actively engaged with CCE in five countries, representing diversity in aspects of cultures, socioeconomic structures, languages, religions and curriculum structures (Dawson et al., 2022). The participants' roles covered CCE policymakers or influencers, teacher PD providers, and teachers. The sample selection followed a purposive sampling method (Creswell & Plano Clark, 2011) for participants, based on their active involvement in CCE, and their role type within the education sector.

The participant identifier codes we use represent the contributor's country and their role in relation to CCE as indicated in appendix. The first two letters represent the

Table 1. Research methodology: Summary by COREQ (Tong et al., 2007).

No	Item	Description
1	Interviewer/facilitator	Ten of the 12 authors signed on this publication conducted the interviews in their respective countries. Interviews were conducted by two researchers in each country.
2	Credentials	All the researchers are active researchers in the field, holding a PhD.
3	Occupation	All the researchers hold ongoing academic positions in their affiliated tertiary institutions.
4	Gender	The research team consisted of nine females and three males.
5	Experience and training	All the researchers are experienced in qualitative research methodologies and in conducting in-depth interviews.
6	Relationship established	The relationships between the interviewer and the interviewees varied from no previous acquaintance to lose professional relationships, such as past meetings in professional associations and other work-related relationships.
7	Participant knowledge of the interviewer	Participants were selected solely on the basis of their roles in the education system and active involvement in CCE.
8	Interviewer characteristics	Interviewer characteristics were not reported.
9	Methodological orientation and Theory	Phenomenology
10	Sampling	Purposive sampling
11	Method of approach	Direct contact by email; snowballing
12	Sample size	36
13	Non-participation	There were two types of refusals. In Australia, contractual limitations related to nondisclosure of information, prevented active policymakers from being interviewed. In England, refusal was explained by lack of time. While we did not systematically documented refusal, we note that a large majority of people contacted agreed to be interviewed.
14	Setting of data collection	Most data were collected via zoom. Some face-to-face interviews were held at the offices of policymakers.
15	Presence of non-participants	No non-participants were present.
16	Description of sample	In each country we aimed to obtain a balanced representation of three types of participants: policymakers, PD providers and teachers.
17	Interview guide	The interview guide consisted of four themes, as follows: (i) Structure of the school curriculum in junior high school (e.g. 'Please provide an overview of how the Years 7–10 curriculum is implemented in schools'); (ii) CCE in the school curriculum (e.g. 'Please describe how climate change is presented in the 7–10 years curriculum.'); (iii) Drivers and inhibitors of CCE in the school system (e.g. 'Please describe what resources (e.g. professional development, curriculum resources, textbooks, websites) are provided to support the teaching of climate change in years 7-10.'); (iv) Personal perspective of the interviewee as a professional in the field of CCE (e.g. 'What do you believe should be the primary goals for CC curriculum?'). The interview protocol was tested in a pilot, consisting of five participants, after which questions, prompts, and challenges were discussed, and the protocol revised. The protocol was originally developed in English, and then translated by the relevant authors into their native languages.
18	Repeat interviews	There were no repeated interviews
19	Audio/visual recording	All interviews were recorded, transcribed and translated to English by the interviewers.
20	Field notes	No field notes were taken.
21	Duration	60–75 min
22	Data saturation	Data saturation was confirmed during the analysis process.
23	Transcripts return	Transcriptions were not returned to the participants.
24	Number of data coders	Authors conducted initial data coding for their respective countries. The initial coding was then shared with the research team for feedback and corroboration discussions, ensuring consistency in role classifications and responses to coding
25	Description of the coding tree	In a series of zoom meetings, each group provided a description of its coding tree, after which questions were raised by their fellow authors regarding the themes they had derived from the data.
26	Derivation of themes	The themes were derived from the data.
27	Software	Word, Google Translate.

Table 1. Continued.

No	Item	Description
28	Participant checking	Participants checking not applied.
29	Quotations presented	Quotations are coded and presented. Tables 2–4 present selected quotations. Due to limited space, only exemplary quotations were selected for presentation from each country. When countries that are not represented in the tables, this may be due to either the participants from thee non-represented countries have not commented at all on the topic, or that their comments form repetitions and do not add new information.
30	Data and findings consistent	Consistency established between the data and findings, using rich descriptions and quotations
31	Clarity of major themes	The clarity of themes established through repeated zoom meetings between the researchers.
32	Clarity of minor themes	Not applicable.

Note: Items adapted from ' Consolidated Criteria for Reporting Qualitative Research (COREQ): A 32-Item Checklist for Interviews and Focus Groups' by T. Allison, P. Sainsbury, and J. Craig, 2007, *International Journal for Quality in Health Care*, 19(6), P. 352. Copyright 2007 by Oxford University Press.

participant's country (AU, FI, IN, EN, IS) followed by the role type – policymaker (P), PD provider (D), teacher (T), or two letters indicating a combination of roles (e.g. DT or PT); and the participant's identity number. For example, AU T1 is a teacher from Australia coded with the number 1.

Across the five countries, representatives of the three types of roles – policy influencer, professional development provider, and teacher were varied. For example, in Israel, the policymakers consisted of high-ranking ministerial officials who were actively involved in developing and overseeing the implementation of the CC curriculum in the Israeli Ministry of Education. In contrast, in Australia, due to procedural limitations related to nondisclosure of information, policy influencers interviewed were those involved in policy making in the past and no longer holding decision-making positions in relation to CCE. While in Finland there are no official policymakers in their devolved system, there are highly regarded authority figures, who schools regularly consult, who were therefore the CCE policy influencers interviewed in that country.

