Norsk Geografisk Tidsskrift - Norwegian Journal of Geography

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/sgeo20

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To cite this article: Leif Tore Trædal, Erlend Eidsvik & Sadhana Manik (2022) Discourses of climate change education: The case of geography textbooks for secondary and higher secondary education in South Africa and Norway, Norsk Geografisk Tidsskrift - Norwegian Journal of Geography, 76:2, 94-109, DOI: 10.1080/00291951.2022.2062044

To link to this article: https://doi.org/10.1080/00291951.2022.2062044

Published online: 28 Apr 2022.

Norsk Geografisk Tidsskrift–Norwegian Journal of Geography
2022, VOL. 76, NO. 2, 94–109
https://doi.org/10.1080/00291951.2022.2062044

Discourses of climate change education: The case of geography textbooks for secondary and higher secondary education in South Africa and Norway

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ABSTRACT

The purpose of the article, which is a comparative study, is to explore climate change discourses in South African and Norwegian geography textbooks by addressing the following questions: What policy discourses of climate change can be identified in the textbooks? How is the climate change content of geography textbooks influenced by predominant discourses in society? The authors assert that problems and solutions to climate change in textbooks are influenced by dominant discourses of climate change in society. Despite expecting to find a strong emphasis on ecological modernization and a win-win discourse in the Norwegian context, and perhaps a stronger focus on civic environmentalism and global injustice in the South African context, their findings reflected that for both countries, textbooks predominantly leaned towards belief in international agreements and green governmentality. Some emphasis was placed on ecological modernization, particularly in South Africa, while civic environmentalism and global injustice perspectives were marginal and lacked context. The overlapping nature of perspectives identified in the textbooks also demonstrated the complexity of identifying problems and solutions connected to climate change. The authors conclude that political ecology can offer a consistent didactical framework to examine the diversity of interests, perspectives and 'stories' about climate change at different scales.

ARTICLE HISTORY
Received 29 June 2021
Accepted 30 March 2022

EDITOR
Arne Isaksen

KEYWORDS
climate change, climate change discourses, comparative study, geography textbooks, political ecology

Trædal, L.T., Eidsvik, E. & Manik, S. 2022. Discourses of climate change education: The case of geography textbooks for secondary and higher secondary education in South Africa and Norway. *Norsk Geografisk Tidsskrift–Norwegian Journal of Geography* Vol. 76, 94–109. ISSN 0029-1951.

Introduction

This article addresses the role of textbooks in climate change education. Education and public awareness are in general highly recognized as key areas for dealing with the challenges of climate change, including in the Paris Agreement (United Nations 2015a) and the UN Sustainable Development Goals (SDGs) (United Nations 2015b). Education is also identified as a key area in developing critical climate literacy among young people (e.g. Leichenko et al. 2021; Svarstad 2021). Nevertheless, in school policies and practical teaching, the focus on the role of education in achieving the climate targets has been erratic and unfocussed, and the competence among teachers on sustainability issues in general has been variable (e.g. Sinnes & Jegstad 2011; Visser et al. 2016; Anyanwu & Grange 2017; Straume 2017).

Our point of departure is to explore how climate change is framed in geography textbooks. There are two main reasons for why the discipline of geography is selected. First, geography is a key discipline in terms of addressing sustainable development in general and climate change education in particular (Sætre 2016: Holt-Jensen 2018). Second, textbooks are important tools in the learning process in geography education (Sidaway & Hall 2018; Esteves 2019). However, we are keenly aware that several studies have unpacked discourses of climate change, as has been emphasized by Fleming et al. (2014). Nevertheless, fewer studies have explored discourses of climate change education in textbooks, and none have done so by comparing geography textbooks in the context of the Nordic and the Southern African countries. Interestingly, the topics of climate

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change action and policies have not been at the core of geography education in the recent past. It can rather be argued that influential textbooks in the field of geography education address climate issues in mainly instrumental and procedural terms, with limited emphasis on climate action and the consequences of climate change per se (e.g. Gershmel 2014; Couper 2015; Lambert & Jones 2017).

The objective of this article is to identify prevailing climate change discourses in geography textbooks in South Africa and Norway. More concretely, we aim at exploring how climate change is framed as a *problem* and what types of *solutions* are provided to solve the problems. The study compares textbooks for secondary and upper secondary education in South Africa and Norway. It is informed by *political ecology* in the sense that the framing of the problem and the solutions to climate change in textbooks are influenced by dominant discourses of climate change in the society (Ho & Seow 2015).

First, we ask: What discourses of climate change can be identified in South African and Norwegian textbooks? Second, we aim to connect these identified discourses to the larger education contexts: How is the climate change content of geography textbooks influenced by the education system, as well as by predominant discourses in the society? Third, we explore how a political ecology discursive approach can be relevant in comparative textbook studies of climate change education and policies. However, we start by outlining a conceptual framework relevant for the study.

Textbook development, political ecology, and discourses of climate change

Despite the importance of geography as a classical *Bildung* discipline[1], as well as its imperative contribution to environmental education and education for sustainable development, research on geography curricula and their content in different education systems is rather limited (Brooks 2018). We have selected the topic of climate change because it is 'an example of the wicked problems in the era of the Anthropocene' (Lehtonen et al. 2019, 341), as well as one of the major societal challenges that education should address in accordance with the OECD's 'Education 2030' strategy (OECD 2018). Not least, as stated firmly by the UN General Secretary António Guterres, the recent report from the Intergovernmental Panel on Climate Change (IPCC) is nothing less than 'a code red for humanity' (United Nations 2021).

Textbooks and curricula are inevitably closely connected. The implementation of curricula passes through a series of transformations ranging from the ideological planning phase to the practical implementation by teachers in classrooms (e.g. Goodlad 1979). Textbooks are normally developed on demand, based on the political decision of developing and implementing new or improved curricula. Hence, politics is inherently intertwined in the processes of textbook development (Balfour 2015; Sætre 2015). Consequently, textbooks should be considered as the first line operationalization of curricula implementation (cf. Goodlad 1979). Furthermore, the perspectives and interests of the publisher and other actors involved in the writing and publishing process influence the content and structure of the textbooks. It can also be assumed that the whole spectrum of actors involved in the curricula and textbook development may have different perceptions and represent different discourses on climate change.

In addition, the trends and focus on topics (e.g. climate change) in the society in general will influence both processes of curricula and textbook development (Fig. 1). Such influences are not confined to the specific national and local contexts of educational systems, but they are best described as what Carney (2009) has referred to as an educational 'policyscape', where education is a continuous formative process across scales, between global policies and national and local implementation. This is particularly relevant in relation to policies that are transnational in nature, such as climate change.

