

Chapter 15

Implementing Climate Change Education: The Role of Inter-sectorial Collaborations



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15.1 Introduction

Climate Change (CC) is an existential threat confronting all global societies, natural ecosystems, and the fabric of life on Earth (Intergovernmental Panel on Climate Change [IPCC], 2020). Anthropogenic-led global CC is at a critical point, where natural forces in the climate system react to cause further warming. Weather and climate extremes have detrimental socio-economic and ecological impacts. The rising temperatures in the Eastern Mediterranean and Israel in the past few decades have already brought about significant damage through forest fires, ecological impairment, decimation of water resources and heat-related morbidity and mortality, especially among vulnerable populations (Yosef et al., 2020). It is widely agreed that pupils in today's world need to be equipped with the appropriate knowledge, skills, values and attitudes, which will enable them to cope with the challenges CC poses in informed and responsible ways. Accordingly, education systems are expected to address these needs, by developing and implementing effective CC educational programs (UNESCO, 2017). The enormity of the threat and the crucial role of education in addressing it have been endorsed by numerous international and

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regional bodies, who have been calling governments to boost Climate Change Education (CCE) within their curricula (UNESCO, 2021a, b).

Studies examining CC representation in the curriculum confirm that in most nations' curricula CC is represented in Science and Geography (UNESCO, 2021a, b). However, a study by Dawson et al. (2022) that compared CC curricula of seven different countries revealed diverse approaches to curricular inclusion. These include the embedding of CC (i) under the concepts of “sustainability” or “environmental literacy”; (ii) within one or few disciplinary subjects; or (iii) across many disciplinary subjects. Each approach has its challenges and limitations. Acknowledging CC as a distinct discipline has also emerged as an option (Eilam, 2022). In Israel CCE is included in both Science and Technology (as a topic of “environmental literacy”) and in Geography (as a topic of “sustainable development”), with more significant inclusion in Geography (Dawson et al., 2022). In the USA, the National Center for Science Education and the Texas Freedom Network Education Fund (2020), conducted a review of the quality of CC inclusion in the science curricula of 50 states. The review found that only 27 states earned a score of B+. The Next Generation Science Standards (NGSS), itself, earned only a B+ for their representation of CC (NGSS Lead States, 2013). However, the State of New Jersey is an exception. In June 2020, the State Board of Education adopted the “2020 New Jersey Student Learning Standards”, making New Jersey the first state in the USA to incorporate K–12 CCE across content areas (New Jersey Climate Change Education Hub, n.d.).

Various studies have directed attention to the important role of biology education in addressing key CC issues (Rushton & Walshe, 2022). CC impacts all levels of biological systems, from individual organisms to biomes, reducing the efficiency of ecosystem services (Bellard et al., 2012; Nunez et al., 2019; Zhou et al., 2020). CC has already begun to reduce the resilience of ecosystems, a necessary condition for species survival (Nunez et al., 2019). CC has also been shown to decrease the genetic diversity of populations due to directional selection and rapid migration, which, in turn, could affect ecosystem functioning and resilience (Bellard et al., 2012). When considering biology education's contribution to CCE, Rushton and Walshe (2022) suggested that beyond providing general CC knowledge and directing students to green jobs, biology education is particularly well positioned to address issues concerning biodiversity conservation and enhance students' connection to nature, an important affective aspect of CCE.

From a policy level perspective, the development of CC curricula is recognized as a multi-stakeholder effort. International and regional bodies such as UNESCO and the European Commission highlight the important role that inter-sectorial collaborations play in promoting CCE in various subjects, including Science and Biology (European Commission, 2022; UNESCO 2021b). The European Commission (2022) applied a survey for examining the extent of collaborations between education and training institutes and the wider communities, in relation to environmental sustainability programs, including CCE. The findings suggest that this form of cross-sectorial collaborations is widespread, with 52% of respondents reporting on collaborations. The report emphasizes the importance of inter-sectorial

collaborations, noting that: “in the EU, there has been a growing emphasis on the benefits and potential of [...] cross-sectoral partnerships between the public and private sector and/or civil society. A dedicated strand under the Erasmus+ programme fosters cooperation among organisations and institutions and many projects have had a strong focus on cross-sector collaboration as a way to strengthen learning for environmental sustainability” (European Commission, 2022, p. 49).