Data collection

The research team jointly developed an interview protocol to guide the 60–75 min interviews, asking the participants to contribute their understandings about the structure of the school curriculum and their role, perceptions regarding CC positioning in the Year 7–10 curriculum, CCE enablers and inhibitors, and their personal perspectives regarding CCE. The interview protocol was originally developed in English, and then translated by the relevant authors into their own language. Interviews were conducted either face-to-face or online (due to COVID-19), recorded and fully transcribed.

Data analysis

The interview transcripts were analysed thematically and inductively, creating themes and categories, in line with a qualitative-phenomenographic approach (Marton, 2005) in a three-stage procedure, including three research team Zoom collaborations:

(1) Authors conducted initial data coding for their respective countries. The initial coding was then shared with the research team for feedback and corroboration discussions, ensuring consistency in role classifications and responses to coding.
(2) After establishing that there were no major differences among the responses of participants within the three role types (i.e. response consistency), in each country, emergent themes were identified for in-depth, cross-country examination. Three multi-national teams were formed, each working on the comparative analysis of a different set of themes. In each team, discussions and negotiations were conducted through an iterative process of revisiting the coded texts.
(3) All authors reviewed the other teams' data analysis process and outcomes, which ultimately identified four main themes in the participants' perceptions regarding CCE.

Findings

The four dominant themes within the participants' perceptions of CCE were related to:
　(i) CC knowledge
　　　a. Conceptualising CC as a body of knowledge
　(ii) CC representation in the curriculum
　　　a. Ideal representation of CC in the curriculum
　　　b. Actual representation of CC in the curriculum
　(iii) CC content and pedagogies
　　　a. CC content
　　　b. CC pedagogies
　(iv) Support for teaching: Teaching resources and professional development.

Details of the key themes in the participants' perceptions are presented in the following sections through the responses of the various participants from each country, and through comparing and contrasting perceptions and trends in CCE implementation within the five countries. Participant quotes are used to exemplify our findings. We present both cross-country comparisons and intra-national comparisons among role types.

Perceptions of climate change knowledge

There was a general consensus amongst the participants regarding the importance of CCE, but a lack of agreement regarding the nature of CC knowledge.

Climate change as a body of knowledge

When considering CC as a body of knowledge, most participants referred to it as a *topic*, a *theme,* or a *big idea*. A **Finnish** participant, for example, stated that CC is 'a topic that goes throughout the curriculum' (FI P2). An **Australian** participant stated that 'climate education may well be the theme that runs through [the curriculum]' (AU P1). CC was described by an **Australian** participant as a *big idea*, stating: 'Climate change – you can put together so many different lower concepts to be all together in this one big idea' (AU D2). Regardless of categorisation, the participants indicated that CC is relevant

across disciplines, with attention frequently focused on the science and geography curriculum.

The participants identified some issues with CC definitions, proposing some distinctions and reflecting differences at the content level of what constitutes CC as a body of knowledge. For example, a **Finnish** participant distinguished between *climate education* and *climate change* as follows: 'I know that in geography there is a lot of teaching about climate change. However, this is different from climate education, which includes value discussions, emotional aspects, societal aspects etc.' (FI PD2). Another distinction, offered by an **Israeli** participant, differentiated between the concepts of *climate* and *climate change*, stating that 'we cannot teach only climate change. We have to teach something about climate before we can teach about climate change' (IS P3).

Indonesian participants made a distinction between *global warming* and *climate change*. This distinction was expressed as follows. 'I know there is a climate change topic in Grade 7 science, but it is not exclusively discussed. … The science instruction only focuses on global warming' (IN P1). An **Israeli** participant commented on a shifting focus, noting: 'It used to be called the greenhouse effect, then global warming. … Two years ago it changed to climate change. Last year, and this year, the expression has taken on a more urgent tone [referring to climate crisis]' (IS P1).

In relation to the perceived nature of CC, the findings revealed that there were no major differences among countries. The participants in Australia, Finland and Israel characterised CC as multidisciplinary. For example, an **Australian** participant stated that 'it's more than just science or just math or just geography, or just art. I think it's an integrated area. So, multidisciplinary …' (AU D3). There was also a strong sense that CC involves humanity. CC was consistently perceived as a socioscientific issue intertwined with other problems, such as the economy and the environment. A **Finnish** participant highlighted the importance of framing CC as a social problem, explaining that 'CCE is, or should be, more society based, because it is a societal problem' (FI D1).

In summary, our epistemological examination concerning the perceptions of CC knowledge revealed that, across all five countries, most of the participants agreed that CC within the curriculum may be a *topic*, a *theme* or a *big idea*. Participants were somewhat vague regarding the nature of CC as a body of knowledge. Similarly, the various ways in which the participants interpreted the meaning of terms associated with CC and the relationships between them reflected a certain terminological vagueness. When considering the nature of CC, many participants suggested viewing it as multidisciplinary, emphasising that CC can only be fully comprehended through a human-oriented perspective.

Climate change representation in the curriculum

There was an agreement among the participants regarding the ways in which CC should be represented in the curriculum. However, when it comes to the actual implementation of CCE, a wide variation was found among the countries.

Ideal representation of climate change in the curriculum

There was agreement across countries and across participants that CCE should be holistic and cross-curricular, and draw from key domains that include socioscientific issues,

sustainability, values and student action. However, the term holistic seemed to be under-stood in diverse ways. Participants in **Finland** noted: 'In the model [referring to Cantell et al.'s (2019) CC Bicycle Model], everything is important. If one thing isn't working, the whole bicycle is useless' (FI PD2), reflecting a systemic understanding. For most partici-pants, the holistic nature of CCE seems to be captured within the framework of sustain-ability education. An **Indonesian** participant explained that when teaching CC, teachers are 'challenged to teach Sustainable Development Goals' (IN P1).