Political ecology and education

In this study we are interested in understanding to what extent predominant interests in society influence climate change content of geography textbooks, and whether the content is influenced by different curriculum traditions. The issue at stake is climate change and how the *problem* and the respective *solutions* to climate change are presented, at different scales, from global policies to local representations. In this endeavour we draw upon the tradition of political ecology and discourse analysis.

Political ecology is concerned with the interactions between people, power, and nature (Robbins 2012).

[1]The term *Bildung* derives from a German philosophical-educational tradition of personal and cultural maturation. As a discipline it refers to a Humboldtian concept of higher education to achieve comprehensive learning and cultural knowledge (e.g. Anderson 2010).

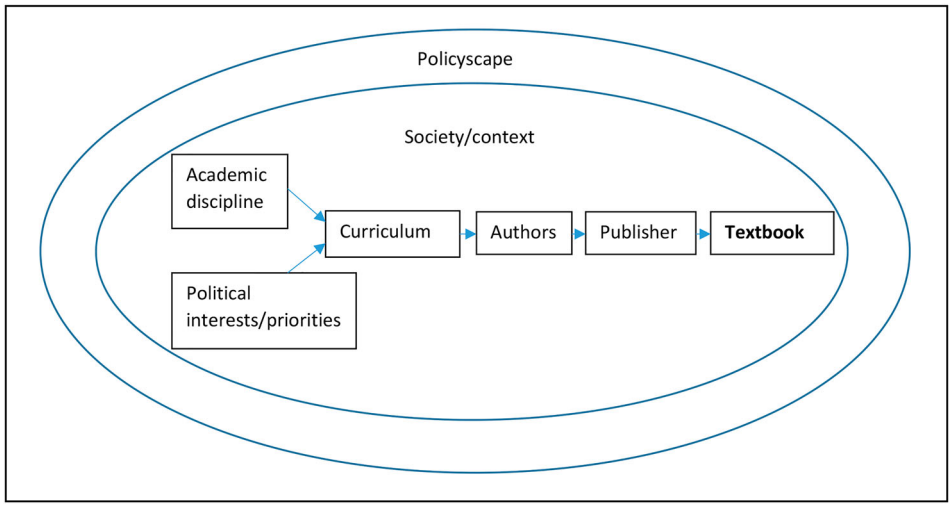

Fig. 1. Revised model of textbook development, influenced by various actors and interests within society (developed from Sætre 2015, 141)

In addressing and analysing these interactions, scale is an important spatial concept (Neumann 2015; Benjaminsen & Svarstad 2021). Global, regional, and local spaces are interconnected. Powerful actors in the global and regional arenas influence local contexts, both in relation to environmental issues and education.

Furthermore, political ecology is frequently associated with studies of actors' divergent interests in 'truth' and competing objectives related to environmental concerns, and how these have impacts on policymaking and concrete implementation on the ground (Blakie 2007). Predominant constructs of realities are influenced by powerful economic actors, with the objective to sustain predominant economic production patterns. Redirecting political ecology towards education could be a meaningful way to provide students (and communities) with skills in a critical reading of landscapes, politics, and narratives about environmental change (Meek & Lloro-Bidart 2017). It might also feed into critical reflections relating to educational systems as the state's extended arm and tool for promoting certain perspectives or 'truths' about relationships between human activity and environmental change (Trædal 2021).

Discourse analyses are often at the core of political ecology studies (Benjaminsen & Svarstad 2021). A discourse can be viewed as a shared meaning of a phenomenon defined as 'specific ensembles of ideas, concepts and categorization that are produced, reproduced and transformed in a particular set of practices' (Hajer 1995, 45). In this study we look at such ensembles (or constructs), assuming that they affect the content of social science and geography textbooks – that is, the framing of issues at stake and solutions to climate change. Here, we assume that this influences how actors with different interests (e.g. continued extraction and turnover of fossil fuels, promotion of indigenous peoples' interests) frame perceptions about 'truth' and causal relationships between environmental problems (such as climate change) and solutions to the issues at stake.

The discursive categories applied are informed by various scholars, but first and foremost by Bäckstrand & Lövbrand (2006), who have developed discourse categories of climate change in relation to tree planting projects in global climate change negotiations. Bäckstrand & Lövbrand (2006, 52) see discourses 'as deeply embedded in scientific practices and techniques, institutionalized in global policy arenas and articulated by agents spanning the public-private and local-global divide'. They identify three main categories: *ecological modernization*, *green governmentality*, and *civic environmentalism*. However, the use of these categories cannot be seen in isolation from the use of similar and related frameworks developed by, for example, Adger et al. (2001), Clapp & Dauvergne (2011), and Dryzek (2013), which also inform our analysis.

The ecological modernization discourse emphasizes the failure of markets to internalize environmental costs. At the same time, it underlines the compatibility of economic growth, environmental protection, and climate change mitigation. Ecological modernization is also characterized by a win-win storyline encompassing the interdependency between economic growth and climate change mitigation. The focus is on innovative technologies for integrated pollution control, market-driven strategies to internalize environmental costs, and flexible, decentralized, cost-effective, and collaborative policymaking. This closely relates to a market-oriented

and neoliberal environmental governance discourse, as espoused by, for example, Ciplet & Roberts (2017) and Clapp & Dauvergne (2011). In relation to climate change, these are views often promoted by governments, including the JUSCANZ Group[2] within the United Nations Framework Convention on Climate Change (UNFCCC), but also global institutions, especially within the Bretton Woods system of monetary management.

The green governmentality discourse corresponds partly to the content of some versions of ecological modernization (e.g. Jänicke 2008), but with a stronger focus on environmental problems as result of the failure of existing institutions to deal with the issues. It reconfirms a belief in a strong state, scientific knowledge, and large businesses. Hence, compared with ecological modernization, the discourse pays stronger attention to the role of a modern administrative state (Bäckstrand & Lövbrand 2006). In addition, green governmentality includes a strong belief in science and research, 'monitoring and evaluation', and results-based incentive systems in the implementation of climate change policies. As such, green governmentality is also indirectly based on neoliberal mechanisms, which also underscores the overlapping (and conflicting) nature of the ecological modernization and green governmentality (Bäckstrand & Lövbrand 2006). The main proponents of the green governmentality paradigm can be found within research and policy elites, such as the Intergovernmental Panel on Climate Change (IPCC) and other UN bodies, such as UNEP (United Nations Environment Programme) and the Food and Agriculture Organization (FAO).

