

Inquiry into the response of Western Australian schools to climate change

Submission by

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Introduction

About me: I am a researcher and educator in the fields of science and sustainability education, working at Victoria University. In recent years I have been particularly focusing on climate change education research and teaching. Currently I am involved in a multi-national research group examining climate change in national curricula of eight countries across four continents. My background as a climate change education researcher and a tertiary educator, positions me well to contribute to this inquiry.

My main aim in this submission is to make a case for including climate change as a core subject in secondary curriculum, across Years 9-12. To do so, I first present the state of play in relation to climate change inclusion in the curriculum, and explain why current approaches are not working. I then proceed to present a framework for considering climate change curricular inclusion, consisting of four critical elements. These are: Conceptualising climate change as a body of knowledge, considering the curriculum organisation, identifying the contents for delivery and sequencing across year levels, forming a conducive educational environment and supporting processes. Each of these elements is discussed sequentially leading to key conclusions.

The state of play

Climate change is the most significant existential threat of our times. Yet, mounting evidence suggest that, globally, this burning topic is not addressed in school curricula, leaving school graduates mostly uneducated about climate change (Dawson et al., 2021; Erasmus+ School Education Gateway, 2020). In many countries, climate change appears in the school curricula in a tokenistic form, commonly fragmented and dispersed among subjects and subsumed as an undefined topic under the undefined notion of sustainability; often treated as a *hot potato* thrown around from one subject to another, and owned by none (Eilam et al., 2019; Gough, 2020). Further evidence suggests that students need to rely mainly on the media as a source of information about climate change (Dawson & Carson, 2013; Field et al., 2019).

Examination of various countries' national school curricula and relevant studies reveals that the most prominent approach to climate change curriculum inclusion, is the *cross-curriculum* inclusion approach. This involves subsuming climate change under various disciplinary-subjects across the curriculum (Lehtonen et al., 2019; Schreiner et al., 2005). Within the *cross-curriculum* inclusion approach there are three main streams. These include: (i) climate change subsumed under the notion of *sustainability* or *environmental literacy*, and further subsumed under subjects (double subsumed); (ii) climate change inclusion within one or a few subjects; and (iii) climate change dispersed across many subjects. It is important to note that often the boundaries between the three streams are vague. The Australian Curriculum exemplifies the first stream in which climate change is subsumed under the notion of *sustainability*. In the Australian F-10 curriculum the notion of *sustainability* appears as a cross-curriculum priority. However, the term climate change is conspicuous by its absence throughout most of the *sustainability cross-curriculum priority*. The term is absent from the Overview and the Key Ideas (including Key Concepts and Organising Ideas). The

term climate change appears only twice in the document under the two Learning Areas of Technologies and Languages. Climate change is particularly conspicuous by its absence from Learning Areas such as Science, and Humanities and the Social Sciences, in which climate change would be expected to be found (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.). The close-to-absence of climate change from the Australian Curriculum in Years 7–10, and its tokenistic appearance subsumed under the cross-curriculum priority of Sustainability has been raised as a concern by several authors (Dyment et al., 2014; Gough, 2020).

The most highly promoted approach for including climate change in the curriculum is through dispersion of climate change across many school-subjects (Field et al., 2019; Gomes & Panchoo, 2015). In this approach, climate change is expected to be addressed in many or all of the curricular subjects, and teachers are expected to demonstrate the capacity to integrate effective climate change teaching in their respective subjects. While no empirical study was found that demonstrates successful implementation of this form of the cross-curriculum approach, there is ample evidence suggesting that this approach is not working. Regardless, it continues to be the most steadfast approach reported in the literature and by many educators (Erasmus+ School Education Gateway, 2020; Field et al., 2019). To exemplify the lack of effectiveness of the approach, I use our examination of the upper secondary (Years 11–12) curriculum in the state of Victoria, Australia. The study revealed that in the 10 out of 94 study designs in which climate change is present, the scope of contents is alarmingly limited, anecdotal, disorganised and incoherent; to the extent that in two study designs, content items were scientifically wrong. Our conclusion in this research was that this curriculum is unlikely to produce graduates who are knowledgeable about climate change (Eilam et al., 2019).