The participants seemed to form an association between the conception of CCE as being multidisciplinary and supporting a cross-curricular approach for implementation. This is summed up by an **English** participant's comment: 'it's just such a key component of many subjects: science, geography, economics, citizenship' (EN P1). However, a **Finnish** participant noted the challenges that this approach poses for teachers, arguing that: 'It is not natural for teachers to implement multidisciplinary education, so it would be important to support them in this' (FI PD2).

The supportive foundations of CCE were variously identified in the different countries. In **Israel,** there was a general agreement that CC should be included in the cur-riculum, and that it is essentially a topic within sustainability. However, there were differ-ences in opinions concerning ways of including CC in the curriculum. One Israeli participant suggested that CC should be included as a topic on its own right, stating that 'it is definitely a topic. In my view – a topic on its own right' (IS T1). Another par-ticipant argued for the inclusion of CC in Geography, while yet another Israeli partici-pant viewed CC as a science-oriented topic that should be included in Science. Participants from both **England** and **Israel** suggested contextualising CC as a socioscien-tific issue in science education. In some countries, the participants paid special attention to inclusion of generic skills and dispositions. For example, the participants in **Finland** and **Israel** promoted emotions, ethics, values and student action, as demonstrated through the comment: 'Values and school culture [as well as] climate-responsible activi-ties are part of all subjects and part of the entire school's operating culture' (FI P1).

Indonesia was the only country where the participants highlighted the importance of teaching CC via the context of disaster risk reduction. The participants in all three roles in **Indonesia** identified the importance of preparing students for disasters. **Finland** was the only country where the option of including CC in a non-subject specific space in the curriculum was suggested. In **Finland,** a participant suggested that 'the best would be if schools would have multidisciplinary projects that would address climate change' (FI T1).

While these country-specificities are interesting in their own right, overall, across the five countries there was clear agreement that CCE is an important curricular inclusion as a complex, comprehensive issue. Further agreement was revealed in accepting the basic tenets of the sustainability education model according to which many participants viewed CCE as part of a set of sustainability issues, within the framework of the Sustain-able Development Goals. Most of the participants advocated for the inclusion of CC in the curriculum through a cross-curriculum approach, in which CC is infused in every subject across the curriculum.

Intra-national comparison of perceptions and aspirations for CCE, by role type. The findings revealed intra-national homogeneity across role-types, in relation to CC

conceptualisation and the inclusion of CC through a cross-curricular approach. The practicalities of cross-curricular structuring tended to be vaguely conceptualised, as demonstrated by the differing opinions of the Israeli participants regarding the appropriate curricular space for CCE, as shown in Table 2.

Actual representation of climate change in the curriculum

While the previous section addressed the participants' conceptualisation of how CC *should* be represented in the curriculum, this section focuses on the 'actual' rather than the 'ideal'.

In contrast to the international and intra-national consistency that we found in the participants' CCE ideations, when it comes to experiences of CCE implementation, we found variation among the countries. As could be expected, the participants' perceptions concerning CC representation in their country's curriculum reflect each country's unique curricular structure. This in turn is reflected in the participants' perceptions concerning CC representation in the curriculum and implementation.

In Australia, the presence of CCE in the curriculum is limited, and primarily optional (Dawson et al., 2022). One **Australian** noted that 'You can completely avoid sustainability or CC, or any of those issues … so I could manage a whole curriculum, tick off everything I needed to do, and never mention sustainability or social justice, and really never

Table 2. Excerpts exemplifying CC conceptualisation, by country and role type.

Policymakers (*P*)	Professional Development Leaders (D)	Teachers (T)	Comments
Australia			
'I think it's an integrated area. So multi-disciplinary project opportunities' (AU P1)	'I think there's a lot of strength in getting it across, a lot more closely than we do at the moment. We're still very siloed' (AU D3)	'You could actually set up certain context, thematic sort of approach for a term or so we look at that. I mean, we do that for STEM' (AU T2)	Participants agreed that CC is a multidisciplinary theme that crosses various subjects.
Indonesia			
'There are two responses to CC we should consider, namely mitigation and adaptation … Philosophically, our understanding about those two implies on behaviour change as well as adoption of innovative technology.' (IN P1)	'It may discuss more about the current condition of the earth, the causal factors, symptoms, impacts and pre-, medium- and post-disaster mitigation' (IN D1)	'Students need to be educated about CC and the impact of climate change on life' (IN T1)	Participants identify the importance of addressing CC impact. Despite nuanced difference in their responses, overall they seem to agree.
Israel			
'I would like it to have more of a presence in the [science and technology] curriculum.' (IS P4)	'We have five core [geography] topics that include: ecosystems and human-environmental interactions, water resources, air resources, waste from the resources, and noise and radiation … . That's why it can be incorporated into any topic.' (PT7)	'It is definitely a topic. In my view – a topic on its own right' (IS T1)	Participants disagree on the curricular 'home' for CC, yet all agreed that CC comes under the umbrella of sustainability.

mention climate impact' (AU D3). Consequently, the **Australian** teachers we interviewed recommended modification to their curriculum to require explicit incorporation of CC.

In **England**, CC is mentioned in Science and Geography curricula, but the participants criticised its overall weak representation, and the lack of standards. As one participant explained: 'There's no doubt that the main barrier until very recently has been the formal curriculum, the national curriculum, and the absence of assessment of climate change in the national examinations' (EN P1).

Indonesia and **Israel** are two countries where CCE is mandated. In **Indonesia,** CCE is mandated in Year 7 Science only, through a focus on CC impacts and natural disasters. In **Israel**, at the time of data collection, aspects of CC were addressed under various subjects across secondary-school levels, including topics in science and geography. However, this has changed in September 2022, when the new mandatory CC curriculum was introduced across K-12. CC curricular inclusion approach consists of integrating the cross-curriculum approach with the establishment of a dedicated CC topic in Years 8 and 10 curricula, including mandatory assessment (Keshet-Maor & Eilam, 2022). At the time of data collection, one **Israeli** participant expressed confusion and concern regarding the scattered appearance of CCE in the curriculum, stating that 'in the ninth grade, it appears in some context or other – but not as a subject in itself. … I think this will entail a bigger job, because this subject doesn't appear in the curriculum in a structured form' (IS T1).