Civic environmentalism is quite different from the discourses outlined above. It is characterized by a focus on 'participation', 'stakeholding', and 'democratic efficiency'. This discourse points to global injustice (North–South aspects) as an underlying and inherent obstacle to resolving issues of climate change. The civic environmentalism discourse further includes the role of civil society in pursuing sustainable development and filling the democratic gap in international negotiations. A key focus is the importance of enhancing the voice of marginalized groups. In educational terms, civic environmentalism could be said to represent alternative metaphors to the predominant anthropocentric and 'modernist' ones, both with regards to how the problem is framed as a socioecological problem (North–South divide, global injustice, and neoliberal 'predatory' financial and economic systems) and in relation to how to address it (participation, democratic efficiency, and a 'new world order'). As such, this perspective is promoted by many civil society organizations and environmental NGOs, and within certain scientific milieus, including critical branches of human geography and political ecology. Also, we initially assumed that, due to the traditional North–South divide in global negotiations, elements of climate justice would influence the South-African textbooks more than the Norwegian ones.

Furthermore, civic environmentalism can arguably be associated with the emerging field of *degrowth*, which is the request for a new 'world order' based on 'an equitable downscaling of production and consumption [in a way] that reduce societies' throughput of energy and materials' (Schneider et al. 2010, 511). Much of the literature calls for a deepening of democracy, more equitable distribution of wealth, and firm defence of ecosystems. Nevertheless, since many of the textbooks analysed in this study were published before this debate caught momentum and since the concept is not directly mentioned in any of them, we do not engage directly with the concept in the further analysis and discussion.

Even though the categories *ecological modernization*, *green governmentality*, and *civic environmentalism* were developed for analysing tree planting projects, we find them useful as a point of departure for analysing other 'sectors' of climate change, including climate change education. Our analysis also revealed that some of the views expressed in the textbooks could not rigidly be classified according to the categories. Environmental issues, such as climate change, cannot necessarily be presented within well-defined boxes, but are rather complex, multidimensional, and overlapping (cf. Dryzek 2013). Therefore, the perspectives and discourses identified in the textbooks are analysed and understood from their own logic and 'nature'. These included perspectives that could be related to a *denial* discourse (cf. Adger et al. 2001), in which climate change is not seen as a problem to be addressed by society, and a *bottom-up* approach in which individuals in societies are seen as responsible for ensuring sustainable and 'climate friendly 'actions (cf. Ciplet & Roberts 2017).

Methodology

Why compare?

Comparative studies in education have a long tradition, in which the state or nation state typically used to be the

[2]An informal consultative coalition with some UN bodies, including the UNFCCC (normally related to countries such as Japan, the USA, Canada, New Zealand, Norway, and members of the EU).

unit of analysis (e.g. Vavrus & Bartlett 2009; Bartlett & Vavrus 2017a; 2017b). However, the concept of comparison is still contested, and Steiner-Khamsi (2010) has warned that comparative studies in education and education policy should avoid the pitfalls of methodological nationalism whereby the nation state is seen as the natural unit of comparison. The scope of our study is not to compare the putatively different education systems of Norway and South Africa per se, and particularly not within the frames of the nation state. On the contrary, we subscribe to the concept of framing education policy as a policyscape (Carney 2009), where a global flow of policies from international organizations and actors to a large degree has displaced the state. Even though education takes place within the state, where the content and format of education discerns from a usually nationally endorsed curriculum, education policy reforms 'do not have a home base, a territory, or a nationality and therefore do not 'belong' to a particular educational system' (Steiner-Khamsi 2010, 237). Therefore, a comparison can be useful to draw attention to how very different educational challenges in dissimilar countries may be addressed by similar policies (Bartlett & Vavrus 2017a). To frame our comparative set-up further still, we apply the concept of comparison along a horizontal axis and a vertical axis (Fig. 2) (Bartlett & Vavrus 2017a; 2017b). The horizontal axis refers to how similar content or policies unfold in distinct locations that are socially produced and connected (Massey 2005; Bartlett & Vavrus 2017a). In our study, this includes how climate change education unfolds in geography textbooks by different authors and publishers published by in Norway and South Africa. The vertical axis concerns processes at and across different scales, from international to local levels (Marcus 1998). Hence, local manifestation of social phenomena (and policies) cannot be separated from national or international forces (Piot 1999). Therefore, we have included a series of multiscalar elements along the vertical axis. In addition, a transversal axis is added to illustrate that comparison is processual across the horizontal and vertical dimensions.

First, we depart from an initial expectation that textbook discrepancies in perspectives on climate change and climate action can be related to the different positions held by South Africa and Norway in global climate change negotiations. If we apply the categories of Annex I, Annex II, and non-Annex I countries as implemented by the United Nations Framework Convention on Climate Change (United Nations 2022), there are different roles ascribed to the respective categories concerning climate change mitigation. Annex I and II parties are OECD member countries and 'economies in transition', and they should aim to reduce their carbon emissions and assist 'developing countries' in reducing their greenhouse gas emissions. Most non-Annex 1 countries are 'developing countries'. However, several high- income and middle-income

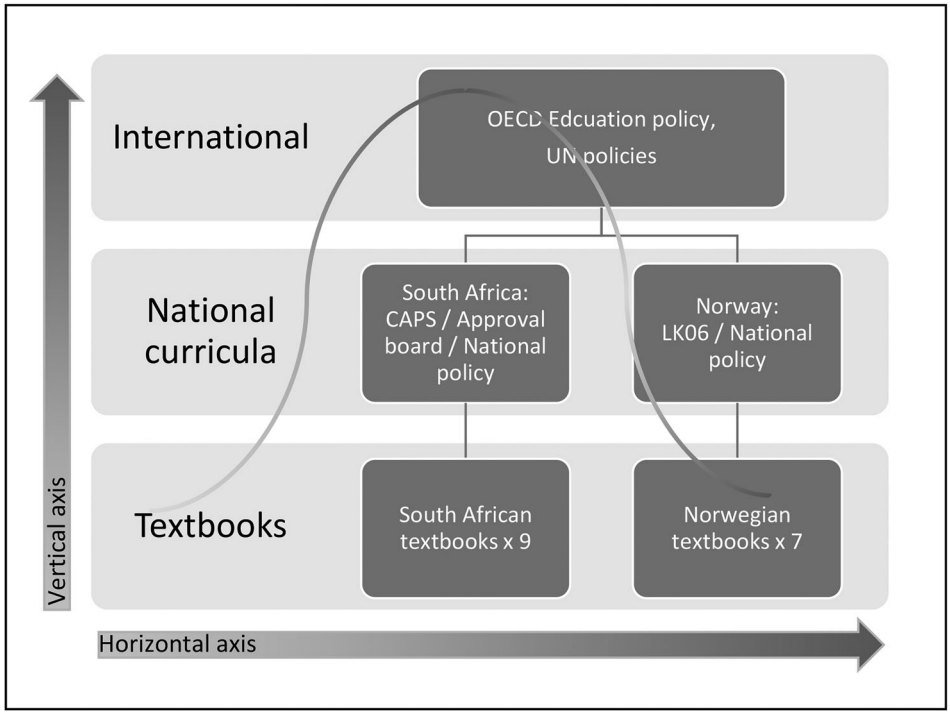

Fig. 2. Comparative framework (adapted from Bartlett & Vavrus 2017a)