It seems that the inclusion of climate change across the curriculum subjects poses unsurmountable challenges to the integrity of climate change as a body of knowledge, to teachers and to students. From a disciplinary perspective, climate change cannot be justifiably subsumed under any specific curricular subject. It does not constitute a topic of science, nor of sociology, mathematics or the arts. It draws upon all of these and more, but integrates and contextualises the various fields of knowledge according to organising principles that transcend beyond the traditional disciplines. From an organisational perspective, the fragmentation approach creates challenges in: (i) developing climate change curricula that ensures that on the one hand the various climate change topics are not repeated in different disciplinary-subjects, and on the other hand, that the various climate change fragments are integrated into a whole; (ii) differential resources allocation, as different resources may be required in geography and math, for example; and (iii) allocation of adequate time for covering climate change appropriately within the already crowded disciplinary spaces (Schreiner et al., 2005; Tolppanen et al., 2017). From the perspective of the teaching, this approach is particularly challenging to teachers, as it challenges their agency and development of professional identity. Specialised content knowledge seems to play an important role in what it means to be a teacher and in developing a successful teaching career. The expectation from teachers to teach climate change effectively in their specialised subjects, essentially sets them to teach out-of-field, and may be viewed as setting teachers to fail, and thus encounter high resistance (Du Plessis et al., 2014; Sharplin, 2014). It comes as no surprise, then, that studies among teachers report that many regard climate change education as an add-on, unrelated and beyond the boundaries of their disciplines (Porter et al., 2012; Tolppanen, et al., 2017). The cross-curriculum approach requires that teachers of various subjects be competent in teaching aspects of climate change. For practical reasons, training every subject specialist in climate change seems impractical. On the other hand, the choice not to train teachers leaves them feeling vulnerable and lacking confidence in their teaching of climate change (Field et al., 2019; Plutzer et al., 2016). The challenges to teachers extend to student

learning. This was exemplified in numerous studies among students, finding: low content knowledge and conceptual understanding, and misconceptions. Students themselves report in repeated studies that they request and expect to learn more about climate change (e.g., Chang & Pascua, 2016; Field, et al., 2019).

This state of affairs seems to be inconsistent with the growing calls by international organisations and treaties, urging improved climate change education. This may be exemplified in dozens of declarations and calls by international bodies to enhance climate change education, since Earth Summit in 1992, leading up to the recent United Nations Climate Change Conference COP26 (UNFCCC, 2021). On 5 November 2021, Ministers of Education once again reiterated their recognition of “the critical role played by education and learning in the transition towards a climate positive future and the urgency of embedding climate considerations into all levels of education” and their commitment to integrate climate change education “in formal education systems, including as core curriculum components, in guidelines, teacher training, examination standards and at multiple levels through institutions (UN Climate Change Conference UK, 2021). Regardless of this commitment and many others, thus far little efforts have been undertaken to seriously examine the ‘how’s and ‘what’s of climate change integration in the curriculum. This submission paper aims to do so by providing a road map for such inclusion, through the consideration of the four critical elements involved in climate change curricular inclusion.