In **Finland,** CCE is mandated in the Core Values and in the geography and biology curriculum. The locally determined nature of the **Finnish** curriculum provides CC opportunities, as one participant explains: 'The curriculum has never been a limitation to discuss topics, such as CC. The question is more about how the curriculum has been able to push teachers to do more. Our curriculum is very open. … In our curriculum's general section it says that Eco-Social education is a necessity' (FI PD2). The **Finnish** curriculum 'has an emphasis on value development, and multidisciplinary learning with schools having autonomy to select their own multidisciplinary projects' (Finnish National Board of Education [FNAE], 2023, p. 11).

Overall, the participants expressed the need to create more explicit connections to CC within their countries' curricula, noting that, in some topics, the connections to CC are not clearly outlined in the curriculum, leaving it up to teachers to make the connections. As a result, 'teachers who are more involved can add their own input … and link their teaching to the climate crisis' (IS P4). Participants also indicated that CCE seems to be in a transitional phase, appearing explicitly in core subjects in some countries and not in others.

Intra-national comparison of perceptions concerning actual implementation, by role type.

While comparisons between countries revealed differences in participants' perceptions of CC curricular implementation, intra-national comparisons showed a high level of consistency. Table 3 presents exemplar excerpts from participants in **England**, **Finland** and **Australia** to demonstrate the conceptual consistency across role types. These countries were selected for presentation due to the clarity of quotes representation this finding.

The examples taken from the three countries presented in Table 3 demonstrate that while there are observable differences between countries concerning the actual representation

Table 3. Excerpts addressing CC curricular implementation, by country and role type.

Policymakers (P)	Professional Development Leaders (D)	Teachers (T)	Comments
England			
'The only way it could be presented in the school curriculum is if a department or one teacher and school chose to do so.' (EN P1)	'Most of our training teachers don't see where it fits in the curriculum.' (EN D1)	'There is no consistency and there's no overall view as to what's being taught and how it's being taught.' (EN DT1)	The participants agree that the formal curriculum does not sufficiently include CC.
Finland			
'Climate change has been talked about in schools for decades now, but mainly in a few subjects. What has been missing is a greater systemic change that would go through the government and all stakeholders.' (FI P1).	'Some teachers are very good and do a lot of different things with their teachers. Some teachers don't do anything, and then there are denialist teachers, who teach opposite to the curriculum.' (FI D1)	'We are a green-flag school, so through that we've done some collaboration between teachers. However, it has been very hard to put the green flag aims into practice, because not all teachers see them as important' (FI T2).	CCE has been present in Finland curriculum for decades, but there is variance in how it is implemented by teachers and schools.
Australia			
'So those are the only three areas (7-10 Science, Geography, Civics & Citizenship) … And even then, it's only as exemplars, not as requirements' (AU P1).	'It is inferred rather than explicit [in science] … ' (AU D2).	'I just mentioned climate change there. But I am not obliged, it's not in the Biology curriculum.' (AU T1).	Participants agreed that CC is not mandated and only inferred and/or included as a personal preference.

of CC in the curriculum, there is again a high level of internal agreement within countries among the representatives of the three role types. This pattern of intra-national agreement is consistent across all of the themes we identified. Thus, the remaining findings will focus exclusively on comparing perceptions between countries.

Perceptions concerning climate change content and pedagogies

Climate change content

There was general agreement among participants that teaching of CC needs to be comprehensive, extending beyond scientific topics to connect with issues related to the economy, society, values and social justice. For example, a **Finnish** participant noted that 'CCE is, or should be, more society based, because it is a societal problem' (FI D1). An **Israeli** participant noted that CC is caused 'not only because of the [science] content but because of all the moral values that go with it' (IS DT5).

In all the countries except **Finland**, the participants tended to emphasise the importance of the science foundation of CC. This was most apparent among the **Israeli** participants, as exemplified by comments such as: 'I do think that the science basis is super important, so they can develop attitudes and argumentation … critical thinking, scientific literacy' (IS DT1).

A participant from **England** expanded on the science content, claiming:

You would want that by the time students leave school at the age of 16, they understand why it is that burning of methane and fossil fuels has led to enhanced levels of carbon dioxide. You'd want them to know about radiation, understand the consequences for global

warming … the movement of air … explain why global warming is not uniform across the globe but is more extreme at the poles. (EN P1)

Participants from all five countries emphasised the role of CCE in equipping students with skills for taking climate action. For example, a **Finnish** participant explained that CCE 'provides an opportunity to take action and be a societal influencer (citizenship education). The aim is that students would start to take positive climate actions' (FI T1). Similarly, a participant from **Israel** noted that CCE needs to be characterised by its 'activism, in the sense of what I can do to promote the issues that are important to me on a personal level, on a political level, or on a national level. Yeah, look at Greta' (IS DT4). An **Australian** participant contributed that 'I'm a big one for making sure there's an activity and action' (AU D1). Finally, an **Indonesian** participant emphasised 'students develop knowledge and therefore can take action on how to tackle global warming in their everyday life' (IN T1). However, an **Israeli** contributor cautioned against just focusing on activism:

> Many schools who focus on the climate crisis, their main focus is on taking the students out to participate in climate demonstrations. … They give this a lot of weight, which is rather easy to do. … While this is important, I am not undermining this, I do feel that there is too much focus on climate demonstrations on the expense of deep learning. (IS DT5)

Table 4 presents a summary of the three main areas of content that emerged from the analysis, using exemplar excerpts from **Indonesia, Israel, and England**. These examples were selected for their clear representation of this finding.