countries are also categorized within this group, such as Israel, Singapore, South Korea, and South Africa. Following this 'geo-economic-political' classification, South Africa could be expected to be representative of a group of countries pointing to the *global injustice* dimension of the problem of climate change, arguing for distributive justice, since the problem has been created by the Annex I and II countries. Therefore, Annex I and II countries should be at the forefront of finding solutions and bear the main financial burden, including mitigation and adaptation efforts needed in the non-Annex I countries. By contrast, textbooks in Norway, as an Annex I country, could be expected to frame the problem of climate change more from an ecological modernization or green governmentality perspective, relying on market-based principles (cap and trade), technology, and international agreements.

Second, the properties of the curricula in Norway and South Africa could imply different approaches to how climate and climate actions are presented in textbooks. The curricula of both countries can be categorized as what Lambert et al. (2014) label as outcomes based, which implies that knowledge is seen as means to an end in response to specific interests and needs (Bagoly-Simó 2017; Brooks 2018). Both countries have experienced a deliberate shift towards seeing education as a tool to meet the needs of the future, in accordance with OECD education policies (OECD 2005; 2018). However, South Africa and Norway still represent somewhat different approaches to curricula development and content. While the South African curriculum a National Curriculum and Assessment Policy (CAPS) could be said to represent an instructive type (detailing the content in terms of what to teach, for how long, and when to teach it in the schooling cycle), the Norwegian curriculum (LK06)[3] can be described as target driven, with specific learning objectives milestones set for Levels 4 (10 years), 7 (13 years), and 10 (16 years). The Norwegian curriculum is still rather open and does not specify the exact content and timing of the teaching, which enables relative freedom for schools and teachers.

Differences in approval mechanisms may also influence the content and structure of textbooks. South Africa has a formal textbook approval system under the responsibility of the Department of Basic Education. In accordance with the CAPS (Curriculum Assessments Policy Statement), the Department coordinates the process of approving textbooks for schools though the Learning and Teaching Support Material (LTSM) National Catalogues of textbooks (RSA 2019). In Norway, this responsibility is left with the textbook publisher. The century-long Norwegian approval system for textbooks was abolished in 2000, in order to accommodate independent teaching and planning, stimulate teachers and schools to use several sources, and leave the quality control of content to authors and publishing houses (Bratholm 2001; Solhaug et al. 2020).

Third, despite the differences in terms of economic structures and educational systems, Norway and South Africa share similarities through being fossil fuel based economies. Whereas South Africa is heavily dependent upon coal as a source of energy, Norway is a major oil and gas producing country. From this perspective, it could be assumed that both countries would have some common interests in terms of continuing a *business-as-usual* scenario, or at least mitigating climate change through technology rather than through reduced consumption or by replacing fossil fuels with renewable energy sources.

What to compare?

The question for analysis is: 'What type of interests and perspectives on climate change and climate change action can be identified in the textbooks?' Here, we assert that the textbooks convey particular representations (descriptions, narratives, explanations), that in turn affect strategies and policies to address both the underlying and direct causes of climate change. Hence, the analysis is influenced by *political discourse analysis* (e.g. Fairclough & Fairclough 2012), in the sense that we are concerned with argumentations for (or against) certain types of action and the choice of policies. For this reason, the textbooks were systematically reviewed and their content identified on the basis of how they view climate change as a *problem* (i.e. the framing of the causes of climate change), and consequently, what type of *solutions* they suggest in terms of reducing greenhouse gas emissions and adaptation to the consequences of climate change.

Selection of textbooks

The analysis included all available textbooks in use in lower and higher secondary education in Norway and South Africa. In the Norwegian context, five textbooks (for three years in each case) were analysed at lower secondary level, and two textbooks for upper secondary level. The textbooks were published in the years 2006–2016 inclusively. Most of the Norwegian textbooks for lower secondary school were published in the years

[3]LK06 (Kunnskapsløftet) was implemented in 2006 and was valid until the school year 2020/2021. The most recent curriculum, LK20 (also labelled Kunnskapsløftet), is a renewal of LK06, based on the Norwegian Government's White Paper Meld. St 28 (2015–2016).

shortly after the revised curriculum was launched in 2006 (LK06). This implies that most were published just before or just after the boost given to climate change awareness with The Stern Review on the economics of climate change (Stern 2007), the UN's Conference of the Parties (COP13) was held in Bali in 2007, and the Nobel Peace Prize was awarded jointly to Al Gore and the IPCC in 2007). Although a renewal of the LK06 curricula was implemented in 2020, with LK20, the latter is being introduced gradually (to Grades 9 and 10 in 2021), and textbooks adapted to the renewal have only to a limited degree been replaced, due to insufficient funding (Holien 2020).

The Norwegian textbooks have been published by from the following publishers:

- Gyldendal undervisning: *Underveis: Geografi 8*, *9*, and *10* (by Birkenes & Østensen, respectively published in 2006; 2007; 2008)
- Cappelen Dam: *Monitor 1*, *2*, and *3: Geografi grunnbok* (by Fossbakken, respectively published in 2006; 2007; 2008)
- Aschehoug: *Matriks 8: Geografi* (by Karlsen & Holgersen 2006), and *9* and *10* (by Holgersen & Karlsen 2007; 2008)
- Fag og kultur: *Kosmos 8*, *9*, and *10: Samfunnsfag for ungdomstrinnet: elevbok* (by Nomedal, published in 2006; by Nomedal & Bråthen, published in 2007; 2008, respectively)
- Cappelen Damm: *Makt og Menneske 8*, *9*, and *10* (by Strindhaug & Haagensen, respectively published in 2006; 2007; 2008).