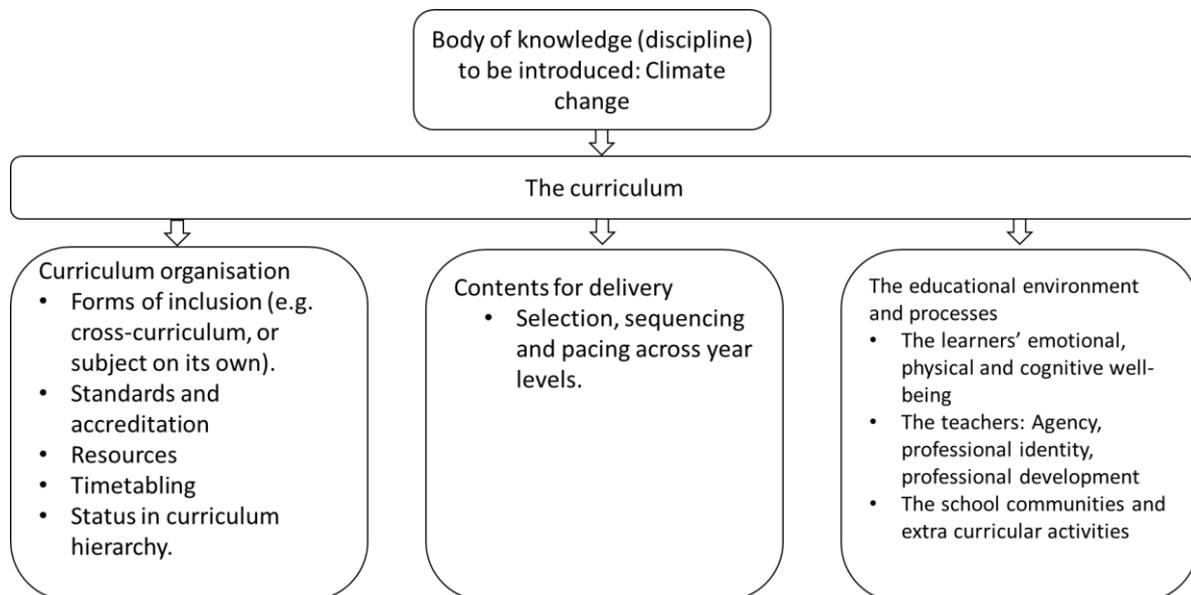
A framework for including climate change in the curriculum

In developing the proposed framework, I draw upon Ross’s definition of *the term curriculum*. Curriculum is defined as: “anything that schools do that affects pupils’ learning, whether through deliberate planning and organization, unwitting encouragement, or hidden and unrealized assumptions, can all be properly seen as elements of the school’s whole curriculum” (Ross, 2000, p. 9). This broad definition allows for a comprehensive consideration of the structures and processes involved in introducing climate change into the curriculum.

The inclusion of any emerging body of knowledge in the curriculum requires examination of the following critical elements: (i) identifying the epistemological nature of the knowledge. In simple words, we need to ask ourselves: What is climate change as a body of knowledge? What are the rules, concepts and theories underpinning the structure of climate change knowledge? What are the boundaries and contents of this knowledge? (ii) the curriculum organisation, including: determining the forms of inclusion (for example: as a cross curriculum topic, or as a subject on its own), standards and accreditation, resources allocation, timetabling, the topic’s hierarchy in the curriculum, and other relevant issues to consider; (iii) considering the selection, sequencing and pacing of the contents for delivery at the various year levels of school; (iv) considering the educational environment and processes: the learners, the teachers and the school communities, in which climate change education takes place. Ultimately, the inclusion of climate change in the curriculum needs to serve the dual purposes of students’ personal growth and service to the communities. Figure 1 represents these aspects hierarchically, whereas addressing the epistemological question of what is climate change, is perceived to precede its inclusion in the curriculum. The figure also highlights the fact that the three aspects of: the curriculum organisation, contents for delivery, and the educational environment and processes, need to be considered in parallel and integratively.

Figure 1.

Critical elements involved in climate change inclusion in the curriculum



In what follows I address each of these key elements, by applying state-of-the-art theoretical and practical experience in the field wherever available, as well as identifying existing gaps in our knowledge.

Climate change as a body of knowledge

This section puts forward the following claims:

- Climate change needs to be regarded as a discipline, from which a climate change subject needs to be drawn.
- Subsuming climate change as a topic of sustainability is the wrong way to go.

The term *discipline* is understood as specialised knowledge in both structure and purpose (Young, 2013). Disciplines are characterised by the ways in which the knowledge is produced, applied, valued and evaluated, as well as rules and concepts related to governing epistemological principles (Duschl & Grandy, 2013; Young, 2013, 2014). The boundaries of disciplines and their contents are not fixed. They are “always fallible and open to challenge” (Young, 2013, p. 107), allowing new disciplines to emerge and justify themselves (Ross, 2000; Young, 2013, 2014). Disciplines form communities of specialist discourse, supporting the development of professional identities (Harland et al., 2006). The learner is initiated into the discourse by obtaining the knowledge and skills relevant to the discipline (Peters, 1965).