In the UK, a Policy Exchange publication highlights the need for governments to take a mediating role in supporting cross-sectorial collaborations (Blake, 2014). UNESCO (2021a) further suggests that it is good practice when ministries collaborate in advancing CCE, thus extending collaborations from the inter-sectorial to the intra-sectorial. Interestingly, data collected in the EU countries suggest that the nature of collaboration is impacted by the number of collaborators. When cross-sectorial partnerships involve multiple stakeholders, the collaboration tends to become more embedded in the system and there is more resource-sharing. When the cross-sectorial collaboration involves only two partners, the focus tends to be project-based (Mulvik et al., 2022). This observation resonates with Kwauk’s (2020) observations in the USA, suggesting that while dual-sectors grassroot collaborations between NGOs and the education sector are helpful in many ways, they are often isolated and overly dependent on individual pioneers or local advocacy. In Israel, it was found that inter-sectorial collaborations play a key role in adding value to policy implementation (Gali & Schechter, 2021). However, there is a lack of information regarding the value of such collaborations in relation to CCE.

Research thus far has given little attention to the perceptions of education policy makers and educators involved in developing and implementing CCE. More clarity is needed regarding the ways in which these key CCE actors respond to the international and grassroot calls for enhancing the representation of CC in national curricula and the ways in which they perceive and navigate inter-sectorial collaborations. Addressing this gap, our study utilizes a case study consisting of Israeli CCE policy makers and educators in order to understand some of the political “push and pulls”, professional considerations and key collaborations involved in including CC in the national curriculum. Overall, this study aims to give CCE makers a voice.

Research Objectives

The objectives of the study are to (i) analyze the perceptions of education policy-makers and education professionals involved in implementing CCE; (ii) identify existing opportunities and challenges to effective implementation; and (iii) characterize the inter-sectorial collaborations involved in CCE implementation.

15.2 Methods

This case study focuses on examining the perceptions of policymakers in the Israel Ministry of Education (MoE), coordinators of middle school teachers’ professional development, and secondary school teachers who are currently active in CCE. This

study employs a qualitative-phenomenographic research approach to qualitatively map and explain the participants' perceptions and interpretations of their lived experiences (Marton, 2005).

Semi-structured interviews were employed for the purpose of eliciting the participants' perspectives regarding a range of issues concerning CC curriculum development and implementation, including their perceptions regarding how CC should be represented in the curriculum and how it is presently represented; enablers and inhibitors for implementing CCE, networking and collaborations in CCE. A total of 17 participants gave their consent and were interviewed for the study. The participants represented three populations involved in CCE in the Israeli educational system:

Policymakers in the MoE (P). These included Chief Directors of subjects relevant to CCE who are responsible for overseeing all aspects related to the pedagogical content knowledge of their subjects, and Inspectors who are responsible for overseeing the compatibility between the formal curriculum and its teaching in schools.

Teacher professional development coordinators (D). This group included heads of teacher professional development (PD) courses, which provide in-service training for teachers. In Israel, in-service training is provided for teachers via several channels: designated regional PD centers managed directly by the Ministry of Education (termed 'Pisga'), National Teacher Centers for Science & Technology ('Malam'), and Master of Education programs which operate as a form of in-service PD training for teachers within a master's degree.

Secondary school teachers (T) in year levels 7–12. Five of the teachers also hold various leadership positions in the MoE, such as mentoring roles. Their disciplinary specialization ranges across science, geography and environmental science. The teachers who participated in this study teach CC in their schools.

Some of the participants belong to more than one group. In these cases, the participants are coded by two letters, signifying their dual roles. For example, a policy-maker who also performs an additional role as a professional development coordinator is coded PD. Table 15.1 summarizes the number of participants per group.

Table 15.1 Participants by code role and number

Code	Role	Number of participants
P	Policymakers in the MoE	5
D	Teacher professional development coordinators	3
T	Secondary school teachers	4
PD	Policymakers in the MoE + teacher professional development coordinators	1
PT	Policymakers in the MoE + secondary school teachers	2
DT	Teacher professional development coordinators + secondary school teachers	2
Total		17

The data were analyzed thematically and inductively, creating themes and categories. Initial coding by the first author and subsequent coding by the other authors, with discussions and negotiation through an iterative process of revisiting the coded texts, led to forming seven main themes, of which four themes are discussed in this paper. These reflect the dominant aspects that emerged from the data and constitute the participants' perceptions regarding CC education.

It is important to note that the data for this study were collected in late 2021. A short time after the completion of the data collection, the Israel MoE and the Israel Ministry of Environmental Protection jointly announced the mandating of CCE across the K-12 curriculum. This announcement was followed by CC curriculum reform. The findings of this study reflect the perceptions of the participants prior to the curriculum reform.