Makt og Menneske was the only textbook for which new editions were published, titled *Nye Makt og Menneske* (Strindhaug & Haagensen 2014; 2015; 2016). Textbooks for higher secondary in Norway were published in 2013 and 2015, and included *Geografi* (Eide et al. 2013) and *Terra nova* (Johnsen et al. 2015).

The selection of South African textbooks consists of nine different English language textbooks or Grades 8–12 (13–18 years). All textbooks were published between 2011 and 2014. The selection included all textbooks on the market for lower and upper secondary education. Seven of the nine textbooks are published by five major international publishing houses:

1. Cambridge University Press: *Study & Master Geography* (by Collett & Winearls 2011)
2. Maskew Miller Longman: *Focus on Geography* (by Dilley et al. 2012) and *Platinum Geography* (by Bornman et al. 2013)
3. Pearson Education South Africa: *Spot On* (by Gunter et al. 2014) and *Achieve!* (by Manson & Ravnescroft 2012)
4. Oxford University Press: *In Search of Geography* (by Oelofse et al. 2011)
5. Macmillan South Africa: *Solutions for All* (by Dube et al. 2011).

Only two textbooks are published by independent South African publishers:

1. Via Afrika: *Via Afrika Geography* (by Beets et al. 2014)
2. Shuter and Shooter: *Shuters Top Class Geography* (by Arjun et al. 2014).

Analysis of climate change in geography textbooks

In this section we present the two educational contexts that correspond to the curricula and geography education in South Africa and Norway. This is followed by a presentation of the results, in which we identify and analyse the contents of the textbooks in the two countries.

South Africa

Education and the national curriculum have been instrumental in building post-apartheid South Africa in line with the Constitution of the Republic of South Africa, 1996 (Government of South Africa 2022). The first post-apartheid curriculum (Curriculum 2000, C2000) was implemented in 1996 and revised in 1997 (Curriculum 2005, C2005). This was a major shift from a content-based education to outcome-based education, in order to overcome the curricular division of the past (Manik 2016). The most recent curriculum, CAPS, replaced C2005 in 2012 and includes all subjects from Grade R (age 4 years) to Grade 12 (age 18 years). The change from the old curriculum to CAPS is described as a change from *how* it was taught (teaching methods) to *what* is taught (curriculum content) (Maharajh et al. 2016).

Geography education and climate in South Africa

In CAPS, pupils are introduced to climate in Grade 5 (10–11 years), in a module titled 'Weather, climate and vegetation of South Africa'. In Grade 6 (11–12 years), the geographical scale is extended and includes a module titled 'Climate and vegetation around the world'.

In Grade 8 (10–14 years), pupils are introduced to climate regions, initially with a focus on South Africa and thereafter with a global perspective. Grade 10 (15–16 years), the first year of Further Education and Training (which includes Grades 10–12, as well as vocational traning), includes a unit on the composition of the atmosphere. This continues in Grade 11 (16–17 years), with an emphasis on the earth's energy balance, the global air circulation, Africa's weather and climate, and drought and desertification. In Grade 12 (17–18 years), students are introduced to a unit headed 'Climate and Weather', with emphasis on cyclones, as well as microsystems such as valley climates and urban climates.

CAPS is instructive and detailed with regards to how the topics should be taught. For example, 8 hours should be dedicated to the unit headed 'Heating of the atmosphere' in Grade 10, which should include the following:

- processes associated with the heating of the atmosphere: insolation, reflection, scattering, absorption, radiation, conduction, and convection
- factors that affect the temperature of different places around the world: latitude, altitude, ocean currents, and distance from oceans
- the greenhouse effect – impact on people and the environment
- global warming – evidence, causes, and consequences, with reference to Africa
- the impact of climate and climate change on Africa's environment and people – deserts, droughts, floods, and rising sea levels.

Analysis of the South African textbooks

The instructive set-up provided by CAPS is followed in all textbooks. Nevertheless, there are profound differences in terms of how the textbooks present climate change and global warming as a problem and its potential solutions. The textbooks present different cases as examples of climate issues and solutions. A summary of the findings relating to the problems and solutions regarding climate change is presented in Table 1.

In general, the textbooks are richly illustrated and contained detailed explanations of the physical aspects of climate dynamics, including the composition of the atmosphere, the role and properties of radiation, the greenhouse effect, the climate zones, and global warming. The textbooks differ in style, ranging from short, bullet point summaries (*Achieve!*), to more lengthy explanations using case studies to contextualize interlinkages between theories and empirical realities (*Focus on Geography*, *Solutions for All*, *Study & Master Geography, Shuters Top Class Geography*).

The causes and effects of climate change related issues and potential solutions to them are addressed in the common unit headed 'Global warming', with its subtopic 'Causes of global warming'. In addition, another unit has a regional focus on Africa, in which climate change and the impact on Africa's environment and people are highlighted. For example, several textbooks mention the shrinking glacier on Mount Kilimanjaro as a case (and proof) of global warming in a regional context (*Focus on Geography*, *Platinum Geography*, *Study & Master Geography*, *Shuters Top Class Geography*).

Causes of climate change are in general linked to increasing anthropogenic greenhouse gas emissions, including from industry, fossil fuel combustion, and to some extent deforestation and agriculture. Most of the textbooks point to the IPCC Fourth assessment report (IPCC 2007), in which it is clearly stated that the rapid changes in climate are caused by human activities.

Problems and solutions

Four of the textbooks (*In Search of Geography*, *Solutions for All*, *Platinum Geography*, *Via Afrika Geography*) deal with issues of climate change and climate change mitigation measures in descriptive terms, and take a more neutral, uncritical position compared with the five textbooks. Hence, no specific discursive links could be identified.

Only four of the textbooks include a specific theme on solutions and strategies to deal with global warming (*Focus on Geography*, *Achieve!*, *Study & Master Geography*, *Shuters Top Class Geography*). This is also a theme that is not predefined in CAPS, and it is in this theme in particular that the differences between the textbooks and their connections to the various discourses are evident.