When considering what qualifies a body of knowledge to be regarded as a *discipline*, Shermis (1962) claimed that a discipline is distinguished by its ability to address hugely significant questions and develop the techniques to answer them. Similarly, Phenix (1964) identified disciplines by their productiveness, referring to the extent to which a body of knowledge is capable of producing “visible evidence of ways of thinking that have proven fruitful” (p. 48). In relating these concepts back to climate change, it seems beyond doubt that the field of climate change is dealing with hugely

significant questions, and is highly productive in providing “visible evidence” (Phenix, 1964, p. 48), thus qualifies as a discipline.

Disciplines emerge and morph over eras, as knowledge expands. With the growing understanding of phenomena, new connections are made that necessitate the merging of two or more disciplines that were previously seen as separate. For example, Goodson (1987) describes how biology evolved in the 19th century from its two separate origins in botany and zoology, with the discovery of genetics. Similarly, in the 1950s ecology evolved from its various disciplinary origins in geology, botany, zoology and others. Eugene Odum (1977), has strongly advocated for the founding of ecology as a new integrated discipline. To do so, he identified a set of epistemological principles that underlie the discipline, and allow the disciplinary-whole to be bigger than the sum of its discrete disciplines-of-origin. Odum ended his paper by calling to pursue further merges between the sciences and humanities. The emergent discipline of climate change has been following this vision by creating intricate merges between diverse and potentially remote fields, such as political science, anthropology, climatology and others. In these merging fields, the whole is greater than the sum of its parts. Some concepts in climate change can only be understood through these merges, while each of the disciplines-of-origin on its own is unable to provide a comprehensive explanation to climate change problems. In this sense, “the emergence of climate change has caused a paradigm shift in our understanding of the essential inter-relationships between the economy, society, global politics and the natural environment, with implications for sustaining life on earth” (Eilam et al., 2019, p. 5).

Climate change is often considered as a topic of sustainability. Here I argue that this conceptualisation is a major hindrance to climate change education. The problem with subsuming climate change under *sustainability* stems from the basic theoretical framework of the term, which brings together a broad range of concepts, often loosely related, with diverse and sometimes conflicting theoretical assumptions. The term *sustainable development* was formally coined in 1987, in the United Nations’ publication *Our Common Future* (World Commission on Environment and Development [WCED], 1987). Education for sustainable development (ESD) was soon adopted by educators, who were quick to replace the old *environmental education* with the new term, claiming it with a broader and deepening meaning (González-Gaudiano, 2005; Jickling & Sterling, 2017). Further credence was given to the new term by the United Nations General Assembly adopting resolution 57/254 and instigating the United Nations Decade of Education for Sustainable Development 2005–2014 (UN DESD). In its International Implementation Scheme (UNESCO, 2004), UNESCO nominated fifteen perspectives comprising the scope of ESD, as an assembly of diverse issues ranging across topics such as HIV/AIDS, disaster prevention and mitigation, corporate responsibility and accountability, and market economy. Climate change appears as one of the fifteen topics listed. Since then the term ESD has morphed into *sustainability education*, *education for sustainability*, *citizenship education*, *global education* and others.

When considering the problem of subsuming climate change under *sustainability*, the above all-inclusive perspectives hold the answer to why this approach is problematic. González-Gaudiano (2005) describes ESD perspectives as “[an] elusive thematic group of issues” (p. 243), made up of various fields of knowledge, each having its own identity and autonomy as a field. ESD provides an empty space of congregation for the various fields, and in turn becomes an “empty signifier” (p. 245). When co-opting these various autonomous fields into this makeshift shared space, they become deformed and obscured. The connections between these fields may go either way—positive or negative—or have no connection at all. For example, it can easily be seen how market economy may pull in an opposite direction to corporate responsibility; or HIV/AIDS may be unrelated to both

market economy and corporate responsibility. Furthermore, there are no rules and regulations that govern the ways in which the empty space is filled, and therefore it can mean different things to different people, with meanings always being transitory and subject to permanent questioning (p. 246).

If *sustainability* is no more than neologism, it seems self-evident that the notion of *sustainability education* is an unsuitable platform for hosting climate change education. It does not provide a framework for coherent, comprehensive, knowledgeable and effective climate change teaching and learning. Being contextualised and subsumed into other contexts, it becomes particularly difficult to trace how the various parts of climate change education have been included in the sustainability education process and whether they have been implemented in a cohesive and holistic way. Furthermore, unlike the notion of sustainability, which is still undefined 33 years after its first public appearance, the field of climate change is a well-defined and measurable body of knowledge, with typical organising principles.