15.3 Findings

The findings are organized by the four emerging themes reflecting the participants' perceptions concerning: The importance of CC and the role of CCE; the scope of CC curriculum; challenges for effective implementation; and inter-sectorial collaborations in CCE. [Appendix](#) shows examples of citations of these themes. A detailed explanation of each theme, which includes citations, is provided in the following.

15.3.1 *The Importance of CC and the Roles of CCE*

The participants expressed broad consensus regarding the urgency of CC as a threat and the importance of CCE. For example, a participant claimed that:

We all experience it, and it's going to have consequences on our lives here in Israel. And from an ecological perspective, too, which is less interesting as far as the average person is concerned. But it's there in the social, personal, and economic realms, too; our quality of life and well-being, our personal welfare, and health (D2).

This highlights a profound understanding of the urgency of CC, its current and future presence in our everyday life, and the pervasiveness of CC impacts across all human and non-human systems. Accordingly, there was wide agreement concerning the need to educate about CC. A policy maker outlined her vision for what may be regarded as a CC-literate school graduate:

The ultimate goal is that every child has heard about the climate crisis. They understand the basis, the causes, the models, the scientific consensus, understand the nature of science, understand solutions, technological and non-technological, are able to offer their own solutions, understand policy issues, and challenges [...] and the impacts (P1).

One participant identified the various purposes that CCE serves, stating: "There are lots of reasons to educate these students both as the future generation who'll be

doing research on these issues, also as citizens, and also as those who will be involved in the decision-making” (DT4). According to this perception, CCE served the purposes of educating for general CC literacy for everyday citizenry; preparing future researchers in CC; and cultivating the necessary mindset of future decision-makers. This perception resonates well with Roberts’s (2007) scientific literacy types, similarly, conveying the idea that CC literacy is more than one conceptual construct.

15.3.2 The Scope of CC Curriculum

In relation to the question of what needs to be included in CCE, there seemed to be wide agreement that the science foundation is important in CCE, however, not as a stand-alone, but alongside other aspects relevant to CC. For example, a policy maker stated that “Science must be there, social studies must be there, civics must be there, and economy. But all the time new things join in: geography, borders, migration, ...” (P1). Most participants agreed that CC is multidisciplinary and that CCE needs to be taught across the curriculum. For example, a policy maker stated that:

I [...] reiterate this to teachers and students, so they understand that CC is not a topic on its own. It is all around us. In physics, chemistry, biology, earth sciences [...] I mean in every domain [...] you can find how to connect the topic to CC (P4).

Similarly, a teacher noted that:

I would say to the students, ‘Notice which of the subject areas deals with global warming. Look at the subjects and make a list.’ And then I’ll say, ‘So, what’s the subject? Which experts discuss it?’ And then, all of a sudden, they realize it’s everywhere (T6).

Many of the participants highlighted the importance of integrating knowledge, skills, attitudes, values and student activism as well as student agency. For example, a policy maker who is also a teacher specified:

These are the three focal points that every student in Israel needs to know—the scientific knowledge, the impact on the environment and society, and at a more advanced stage, about the economy, too, and the solutions to the climate crisis, and what we, as students, can do in this regard (PT7).

The importance of values in CCE were also highlighted: “It’s not only because of the content but because of all the moral values that go with it” (DT5); “There are inherent values. Values toward the environment which we must commit to. Values of cultivation, reduced consumption, efficiency...commitment” (DP6). Finally, much emphasis was placed on behavioral acquisition and activism. For example, a teacher explained that CC “includes aspects of taking responsibility, action taking, and change. Even in personal life.... Education for sustainability and social justice, education for environmental activism...” (T1). Overall, the participants cast a broad scope for CCE.

15.3.3 *Challenges for Effective CCE Implementation*

The findings revealed various challenges to CC inclusion in the curriculum. The first relates to systemic change, where CC curriculum reform challenges the MoE at the system level. The second challenge relates to CCE epistemic ambiguity, and additionally, a challenge concerning the curriculum users' experience.

From a policymaking perspective, the main challenge was described as mobilizing the system. A policymaker described MoE as a massive system that is hard to change from its present track; thus it tends toward conservatism. Curriculum reform in CCE requires more flexibility than the system naturally tends to offer. A policy maker equated MoE to a big ship: "Turning a big ship from its course takes time. It's not a sailboat that can zip through the wind. But things are happening [...] There's a lot of determination, and you can also see things in writing that are under way" (P2).

Another potential barrier is the lack of clarity and agreement regarding CC epistemology and ways for its inclusion in the curriculum. For example, a policymaker explained the confusion that exists even at the terminology level:

It used to be called the Greenhouse Effect, then Global Warming [...]. Two years ago [it was] Climate Change. Last year, and this year, the expression has taken on a more urgent tone [climate crisis]. So, it's not fair to ask us how come you're not teaching it... and talk about a concept that's essentially new and constantly changing (P1).