Table 4. Excerpts demonstrating shared perceptions concerning CC curricular content.

Perception theme	Indonesia	Israel	England
CCE contents are comprehensive	'The content includes the definition of CC, the cause of CC, its impact, and how to deal with it. Context about CC phenomena or data are also important, such as flood or extreme weather' (IN T2)	'Science needs to be there [in the CC curriculum], society, civics … and also the economy … geography, borders, migration, … all this knowledge must be integrated with skills' (IS P1)	Climate change education has the potential to be a socioscientific issue, because it draws in all these bodies of knowledge. You can't understand how different countries react to climate change without including politics' (EN P1)
The importance of the science basis in CCE	'The material on climate change … started with the understanding of climate change itself, what is meant by greenhouse effect, various greenhouse gases and their sources … ' (IN T3)	'The science basis is super important, so they [students] can develop defensible arguments.' (IS DT4)	'You'd want them [students] to know quite a lot about physics, chemistry biology' (EN P1)
The need to educate for action	'The main goal is to make students aware and to be able to move students to independently participate in tackling climate change' (IN T3)	'The third basis [of the CC program] is action outside of school and in- school. When I finish the teaching in school I encourage them [the students] to be active. To begin with, prepare a lecture and present to their parents, other teachers, friends in youth movements. … At a more advanced stage we participate in climate demonstrations.' (IS T2)	'I think what's really important is to bring it down to a level where people feel they are able to have some control' (EN D2)

The CC content findings reveal an agreement across countries and across stakeholders regarding the need to develop a comprehensive multidisciplinary CC curriculum, and the important role of the scientific basis in CCE combined with cultivating skills for action taking.

Climate change pedagogies

A rich repertoire of pedagogies for teaching CC were identified by contributors across all five countries. Student-centred pedagogies dominated the interviews, with an emphasis on authentic settings that engage students in active learning. Connecting CC to local issues, cultivating activism and citizenship education, teaching CC as a *big idea*, applying the socioscientific approach to CC, developing critical thinking, a sense of agency and addressing the emotional aspects of CC were also highlighted as important pedagogical approaches. Other notable pedagogies were outdoor learning, place-based learning, inquiry-based learning, problem-based learning, experiential learning, and interpreting data from graphs and simulations. An **Australian** participant noted: 'The experiential component is really important.' (AU D1), with an **Israeli** contributor advocating for 'out-of-school' fieldwork for students to engage in embodied observation and data collection to enhance comprehension and ensure memorable learning (IS DT5). This rich suite of approaches was evident across all the countries, and in some countries (e.g. **Israel**) they were advocated by participants from all three role types.

Stories of inspiring CCE pedagogy examples were shared by the participants, including 'really dealing with local issues which are really impacting their lives, so they are aware … it's the power of relevance here' (AU T2); advocating with the local mayor to address urban heat vulnerabilities after students' 'amazing' heat islands inquiry project (IS PD6); and using 'a (climate science) simulation that combines role-play.' (IS D3).

CC teaching through socioscientific issues was seen as a pedagogy to encourage teachers 'to be empowered to interpret the curriculum' in an interconnected way (AU D4). An **English** contributor summed up these generative opportunities with the comment that:

> one of the wonderful things about socioscientific issues is that for students to really understand the issue, they need to both have a good grounding in science and in some other bodies of knowledge, whether that's economics or mathematics, or even an art subject or moral philosophy or politics or psychology or sociology.' (EN P1).

Real world science connections were also identified as a strategic approach to inspire students. 'I brought in the manager of the Bureau of Meteorology in **Israel** … and he gave a talk about CC … and I brought in Professor [CC researcher] and he gave talks about CC, and they took it in hungrily … ' explained one participant (IS DT5). In **Israel** use of open-access big data and citizen science data generation signals a productive technology-driven direction for new CCE pedagogies. Examples were shared of using satellite measurement and imagery databases, and historical datasets, for students to use in conjunction with their own observations and analyses [for e.g. to 'calculate the amount of stored carbon' in local trees (IS DR5)].

There was less certainty about pedagogical strategies for responding to the psychosocial dimensions of CCE, even though the participants identified generic and personal capabilities curricular areas as interconnected in CCE. As one **Finnish** participant

stated: 'We may understand the seriousness of CC, but the aspect of how to influence issues, is not on teachers' radars. We need active citizens to deal with these issues' (F1 D1). Allied to discussions of supporting students to become active, informed citizens, pedagogies for developing critical thinking were emphasised as important in CCE, illustrated through this **Australian** participant's comment:

> I think it's critical thinking about information – what's the information out there and how you make sense of information, how to make sense of the data that's been given … and not what someone else is saying about it because it's an opinion or there is a political agenda behind what's been spoken. So, they become a bit more critical about what they're reading (AU T2).

Many participants expressed heightened awareness of the emotional aspects of CCE. A **Finnish** participant argued that 'it is not only about knowledge; it's also about emotions. The emotional side is not easy to address in schools' (FI T2). An **Australian** participant emphasised climate anxiety, noting: 'I really believe in climate anxiety and the impact that that's having in the disengagement of our children' (AU D3). Others addressed the importance of building emotional resilience and creating an inclusive classroom atmosphere. An **English** participant described the importance of a safe-space classroom culture: 'Being able to discuss and knowing that they're in a relatively safe environment. … The teacher is going to keep control of the class and make sure they're not insulted by the other fellow students … so you do need a good classroom culture' (EN P1). As an **Israeli** participant explained, CC pedagogies go beyond discipline knowledge, identifying this as a potential impediment to teacher CCE preparedness:

> A second barrier is the pedagogical knowledge of how to teach this topic [CC], also the psychological-emotional aspects, and also … even things like how to teach a simulation? How do you work with a simulation? You need to do it right … how to do a role-play right? How to employ critical thinking right? How to do SSI [socioscientific issues] right? It is something that needs to be understood. (IS D3).