In summary, climate change needs to be regarded by curriculum developers as a discipline in its own right, and not as a topic of sustainability.

This fundamental epistemological assertion provides the basis for further consideration of climate change inclusion in the curriculum. The three aspects of curriculum organisation, contents for delivery, and the educational environment and processes are addressed sequentially in what follows.

Curriculum organisation

This section puts forward the following points for consideration:

- There is an urgent need to establish a core high-status climate change subject in the curriculum.
- Climate change should not be taught as a cross curriculum topic for various reasons explained.
- There is a need to set benchmarks, standards and methods of accreditation.
- Teacher training and specialisation required.

The discipline of climate change has been incrementally building up and establishing itself over the past century. It is finally time, and well overdue, to introduce climate change as a core high-status subject in the curriculum.

By establishing climate change as an independent subject in the curriculum, benefits will be gained in relation to establishing standards, accreditation, resources allocation, ensuring timetabling and gaining status in the curriculum hierarchy. Curriculum Theory has demonstrated that curricula are organised by hierarchies and subjects compete to gain status. Core subjects have higher status than elective subjects, and cross-curriculum subjects have the lowest status (Ross, 2000). Within the curriculum hierarchy, cross-curriculum subjects, such as Sustainability in the Australian Curriculum, were described as “not worthy of description, and thus unbounded, non-classified” (Ross, 2000, p. 111). Additionally low status subjects are unlikely to have benchmarks, standards or assessments for evaluating learning outcomes, and forms of accreditation. These are essentially, if we wish climate change education to be regarded seriously. Educators who are passionate about advancing the teaching of climate change should have an inherent interest in advancing the status of climate change by including it as a core subject in the curriculum.

The establishment of a climate change subject would carry with it important activities that distinguish curricular subjects and support quality teaching. These include: allocation of time and space in the school timetable, categories of examination, and accreditation (Ross, 2000). The recognition of climate change as a subject would also attract resources and academic scholarship aimed at developing best practices in teaching and learning climate change (Harland et al., 2006). These include the introduction of climate change specialisation into teacher training courses. By beginning to address climate change as a discipline, education scholars may begin researching climate change literacy in a more deep and meaningful way, by systematically unpacking the set of skills and knowledge associated with such literacy. In the current state of cross-curricular dispersion, climate change literacy becomes meaningless when subsumed under geographic literacy, science literacy and other literacies. Each of these literacies has a set of skills and principles which do not necessarily overlap with climate change literacy. For example, the characteristic of model uncertainty due to forcing (Deser et al., 2012) is typical to climate change and less so to other disciplines.

From the perspective of the learners, subjects provide students with signposts and boundaries that support conceptual development (Young, 2014). Such boundaries derived from disciplinary knowledge ensure that students will no longer be required to integrate the fragmented pieces of information by themselves. It ensures more rigour in creating linkages and improved ability to synthesise ideas (Harris & Burn, 2011). When it comes to climate change, coherent, well organised and evidence-based learning of a climate change subject is the best safeguard against media misinformation (Harris & Burn, 2011).

Establishing a new climate change subject in the curriculum is not a mere technical fix. It calls for a curriculum reform. Schwab in his 1973 publication “The practical 3: Translation into curriculum”, addressed the challenges of transforming a discipline into a curricular subject in much detail. Such a process entails a range of professional and administrative activities, including for example: resources development, development of evaluation methods, standards, accreditation, timetabling, allocation of disciplinary-specialist teachers, training teachers, setting frameworks for developing discipline-specific pedagogical content knowledge, and more (Ross, 2000). Schwab (1973) described the meticulous attention that needs to be given to choosing which pieces of disciplinary knowledge to teach, how these are connected among themselves, to students’ prior learning, and to learning in other subjects. This issue is discussed in what follows.