The textbooks that address climate change mitigation measures and solutions refer mainly to a context of large-scale governmental and international responsibilities (*Focus on Geography*, *Achieve!*, *Study & Master Geography, Shuters Top Class Geography, Spot On*). The role of the IPCC, the Kyoto Protocol for reduction in greenhouse gas emissions (Oberthür & Ott 1999), carbon taxing regulations, and the Montreal Protocol for regulating substances depleting to ozone layer (United Nations Environment Programme 2009) are presented as examples of trust in international governance for potential solutions to problems related to climate change. Whereas international governance

Table 1. Summary of the the main findings relating to climate change presented in South African geography textbooks

South African textbooks	The problem	The solution
Study & Master Geography (Collett & Winearls 2011) Cambridge UniversityPress	Industrial revolution, and the green revolution Fossil fuels, increasing population, deforestation	International agreements, reducing greenhouse gas emissions by changing our lifestyles Individual responses/responsibility Climate justice – poor countries should also benefit from climate action
Focus on Geography (Dilley et al. 2012) Maskew Miller Longman	Industrial activities Agriculture and methane emissions: rice paddies and cattle Increasing population Increasing aerosols Deforestation Unfair distribution: Africa only responsible for 4% of global emission, but South Africa is among the top-20 polluters)	Montreal Protocol for Ozone layer preservation Kyoto Protocol actions, carbon trading Carbon taxing. Reforestation Technical solutions – CO2 storage Individual actions: recycling, awareness, actions Rewards for individual actions
Platinum Geography (Bornman et al. 2013) Maskew Miller Longman	Industrial activities/increase in industrialization Poor countries in Africa and Asia most vulnerable to climate changes/will suffer most Deforestation and desertification	No concrete solutions, but recommends/emphasizes the following: Encourage students to involve in mitigation issues Importance of international agreements, government responsibility
Spot On (Gunter et al. 2014) Pearson Education South Africa	Fossil fuel for industry and transport Deforestation	Remove greenhouse gases via carbon sinks: afforestation Alternative/renewable energy sources Kyoto Protocol actions and international agreements
Achieve! (Manson & Ravenscroft 2012) Pearson Education South Africa	Human activities increase the levels of greenhouse gases: Deforestation, fossil fuel, livestock Developed countries (Europe and USA) have higher emissions, and higher responsibility to cut emissions	Trust in Kyoto Protocol actions and international agreements 'Western' responsibility for emissions
In Search of Geography (Oelofse et al. 2011) Oxford University Press	Greenhouse gas emissions, deforestation CO2 is perceived as a major contributor to global warming	Mainly neutral descriptions, but with emphasis on technical solutions and transition to clean power International governance intervention through the Montreal Protocol and through EU ban on CFC gases Points to the complexity of global warming by mentioning the paradox that global warming can be reduced by dimming (air pollution)
Solutions for All (Dube et al. 2011) Macmillan South Africa	Greenhouse gas emissions from human activities, 'pumping' pollutants into the atmosphere at an alarming rate	No particular solution emphasized on climate action Strong emphasis on ozone depletion International governance through the Montreal Protocol to reduce emissions, in addition to individual responses
Via Afrika Geography (Beets et al. 2014) Via Afrika	Greenhouse gas emissions Enhanced greenhouse effect	Taxes on energy and carbon, technical adjustments and innovation No specific political or economic instruments mentioned
Shuters Top Class Geography (Arjun et al. 2014) Shuter & Shooter	Greenhouse gas emissions from human activities, including the use of fossil fuels and the practice of deforestation	The role of the IPCC Increase capacity of carbon sinks, absorb GHGs from the atmosphere, reduce emissions Kyoto Protocol actions, individual responses Technical solutions for carbon capture and storage, market mechanisms

and cooperation is seen as the main level at which the challenges of climate change can be resolved, less attention is given to national or state level interaction or governance. For example, in *Shuters Top Class Geography*, the following is stated in connection with solutions for climate change mitigation, 'Policies, such as the Kyoto Protocol, aim for increased use of renewable energy and increased energy efficiency' (Arjun et al. 2014).

In addition, and partly as an extension of international cooperation, three textbooks emphasize reliance on market mechanisms and technology innovations within clean energy and carbon capture and storage (CCS) (*Focus on Geography*, *Via Afrika Geography*, *Shuters Top Class Geography*). Interestingly, two of these (*Via Afrika* and *Shuters Top Class Geography*) were published by the two independent South African publishers.

Only three of the textbooks (*Study & Master Geography*, *Focus on Geography*, and *Achieve!*) mention climate justice and what we have outlined as a civic environmentalist discourse. However, the mentions are only supplementary statements without further contextualization, leaving the injustice dimension devoid of analytical framing and explanation. The above-mentioned three textbooks rather briefly include issues in which pollution, global warming, and climate change mitigation are seen in relation to global geopolitical injustice, with the major pollutants located in the Global North and countries in the Global South having to pay the price for those injustices. The concept of global injustice is explained through a dichotomy of the developed world versus the developing world. South Africa is placed in the developing category, while the developed world is referred to as the USA and most European countries: 'Developed countries such as the USA and most European countries have higher emissions of CO2 and methane than poorer, developing countries, and therefore more responsibility to cut their emissions' (Manson & Ravenscroft 2012, 33). Also, *Study & Master Geography* appeals to students' critical judgement by posing rhetorical questions that refer to a context with injustice: 'Rich countries have developed with the help of fossil fuels, so why shouldn't poor or developing countries be allowed to do the same?' (Collett & Winearls 2011, 38).

However, many of the textbooks also emphasize individual action in reducing emissions, which engages directly with the learner and learners' agency for change in the transition to a low-emissions future. The shift mimics that of global policies from the previous governmentality of *distributive justice* (in which environmental problems were seen as caused by rich countries, and poor countries had to bear the brunt of their choices) to a discourse that connects to what Ciplet & Roberts (2017, 152) refer to as *everyone is responsible*, thus marking a bottom-up approach to mitigating climate change.

Norway

Education has also been instrumental in the nation building process and community unity in Norway. Since the interwar period, the principle of a 'unity school' (*enhetsskolen*) has had a strong hold in society, implying that all citizens have equal access to good quality education. However, the Norwegian system of curriculum and textbook development is different from the South African one, especially in terms of quality assurance systems. As already clarified, the formal approval system for textbooks was abandoned in 2000.

The curriculum in Norway may be considered as outcome oriented, and the open learning objectives are formulated for three milestones in Levels 4, 7, and 10 respectively. Hence, there are no formal requirements with regards to when sustainability and climate issues are taught. This has implications for the structure and contents of geography textbooks. At what level (year) and *how* sustainability (and hence also climate change) is understood and addressed within these intervals is very much left to the authors of textbooks, publishers, and the teachers themselves to decide.