Overall, there seemed to be a consensus among the participating educators regarding CC pedagogical best practices, suggesting their broad applicability across national settings and across domains for CC curricula across the globe.

Support for teaching: teaching resources and professional development

After identifying possibilities and practices for CCE with the countries' educational leaders and teachers, the focus shifted to considering support measures for teaching CCE. The participants generally agreed that there are abundant resources available to support CCE teaching. For example, a **Finnish** participant noted: 'Online there is a very large amount of learning materials that teachers can use' (FN T1). Similarly, an **Israeli** participant stated that 'any teacher who's interested – they have a place; they have aids; they have materials. They can't complain that they've got nothing (IS PD6). However, most participants argued that valuable resources were not necessarily easy to access. As an **Indonesian** participant indicated, 'my content knowledge is not enough. I only understand climate change in general terms, but in order to teach it to students, I have to look for more related and relevant teaching materials' (IN D1).

The participants also discussed issues concerning the provision of effective PD. In **Finland,** a participant explained that PD is available for teachers, but they do not take advantage of it, commenting that 'the Ministry funded projects so that NGOs, Universities etc., can provide in-service teacher training. … The problem is that teachers are tired and often skip the training' (FI D1). In contrast, participants in **Australia** and **Indonesia** complained about the lack of PD and support for teaching, illustrated through the concern that 'so far there have been no supporting factors to teach this material' (IN D1).

Leadership in CCE was also noted as important in supporting teachers. In **Finland**, a participant argued that 'governments can and need to take a role' (FI T1). An **English** participant stated: 'I think we need an overview of climate change. And I very much think that we need some resources for teachers and for leaders in school to know how to address this. We have a lack of coordination at the moment' (UK DT1). Similarly, an **Australian** participant said: 'Leadership has to prioritise it. If it's prioritised, then we need to be able to provide solid, consistent, professional learning, not one-off experiences' (AU P1). In **Israel** there was a consensus across the three role types that the Ministry of Education must show its commitment, and leadership in promoting CCE.

Many insights about provision of CCE teaching support were contributed in the participant interviews. Table 5 presents three summary statements with illustrative comments from participants. These synthesising statements further highlight the key themes that emerged from the contributors' perceptions about support for teaching CCE, namely, availability of resources, provision of PD and leadership in CCE.

Internationally, we found a continuum in the support available for teaching CCE, ranging from Australia, where teachers were reportedly required to source resources for teaching on their own with very limited PD and insufficient government leadership in CCE, to Finland, where participants reported that there are abundant resources and some provision of PD, but a lack of PD uptake by teachers. Finally, in Israel, the findings reveal strong governmental commitment to support the teaching of CC, including efforts to enhance resource development and PD. However, the overall consensus from participants was that effective CCE implementation requires government leadership, PD and appropriate support and guidance for teachers. This call for government

Table 5. Key theme statements with exemplar comments illustrating support for teaching CCE.

High level leadership support is needed to elevate CCE as a priority.
'I don't think there is a set national CC education goal as such. It doesn't come across as this is something that you need to really work on.' (AU T2)
'In my view, our government, particularly the Ministry of Education, should make a policy about minimum standards of CC curriculum.' (IN P1)
'We need to provide them [paid hours] to the teachers and the principals first – instil it top-down.' (IS P5)
Time poor teachers need easy access to quality resources
'We really provide ready-made resources. But I'll say it again, I'm guilty of not making them accessible enough.' (IS D1)
'I am aware it needs time and energy to adapt the resources (IPCC reports etc.) for school need.' (IN P1).
'There's lots of stuff out there; that teachers will tell you that don't have the time to go find it.' (AU D2)
'A few teachers may have supporting resources, but textbooks are still dominant. (IN P2)
Teachers need accessible, authoritative, incentivised PD
'I think it would be good if there is a collaborative program which involves experts, academics and us [teachers] to develop CC learning program.' (IN D2)
'Providing our teachers with the professional learning and the supportive resourcing that they need to make things really happen.' (AU P1)
'Even though we have a lot of in-service training programs, and we try to make them accessible, we still have a problem with budgets for a number of in-service training programs.' (IS P2)

leadership complements the earlier call from the participants for development of a comprehensive CC curriculum.

Discussion

This study aimed to compare and contrast the perceptions of educators in five countries, who were actively involved in CCE at varying levels ranging across policymaking, professional development providers and teachers. The findings revealed a unanimous and unequivocal view amongst all the participating educational leaders and educators that CC is a vital curricular mandate. CC was identified as a complex multi-domain and multidisciplinary topic, in which cognitive understanding as well as affective and behavioural aspect inclusions are necessary. This high-level complexity created uncertainties for the participants regarding the specifics of the 'what' and 'how' recommendations for implementation of CCE curricular structuring, supportive resourcing and teacher expertise.

There was unanimous support for the application of a cross-curriculum approach for implementing CCE in all K-12 levels. However, participants also reported that, in practice, the implementation of this approach is currently lacking. Previous studies have consistently revealed a similar gap, in which the advocated cross-curriculum implementation is not applied. Instead, research has found that in many countries CCE is implemented primarily in Science and Geography, starting in the middle-school years (Dawson et al., 2022; European Commission, 2022; UNESCO, 2021). This gap is not only between the rhetoric and the practice, but also reflects a gap between the broad consensual opinion and its weak theoretical foundations (Eilam, 2022). The gap noted in the five countries in this research invites us to rethink whether the prevailing approach for including CC in the curriculum through a cross-curriculum approach is indeed effective, and to conduct research into best practices for CCE inclusion while being cognisant of the powerful influence of discipline-based thinking. Regardless, our findings suggest that among the policy makers there is a growing awareness of the importance of including CC, suggesting that, with time, we may expect to see more CC inclusion.