Climate change contents for delivery

This section puts forward the following points for consideration:

- The contents of the climate change subject need to be drawn from the disciplinary knowledge. Various studies and programs are already available proposing climate change contents for delivery.
- The question of pacing and sequencing climate change contents across years levels has not received sufficient consideration. Further research required in addressing this issue.
- Pacing and sequencing of climate change content knowledge needs to pay careful attention to students’ cognitive-emotional developmental stage. Inappropriate teaching of contents at the wrong age may not only be ineffective, it may also be harmful.
- I propose Years 9-12 as appropriate for teaching climate change.

Selecting, sequencing and pacing across years levels are critical aspects of transforming an academic discipline into a school subject. While school subjects may or may not be derived from disciplines,

Young (2013) considered disciplinary-based subjects as the most *powerful* form of knowledge since it prepares students for successful participation in adult life. Furthermore, the fallibility of knowledge can only be experienced from within the disciplines. When disciplinary knowledge is organised for transmission, Young (2013) states that “there are no countries that have good education systems that do not rely on their disciplinary specialists as sources of curriculum knowledge” (Young, 2014, p. 198). A major consideration in the transformation of disciplines into subjects relates to what to teach, when to teach, and who to teach. Here I briefly address the questions of what to teach (the contents) and when to teach (pacing across year levels).

In relation to the contents of climate change, it is important to draw the boundaries of a subject as well as identify key knowledge within the boundaries. Various studies have already begun this process (e.g. Lehtonen et al., 2019; Schreiner et al., 2005; Tolppanen, et al., 2017). Additionally, across the world none governmental organisation, as well as international bodies such as UNESCO have taken the initiative to develop a suit of climate change educational programs (UNESCO, n.d.). In my 2019 paper, we addressed this issue by mapping out climate change contents. These were organised along a continuum of climate change perspectives, ranging between: “(i) science facts; and (ii) humanity: socio-economic-political structures, networks, ethics and conduct” (Eilam et al., 2019, p. 14). Under these perspectives, eight key climate change themes were identified and presented on the continuum ranging from more science-facts-based to more humanity-based (and less science-facts-based) aspects of climate change. “The key themes are: observed changes in the climate; drivers of climate change; future climate change; risks and impacts; adaptation and mitigation; socio-economic; policy and governance; and ethics” (p. 14). The thematic contents were then organised by: “fundamental questions; and essential content knowledge” (p. 14). The fundamental questions serve as anchor-points for the subsequent contents of each theme (Eilam et al., 2019).

While it seems that by now we have a good idea regarding climate change contents for delivery, the question of when to teach climate change has thus far not been appropriately addressed in the literature. This is not surprising, as climate change as a subject poses unique challenges to sequencing and pacing across year levels. This is due to a number of reasons. First, climate change as a topic is unique its inseparability from our daily lives, whether we are aware of it, or not. Unlike most other curriculum topics taught at schools, the impacts of climate change are visible, forceful and mostly unavoidable. This unique characteristic might suggest that we need to begin teaching climate change as early as pre-school. However, this assumption may be challenged by another unique characteristic of climate change, which is its complexity and enormity. Climate change is likely the most complex multi-system challenge in human history, with exceptionally high level of inseparability of its parts. Whereas in traditional subjects such as biology and chemistry, contents may easily be divided into stand-alone discrete parts, this is much more difficult to do in climate change, as often, the meanings and implications arise from the relationships between the parts, rather than the parts themselves. For example, it is difficult to teach the topic of climate induced migration as disconnected from droughts, and economic inequality. When it comes to fine-tuning the contents of climate change to students’ cognitive and emotional developmental stage, we know very little.

Various epistemic cognition models provide some direction for further investigation into this question. Particularly the group of cognitive developmental models, such as the Reflective Judgment Model (RJM) (King & Kirchner, 2004), D. Kuhn’s Developmental Model of Critical Thinking (1991), and Kuhn et al.’s, (2000) development of epistemological understanding. These models suggest that epistemic cognition and the way people make judgments about controversial (ill-structured) issues is

an age-related developmental capacity (King & Kirchner, 2004). Furthermore, these developmental processes span across judgment domains, including: taste, aesthetics, value and truth. Together, these cognitive models suggest that the pacing and sequencing of climate change education needs to pay careful attention to students' cognitive-emotional stage. Inappropriate teaching of contents at the wrong age may not only be ineffective, it may also be harmful.