Geography education and climate in Norway

In the LK06 curriculum for primary and secondary schools, climate change is not spelled out in concrete terms in the geography curriculum for lower secondary schools (Utdanningsdirektoratet 2006). LK06 emphasizes the role of science in teaching about sustainability issues, but it also includes learning objectives in relation to the topic for geography. In LK06, the focus is on 'sustainable development' in general, rather than specific environmental problems, such as climate change. This has been strengthened in the recent curriculum renewal, LK20 (Utdanningsdirektoratet n.d.,a), with a strong overall emphasis on 'sustainable societies', but without including climate as a specific topic in the social sciences and geography for lower secondary schools (Utdanningsdirektoratet n.d.,b). Instead, climate issues are transferred to the natural sciences (Eidsvik 2020). For upper secondary schools, climate issues are still framed within the geography curriculum. As such, the content of geography in lower and higher secondary schools does not correspond thematically.

Analysis of the Norwegian textbooks

The extent to which climate change is addressed in the textbooks varies. The results of the reviews are summarized in Table 2. In general, the framing of 'the problem of climate change' ranges from a general omission of the topic to a focus on economic growth and population increase ('population bomb') (e.g. *Kosmos 9*) as key underlying problems of climate change (and unsustainability in general). Three of the textbooks (*Matriks 10*, *Underveis 8*, and *Nye Makt og Menneske* 10) also focus on the consequences of climate change, and how it is likely to affect peoples' lives in different parts of the world.

The lack of an international climate change agreement is emphasized in most textbooks. Accordingly, a climate agreement is viewed as necessary to generate international cooperation for global action. In this

Table 2. Summary of the main findings relating to climate change presented in Norwegian geography textbooks

Norwegian textbooks	The problem	The solution
Makt og Menneske (vols. 8–10) Strindhaug & Haagensen (2006, 2007, and 2008) Cappelen Damm	Technology both part of the problem and the solution Economic growth and unfair distribution of wealth and resources as underlying causes	Technology also the key to solving the problem Alternative renewable energy sources Climate agreement needed Carbon capture and storage (CCS) needed in particular Government has responsibility to address the issues and find solutions NGOs important promoters of solutions
Kosmos (vols. 8–10) Nomedal (2006) Nomedal & Bråten (2007, 2008) Fag og kultur	Lack of a climate agreement a major challenge Population growth, affluence and unsustainable consumption levels Global injustice in consumption and welfare as an underlying cause	Rich countries' main responsibility to solve the problems since they also caused them International agreements necessary Technology and measurements (carbon footprints) Changing peoples' attitudes Greening of private sector needed Civil society
Monitor (vols. 1–3) Fossbakken (2006, 2007, 2008) Cappelen Damm	Unsustainable use of resources in general Oil-based economy leading to CO2 emissions Refers to professional disagreements about the causes of climate change	Economic growth and sustainable use of resources Precautionary principle: need to take action despite scientific disagreements ('better safe than sorry')
Matriks (vols. 8–10) Karlsen & Holgersen (2006) Holgersen & Karlsen (2007, 2008) Aschehoug	Descriptive in terms of how CO2 affects climate and the negative effects of climate change Does not point to any specific underlying causes/problems	Technological solutions and pollution control constitute the main approach International agreement needed to achieve global concerted efforts to tackle climate change
Underveis: Geografi (vols. 8–10) Birkenes & Østensen (2006, 2007, 2008) Gyldendal	Focuses on the effects of climate change Refers to disagreements between scientists in terms of whether or not climate change is human made	International agreement needed Countries' responsibility to comply with the agreements and standards
Nye Makt og Menneske (vols. 8–10) Strindhaug & Hågensen (2014, 2015, 2016) Cappelen Damm	Emissions from industry and land use change Technology development Mass consumption and global inequalities Failure to internalize ecological 'costs' in the economy	Focus on technological solutions in general, and carbon capture and storage (CCS) in particular Market solutions important (market mechanisms – 'cap and trade') International agreement needed Consumer knowledge/attitudes
Geografi Eide et al. (2013) Cappelen Damm	Main focus on the physiscs of meteorology and climate change, and the role of GHG emissions Does not present/discuss concrete sources of emissions, both direct and underlying	GHG emissions as the cause of climate change Neutral in terms of both causes and solutions
Terra nova Johnsen et al. (2015) Aschehaug	Main focus on the physics of meteorology and climate change, and the role of GHG emissions	Does not address solutions to climate change

regard, the role of governments in finding solutions and generating global international agreements is highlighted as an important premise for solving the problem of climate change: 'The major environmental question in the coming years, is whether the signatory countries manage to follow-up the commitments made in the Kyoto Protocol' (Strindhaug & Haagensen 2006, 111).[4] Some textbooks also refer to other success stories of international agreements and cooperation, such as those concerning chlorofluorocarbon emissions and 'acid rain'. In this sense, the textbooks confirm the role of international agreements, governments, and institutions to find ways to face the global challenge of reducing emissions.

Technology and innovation to reduce CO2 emissions are highlighted in most of the textbooks, for example in terms of developing new clean energy sources, energy efficiency, and CCS. Since technological solutions are

[4]All translations into English in this article were done by the first author, Leif Tore Trædal.

important aspects in both ecological modernization and green governmentality discourses, they (technological solutions) cannot necessarily be firmly rooted in only one of them. The prominent position of CCS as an example of a mitigation technology given in several of the textbooks must also be understood contextually, since this has been an important priority in the Norwegian climate change policy processes since the early 2000s.

One textbook, *Makt og Menneske 9*, mentions nuclear energy as an 'interesting' CO2-neutral alternative to fossil fuels. Furthermore, the contrasting nature of technology is underlined in some of the textbooks, in the sense that technological development historically has caused most of the emissions and is therefore a key part of the 'problem', while at the same time technology must also have a prominent role in 'solving' it.

Another textbook, *Kosmos 10*, simultaneously focuses on the importance of a climate change agreement and points towards the global inequalities and injustices of the world economy as a key underlying factor for climate change, demanding richer countries to take larger share of the responsibility. This is compatible with both green governmentality and civic environmentalism ways of thinking: 'The current consumption of the rich countries is unfair. People live in ways that compromise the poor. A sustainable development must create higher degree of equality between the poor and the rich countries' (Nomedal & Bråthen 2008, 96).

Also, the role of civil society and NGOs is highlighted in a few of the textbooks (including *Makt og Menneske* and *Kosmos*) mainly with regards to the role of environmental NGOs and civil society in relation to climate change negotiations and political influence. There is less focus on their role in promoting the interests and rights of marginalized groups, including indigenous peoples.