Concerning CC content, in most countries, the participants highlighted the importance of the science knowledge foundation of CC. These views correspond with efforts made in the US in developing 'The Essential Principles of Climate Science Literacy' (US Global Change Research Program [USGCRP], 2009). The seven principles of the US framework focus primarily on the scientific aspects of CC. This science-based view of CCE has also been widely reported in science education research. For example, Shepardson et al. (2012) developed content scoping for CC school curricula, presenting a 'climate system framework for teaching about climate change' (p. 323). Their framework is guided by three questions: (i) What is a climate system and what are the components of the system? (ii) What happens to the system when components within the system change? and (iii) What are the impacts of these changes? Similarly, Zangori et al. (2017) focused on carbon cycling as a key natural system that requires robust science literacy to understand how and why climate change is occurring, exploring the specific learning processes that support students, as well as what the products of the students' reasoning should be.

While many participants acknowledged the importance of the science-basis in CCE, there were similarly many voices arguing for the importance of developing a comprehensive conceptualisation of CCE that goes beyond the science and interconnects a range of societal aspects, including social justice and ethics. These perceptions have been echoed in other studies that emphasise the importance of developing a value-oriented mindset that needs to form part of CC literacy (Goldman et al., 2013; Tolppanen & Kärkkäinen, 2022). Breslyn et al. (2016) argued that the choice of topic through which to introduce scientific knowledge should be guided by a sociocultural perspective, utilising learners' personal and cultural experiences. Similar to the findings in our study, in Indonesia Mostacedo-Marasovic et al. (2023) found that Indonesian participants emphasise disaster response in CCE. They argue that 'current changes to Earth's climate system are heavily driven by human activity and, while it is essential to understand the natural principles and processes upon which these changes depend, it is equally as important to cultivate learning about the implications of GCC for human existence' (p.1).

Despite these findings, very few educational programmes are evident that focus on social issues, such as environmental justice and ethics, in relation to CC (Monroe et al., 2019). Recent research aligns with our participants' perspectives that climate science learning is subject to a myriad of influences (e.g. worldviews, social norms, values, epistemic cognition, political identity, and emotions), which extend far beyond the changes in conceptual knowledge (Olsson, 2022; Zummo, 2023).

In our study, the participants also called for a student action element, echoing an education for environmental citizenship approach, where students are regarded as social transformation *change agents* (Sarid & Goldman, 2021). An example for such an approach is illustrated in Parth et al. (2023) who argued that – to advance climate-friendly actions and educate the next generation of climate activists – teenagers should be encouraged to take on the role of researchers and perform reliable and valid research. They engaged teenaged students in a transdisciplinary, intergenerational inquiry project, designed not only to impart scientific literacy, but also to impact the behavioural dimension by promoting participants' intention to act.

In recognising the complexity of CC (and CCE), our contributors also acknowledged an expertise challenge for educators teaching the complex and far-reaching knowledge and capabilities associated with CC, particularly in mainstream, predominantly discipline-defined teaching and learning. The participants themselves exhibited some lack of clarity regarding the nature of CC and the ideal discipline content that should be part of CCE. Eilam (2022) claimed that epistemological vagueness may form a barrier for effective development and implementation of CC curricula. Our findings support this claim by demonstrating the impact of epistemological vagueness on responses to CCE implementation, including positioning of CC in curricula and arrangements for supporting teaching CCE. Consequently, we recommend a clear mapping of key characteristics and formulation of a comprehensive view of CC, and a clear epistemological framework, to guide future CC curricular development and teachers in their implementation of CCE.

The CCE pedagogies the participants identified were predominantly non-discipline-specific, student-centred and active learning approaches that are familiar to most teachers. However, the psycho-emotional aspects of CC were identified by the participants as an emerging pedagogical area of concern that educators will need support with. This

supports a similar finding by Clayton et al. (2023) among teachers and parallels a global concern of increasing youth ecoanxiety and the need for adults to be responsive to this (Hickman et. al., 2021).

Finally, our results indicate a strong need for government leadership in CCE. The CCE deficiencies and uncertainties described by the participants in the five countries represented in this study were attributed, in part, to a CCE authority vacuum. While there were expressions of expectations for government leadership, there was variation in the extent to which educators felt the lack of government support. The educators called for authoritative direction in conceptualising and positioning CCE in curricula, and in resourcing teachers and providing PD. It is noteworthy that these calls for CCE leadership appear to be having an impact. Since our interviews, governments in Australia, Finland, and the UK have strengthened their curricular directives and resourcing for CCE, and in Israel a new mandated CC curriculum was developed and implemented.

Study limitations

In comparing the CCE perceptions and practices of educational leaders and educators in five countries we found nuanced differences between the different countries but overall a high degree of consensus. We recognise that our study has limitations regarding the small sample size for representation of the specific roles for each country, in addition to the diverse interpretation of what the educational roles encompass in each setting – a variability that is expected for the naturalistic context of our study. Likewise, variability in interview data in this qualitative method has inherent limits. Accordingly, our findings are not generalisable, however the rich and nuanced contributions from the interviewees and the consistency in findings within and among the countries suggests valuable trends to consider for future CCE research and practice.

Conclusion

This study of perceptions of policy makers, professional development providers, and teachers in five different countries regarding CCE in their school systems, indicates that the educational actors leading and involved in CCE worldwide are deliberating about central questions and issues topical in contemporary CCE discourse. Research into the perceptions of CCE policymakers who are directly responsible for the implementation of CCE in formal school systems are rare, as are studies across the educational hierarchy, from policy making to classroom teaching. By undertaking this research, we were able to identify critical aspects in CCE that form major areas of concern and require improvement. The gap between perceptions of the importance of CCE and implementation in practice is still evident, although indications from the five countries in this study suggest that CCE is beginning to transition into a more definitive and stronger position in curricula, with improving support for teaching CCE.