Concerning CC inclusion in the curriculum, the data revealed some tension among policymakers over ownership, where the Biology Curriculum specialist suggested that Biology is the curricular frame for CCE, stating that "climate change is Biology, only more general- global biology" (P2). Similarly, the Geography Curriculum specialist suggested that Geography needs to host CC, stating that "Geography is the core of climate change; climate is actually a geographical subject in its essence" (PT8).

The lack of conceptual agreements regarding the epistemology of CC poses a challenge for integrating the subject within the curricula. The fact that educational professionals responsible for the biology curriculum identify biology as an umbrella field for CCE has implications concerning the didactics of teaching CC within biology education. Additionally, when taught within the framework of Geography, this may lead to the omission of aspects of CC concerning biological systems.

Importantly, various participants across the three groups suggested that CC is somewhat sidelined in the curriculum and does not receive sufficient attention and resources, suggesting that CC "gets mentioned, but it doesn't get any major attention in teachers' lessons. They can skim through it. They don't have to delve into it" (DT5). The sidelining of CC poses a challenge from a curriculum user perspective, as it forms a barrier for educators who wish to devote more time in the curriculum to addressing CC, yet they are not supported to do so by the curriculum, and, consequently, by the system.

15.3.4 *Inter-sectorial Collaborations in CCE*

The analysis revealed that the MoE is involved in inter-sectorial collaborations across three sectors, including: other governmental bodies, such as the Ministry of Environmental Protection (MoEP); Non-Governmental Organizations (NGOs); and the scientific and academic community. The relationships between these groups and the MoE are described below.

Other governmental bodies. Governmental bodies such as the Israel Meteorological Service, the MoEP, and the Electricity Company, collaborate with the MoE in diverse ways, including funding projects, developing educational resources and supporting their implementation. For example, a participant stated: “The MoEP is a great partner. They fund the MoE educational programs with 10 million NIS, supporting all the educational programs and a list of annual programs” (PD6). Analysis also revealed that while these collaborations are appreciated by the MoE, various tensions arise around policymaking ownership. For example, a participant described how a MoEP representative may “direct us: ‘Next year I want you to work on one, two, and three.’ How is this possible?” (P1).

Non-Government Organizations. A range of NGOs are active in developing resources and implementing CCE. Some of their activities are funded by the MoE. They also play an important role in applying pressure on the Ministry to implement CCE and not procrastinate in this endeavor. A policymaker, who is also a teacher, explained “the topic of climate change is ... a ‘hot’ topic that the Green organizations and social groups are extremely active in implementing. Sooner or later CCE will become imbued deep within the education system” (PT8). NGOs have the advantage of not being constrained by the formal curriculum. While their contribution is appreciated, here too criticism arose regarding educational risks associated with NGOs imposing their agenda, and challenges arose regarding quality assurance, for example: “There are materials, but I will not say that they are sufficient, I will not say that experts have read them all and checked their scientific or pedagogical correctness” (D3).

The scientific and academic community. Strong and trusting relationships exist between the MoE and academic institutions and scientists. Policymakers trust the scientists’ views and seek their consultancy, for example: “It is very important for me to be in touch with all the Green academicians, because they are going to help us identify the ‘moving target’ [metaphor for the issue of climate change]” (P1). Academicians not only have influence on shaping the curriculum, but they are also actively involved in the classroom implementation of CCE. Overall, the findings suggest a network of inter-sectorial collaborations. These collaborations are by no means simple. Policymakers describe their complexity as mutually beneficial on one hand, yet the blurring of boundaries also involves the blurring of responsibilities and authority division between the sectors.

15.4 Discussion and Conclusions

This study provides insights into the perceptions of CC educators who are actively involved in policymaking and implementation in Israel. The findings reveal that at the time of the interviews, there was a broad consensus regarding the importance and the need for CC curriculum reform. These sentiments emphasize the importance of CCE in educating students to become change agents as part of the means for a deep social transformation toward sustainability, reflecting an environmental citizenship approach (Sarid & Goldman, 2021), in order to withstand CC calamities.