On the backdrop of this information scarcity, I would like to present here my personal view regarding this critical question of sequencing and pacing. I suggest that climate change subjects need to be introduced as core subjects in Years 9-12. However, aspects of climate change need to be carefully chosen for earlier years as well, particularly in relation to adaptation. Beyond that, education in the earlier years needs to focus primarily on creating meaningful connections between the learners and nature, appreciation and a sense of awe. As a main goal for primary education, I would put forward the formation of values and ethics of care in relation to human relationship with the Earth. To my view, the bad news can wait to secondary school. Due to the limited scope of this submission, I will not expand here to justify my views. However, it might be worth mentioning that I am currently working in developing a systematic research into the question of sequencing and pacing of climate change education.

The educational environment and processes

This section puts forward the following points for consideration:

- Climate change education may potentially pose threats to students' well-being, thus requires the application of appropriate pedagogies.
- Teachers are critical for successful implementation of climate change education.
- Successful teaching of climate change can only arise in an environment conducive to development of teacher agency, professional identity and community of practice. This cannot be achieved through cross-curriculum approaches.
- Effective climate change education requires collaboration between schools, communities and organisations.

The educational environment includes the learners, the teachers and the school communities, as well as pedagogies and strategies applied in the educational processes. Similar to pacing and sequencing of the climate change subject, thus far little research addressed these aspects empirically through evidence-based approaches. In relation to the learners, climate change education has immediate and direct implications on students' well-being, as no other curriculum subject. Climate change not only threatens students' physical and mental well-being due to its impacts, but the teaching of climate change may pose an additional threat on its own right. This issue requires careful consideration by all those involved in the educational process. While the term *climate anxiety* has been introduced, there is a need for more information related to understanding students' vulnerability to the effect, and development of ethical and appropriate pedagogies to address this issue. Some open questions include: Are there particular age groups more susceptible to climate anxiety than others? Are there socio-cultural-demographic groups that are more susceptible to climate anxiety than others? What pedagogies may be effective in addressing this form of anxiety? Other pedagogical questions that require further consideration are: What are the goals of climate change education in relation to acquisition of skills, values, and attributes? What values should underlie climate change education and how should they be addressed in a classroom setting?

When considering the teachers who teach climate change, studies suggest that for teachers to become incentivised to teach climate change, this subject needs to be connected with their

professional identity (Mockler, 2011; Pedretti et al., 2008). Development of professional identity is reflective of teachers' competence, performance and recognition (Carlone & Johnson, 2007): where competence refers to knowledge and understanding of the disciplinary content; performance refers to social performances of relevant disciplinary practices such as ways of talking and behaving; and finally, recognition refers to being identified by oneself, colleagues and others, as a climate change teacher (Carlone & Johnson, 2007). In Young's terminology, these teachers would be known as climate change education specialists (Young, 2013, 2014). Once a community of specialists is formed it follows that various means of support will develop through institutional efforts. These include climate change professional development workshops, resources for teaching, and communities of practice, all which are typical to the work of disciplinary professional communities in education (Pedretti, et al., 2008; Wenger, 2011); and are critical for developing teacher agency in climate change education (Priestley et al., 2015).

Finally, schools are nested within communities. Communities and the services they provide, including NGOs and governmental organisations may act as powerful educational agents regarding climate change. They provide authentic sites of action and hands-on experiences for students. They may provide the meaning, the purpose and context for climate change education. Effective climate change education requires schools to develop networks and collaborations within their communities and across organisations. Further work required for identifying effective strategies of collaboration.

Conclusions

Curricula documents are critically important as policy manifestations of the values and priorities of educational practices (Rickinson & McKenzie, 2021). The role of climate change in the curriculum can no longer be ignored. Cross-curriculum inclusion of climate change education does not work for a range of theoretical and practical reasons outlined in this paper.

If we wish our children to be effectively educated about climate change then we need to move forward to integrating climate change as a core subject in the curriculum. This inevitably will require extensive efforts and resources by all the relevant stakeholders. While these challenges may seem insurmountable, they are essential to no less degree than the essentiality of transitioning the world into zero emissions.

Thank you for the committee's time in reviewing this submission paper.

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