The updated version of *Makt og Menneske* 8 – *Nye Makt og Menneske 8* – presents 'market solutions', namely trading of carbon quotas, as a likely key solution to the problem of climate change, much in line with a neoliberal environmental discourse type of thinking. This 'evolvement' may be coincidental, but also – and more likely – reflects changes in both professional and policy milieus (and society in general) on how to frame problems and solutions to climate change since the first editions of the three volumes of *Makt og Menneske* were published in 2006, 2007, and 2008, respectively.

Two of the textbooks express views on climate change that could rather be associated with a climate *denial* discourse (cf. Adger et al. 2001), namely *Underveis: Geografi 8* (Birkenes & Østensen 2006) and *Monitor 3* (Fossbakken 2008):

> One of the big questions is how human made [climate change] is. This is a disputed question among scholars. How much is attributable to our emissions of CO2 and deforestation as compared with variations in solar radiation and emissions of volcanic debris? (Fossbakken 2008, 82)

Both of the upper secondary school textbooks – *Terra Nova* and *Geografi* – focus mainly on the physical aspects of climate change, such as the effects of the anthropogenic emissions of greenhouse gases, and not on the direct and underlying factors causing the emissions themselves. Consequently, they do not suggest possible solutions to reduce the emissions, and how hence to adapt to climate change.

Synthesis of the findings

Despite the differences in curricula approaches, school policies, and economic structures, we found that the South African and Norwegian textbooks predominantly leaned towards what we have referred to as the green governmentality discourse on climate change governance. In particular, the importance of international agreements in finding solutions to the problem of climate change as a global challenge is highlighted in most of the textbooks published in the two countries. The role of a strong administrative state is also foregrounded in the Norwegian textbooks, but to a very limited degree in the South African textbooks. It also seems that the links to ecological modernization are more apparent in South African textbooks than in the Norwegian ones.

If we connect textbook contents to a historical timeline of environmental and climate governance, Gareau (2013), for example, argues that the history of environmental governance has seen a gradual move from state regulatory to private, market-based solutions. Ciplet & Roberts (2017) refine this transition into five major phases of climate governance. The first phase concerns global political action on ecosystems in the 1970s following the UN conference on the environment in Stockholm 1972. The second phase follows the founding years of the UNFCCC in the mid-1980s and the Brundtland Commission and its report in 1987 (World Commission on Environment and Development 1987), when private business and environmentalism were reconciled. From then on, business was to be part of the solution responding to environmental problems, with increasing emphasis on economic growth. The later phases concern marketization of climate action through the Kyoto

Protocol (1997) and ending with the Copenhagen Accord in 2009, followed by what Ciplet & Roberts label a shift to a 'pledge and review' system with much stronger civil society involvement, including stronger bottom-up approaches. The final phase is the current post-Paris Agreement phase, in which 'mitigation decisions are more likely to be made unilaterally, bilaterally and in "climate clubs", outside of the UNFCCC processes' (Ciplet & Roberts 2017, 155).

By leaving the post-Paris Agreement phase out of this analysis, since the analysed textbooks were all published in the period 2008–2014 before the Paris Agreement, we could expect an emphasis on market-liberal ecological modernisation, in addition to civil society involvement and what we have outlined as civic environmentalism. Nevertheless, in the textbooks in both Norway and South Africa there is a predominant trust in state and large-scale international climate governance, even though there are also scattered examples of market-based solutions. Therefore, even though we find that perspectives from green governmentality are predominant, the complex and overlapping nature of the discourses found in many of the textbooks must still be underlined. This reminds us, in Dryzek's phrasing, that 'environmentalism is composed of a variety of discourses, sometimes complementing one another, but often competing. A discourse is not like a tribe' (Dryzek 2013, 22).

In conclusion, the textbooks point to a need for an international governance of climate issues. As shown by Gareau (2013) and Ciplet & Roberts (2017), we have seen a shift from state regulated environmental governance to market-based neoliberal governance, and towards civil society involvement. However, a level of international climate governance policyscape seems to be lacking. As such, there is a dissonance between the analysed textbooks and the historical trajectory of environmental governance.

Conclusions

In this article we have analysed and discussed the role of geography textbooks in climate change education in South Africa and Norway. We have mainly been informed by three discourses of environmental governance: *ecological modernization*, *green governmentality*, and *civic environmentalism*. It was not our intention to recommend that textbooks should aim at fitting into any of these specific categories, or to argue that one category is qualitatively better than the others. Instead, we aimed to explore and analyse the textbooks' content in relation to predominant climate governance discourses.

The analysis demonstrated that climate change as a topic in geography textbooks varies both between and within Norway and South Africa. The overlapping nature of the discourse categories revealed that categorizing textbooks according to the outlined discourse framework is not a straightforward exercise. However, we found an overall emphasis on international agreements and green governance in the textbooks in both countries. Our expectations regarding the South African textbooks were more inclined towards a global injustice framing of climate change (civic environmentalist) and those regarding the Norwegian textbooks towards a neoliberal market-based governance (ecological modernization) were not confirmed. On the contrary, we found that an understanding of climate change mitigation through an ecological modernization discourse is even stronger in the South African textbooks than in the Norwegian ones. This finding may also serve as a reminder of the not so useful categorizations and dichotomies between a Global South and Global North (or, for example, 'developing' versus 'developed' countries), which determines how we establish prejudicial and broad-brushing assumptions about countries.

The concept of a vertical and a transversal axis of comparison, with a *policyscape* of climate change education is useful to contextualize how educational phenomena, policies, and content are increasingly interconnected across scales. The horizontal axis reminds us that textbooks are manifestations of educational policies and its appropriation at local scale. Furthermore, differences in the textbooks' contents and approaches can be traced back to differences in curricula and educational traditions across the horizontal axis in the respective country contexts. For example, the instructional design of the South African curriculum set certain limits to the textbooks' development and contents compared with the less predefined Norwegian curriculum.

This study culminates in a question about whether geography textbooks are well adapted tools for climate change education. The multiple and overlapping nature of climate change discourses identified in the study demonstrates the complexity of the underlying factors of problems and solutions to mitigate and adapt to climate change. The scientific quality of textbook contents is important to ensure that substandard or off-topic textbooks are not used in teaching activities at schools. Nevertheless, it is equally important that textbooks facilitate critical discussions and reflections on the multiple perspectives and conflicting interests that climate change often represents at various levels and scales, from the local to the global. In this regard, the theoretical strands of political ecology may offer an important didactical and

analytical framework for critical analysing representations, cases, and 'stories' related to climate change, which can be of relevance for framing climate change in textbooks (including geography textbooks), and in climate change teaching and education in general.

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