At the time of the data collection, CC was implemented in the Israeli curriculum mainly in secondary Science and Geography subjects. However, the study reveals a gap between the actual approach to implementation and what educators perceive as the best practice which is the cross curricular approach. Previous studies revealed similar gaps. The evidence suggests that while the cross-curriculum approach is highly advocated (e.g., European Commission, 2022; Mulvik et al., 2022; UNESCO, 2021a, b), contrary to the prominent expectation, only scarcely do countries implement this approach in their curricula, and it rarely trickles down into implementation (European Commission, 2022; UNESCO, 2021b). In England, for example, CC in the national curriculum is confined to secondary Science and Geography subjects. However, like Israel, a study among teachers clearly showed the teachers' preference toward the cross-curriculum implementation approach (Howard-Jones et al., 2021).

When considering the challenges for CCE curriculum development and implementation, epistemological vagueness seemed to act as a barrier. This epistemological vagueness seems to permeate CC discourse at all levels. Vagueness concerning CC epistemology was also found in the State of Victoria Australia upper-secondary curriculum documents (Eilam et al., 2020).

Finally, this study contributes to shedding light on the under-researched aspect of inter-sectorial collaborations in CCE. While previous literature has stressed the importance of such collaborations (Mulvik et al., 2022), thus far studies identifying and characterizing specific collaborations between Ministries of Education and other sectors in CCE are scarce. The present study identified three different sectors with which the MoE collaborates, and characterizes the nature of these collaborations. The findings suggest complex relationships. On one hand they support the findings of Gali and Schechter (2021), by which Ministries in Israel acknowledge the contributions of inter-sectorial collaborations. On the other hand, these relationships often come at a cost and are often difficult to navigate. The tension concerning authority or who decides what goes into the curriculum can also take the form of a struggle over who holds the authoritative knowledge. In the present study, policymakers expressed concerns that the quality of materials delivered in schools by the NGOs may not align with the Ministry's standards and may suffer from inaccuracies. Here, the policymakers perceive themselves as bearing the responsibility for and authority over the quality of education delivered in their schools. Thus, it was revealed that the aspect of authority is not only a question of power of decision

making, but also a question of responsibility and authority regarding knowledge and best educational practice. Currently, worldwide, NGOs play a major role in CCE resources development and implementation (Mulvik et al., 2022). However, thus far little is known regarding the knowledge-authority relationships between the formal and informal education systems. This knowledge gap suggests that further research is required to develop deeper understanding concerning the knowledge-authority in the relationships between the formal and informal education sectors.

To conclude, by giving a voice to CCE policymakers and educators, this study provides a meaningful contribution to understanding some of the challenges involved in CCE policy development and implementation, and points out areas requiring further investigation. Particularly, it was found that more research is required to understand best practices for the inclusion of CC in the curriculum, and identify the scope of CCE and effective ways for implementation. In light of the current curriculum reform concerning CCE that occurred subsequent to this study, it is important to further explore how this reform influenced inter-sectorial collaborations around CCE, as well as aspects concerning its implementation as perceived by the actors involved in its updated implementation.

Appendix

Additional examples of citations for each theme

The importance of CC and the role of CCE	The scope of CC curriculum	Challenges for CCE effective implementation	Inter-sectorial collaborations in CCE
They witness destructive phenomena in some form or other almost every day, both near and far. There's evidence almost daily. Climate change happens almost every day in every corner of the world, and the phenomena are getting to be more extreme (PT8)	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. The climate crisis is a part of almost all of the core topics, except noise and radiation. That's why it can be incorporated into any topic (PT7)	I don't think they've defined any yet. And a committee has been set up on the subject, and it's really a fledgling committee. But it's expected to swing into high gear in geography and in the sciences, and also to set goals [...]. As far as I know, it means that no objectives have been defined and set as yet by the Ministry of Education. It's in the process [of happening] (PT8)	There are collaborations to boost this issue and also requests from them to collaborate; to work with students and with teachers. I mean that for their part, they often initiate in-service PD courses to consolidate the existing information and to get the teachers to take action (P4)

(continued)

The importance of CC and the role of CCE	The scope of CC curriculum	Challenges for CCE effective implementation	Inter-sectorial collaborations in CCE
I think it's mostly about how it's connected. It's something that's happening around us, and it can't be separated from our daily lives. And it's our role as science teachers to connect it to what's encountered on a daily basis, and to put it into a scientific context (T3)	I would like it to have more of a presence in the [science and technology] curriculum [...]. I agree that it hasn't been proclaimed in any way. Teachers who are more involved can add their own input to the subject matter and link it to the climate crisis (P4)	I think this will entail a bigger job, because this subject doesn't appear again in the curriculum in a structured form, with exercises and references, like there are in all the other subjects (T1)	Currently, outside of the ministry, there are a lot of well-intentioned agencies that sometimes pull a little in other directions, but by and large, it's possible to collaborate with them (P2)

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