A forward-looking trajectory that may be drawn from the findings of this study, includes the need for empirical research to substantiate evidence-based approaches to CCE, develop an integrated view of CCE contents and pedagogies, governments needing to take leadership on developing evidence-based CC curriculum, and providing

appropriate PD for teachers. By addressing these issues, CCE may be assisted in moving forward from its transitional phase to a more established educational field.

Ethics statement

Ethics approval was granted by the University of Western Australia and reaffirmed by each of the affiliated academic institutions in each participating country.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Vaille Dawson http://orcid.org/0000-0003-1754-9086
Efrat Eilam http://orcid.org/0000-0001-6076-6487
Nofar Naugauker http://orcid.org/0009-0006-2350-8650
Gusti Agung Paramitha Eka Putri http://orcid.org/0000-0002-5405-7606
Agung Wijaya Subiantoro http://orcid.org/0000-0002-0576-6457
Peta White http://orcid.org/0000-0002-0225-5934
Helen Widdop Quinton http://orcid.org/0000-0002-1020-2672
Justin Dillon http://orcid.org/0000-0001-5154-8306

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Appendix

Participants by country, role types and total number of participants per country.

Country	Policy influencers (P)		Professional development providers (D)		Teachers (T)		Mixed roles (Specify the mix: PD; PT; DT)		No per country
	Code	Role description	Code	Role description	Code	Role description	Code	Role description	
Australia	AU P1	Past Victorian Curriculum Manager. Has influenced STEM curriculum development.	AU D1	Professional Learning Leader who has held roles in schools and in the state of Victoria, supporting science teachers and all teachers. Has developed popular guiding frameworks for teaching.	AU T1	Senior (Grade 11 and 12) Biology teacher. Also Biology methods teacher for preservice teachers in Victoria.			7
			AU D2	Science curriculum consultant for the Independent School sector for the state of Western Australia (WA).	AU T2	7–10 science teacher and discipline leader in their school. Uses the Australian Curriculum in WA			
			AU D3	STEM and Sustainability Leader in the Catholic schools sector, in Victoria, Provides guidance to teachers.					
			AU D4	Past Victorian Regional Leader for STEM curriculum policy to practice implementation.					
England	EN P1	Professor of Science Education Chief examiner for 10 years involved in National Curriculum working group- 2013–2015 and ASE (Association of Science Education)	EN D1	Science education team at Department of Curriculum, Pedagogy and Assessment (CPA) Tutoring and teaching PGCE science students teachers science (and chemistry) teacher and head of science, in secondary schools in London between 1990–2004					6
	EN P2	Head of Department of Curriculum, Pedagogy and Assessment (CPA) Associate Professor of Education Research Lead for the Centre of Climate Change and Sustainability Education Former secondary school geography teacher	EN D2	Tutor in teacher education for student teachers Leads on initial teacher education programmes and projects former secondary geography school teacher	EN T2	Geography teacher in a London secondary school.	EN DT1	PD provider. Former Head of Geography and prolific author of geographical teaching resources, textbooks.	
Finland	FI P1	Works for the Finnish National Agency of Education. Role includes being involved in curriculum implementation.	FI D1	-Works for an NGO, that provides in-service teacher training and teaching materials for teachers. -Has developed a multidisciplinary material package for CCE, widely used by teachers around Finland.	FI T1	Teaches biology and geography. Eco-support person of school.	FI PD1	Member of curriculum committee (for chemistry).-Manager of science lab, where teachers can come and visit with their students (apart of Aalto University).	7
	FI P2	Head of teachers' union.			FI T2	Physics teacher Textbook author. Involved in developing school-based curriculum. Background in Green-Flag schools.	FI PD2	Member of curriculum committee (for biology). Works at the University in teacher training (pre-service and in-service), Involved in various professional development programmes, Social influencer of sustainability education.	

Indonesia (Bali &Central Java)	IN P1	Academic researcher in the field of climatology. Has been involved in CC programme development for the Ministry of Education			IN T1	Grade 7–10 science teacher in a state junior high school located in south Bali.	IN DT1	Science teacher in Grades 7–8 who actively participates in preservice teacher mentoring programme in Central Java	6
	IN P2	An academic involved in science curriculum development. Also has a role as an editor of science textbooks published by the ministry of education			IN T2	Grade 10 Biology teacher in a private senior high school located in the capital city of Bali.	IN DT2	A leader of professional learning group for teachers at one of the state junior high schools located in central Bali. Has over 8 years of teaching experience. Teaches Natural Science at Grade 7-9.	
Israel (IS)	IS P1	Chief Director of the Science and Mathematics Division F-12, Israel Ministry of Education	IS D1	Head of Teacher Professional Development Department, Weizmann Institute of Science	IS T1	Secondary school Environmental Science teacher. Leading teacher and national teachers' mentor in environmental sciences	IS PT1	Director of Environmental Science in Years 10-12, Israel Ministry of Education, and an Environmental Science Teacher	10
	IS P2	Director of Biology, Years 10-12, Israel Ministry of Education	IS D2	Senior lecturer at a teacher training college. Specializes in Science and Environmental education research and teaching	IS T2	Science Education in Primary School. Leading climate change teacher. Established and chairs the organisation entitled: 'Teachers for Climate'	IS DT1	Teachers' mentor in the Division of Science, Israel Ministry of Education. Teaches secondary biology	
	IS P3	Nation Geography Instructor, at Israel Ministry of Education; Substituting Director of Geography at the time of the interview (2021), Israel Ministry of Education							
	IS P4	Director of Science and Technology in Years 1-9, Israel Ministry of Education							