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Political Discourses as A Resource for Climate Change Education: Promoting Critical Thinking by Closing the Gap between Science Education and Political Education

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Abstract: This paper discusses political discourses as a resource for climate change education and the extent to which they can be used to promote critical thinking. To illustrate this, we present here an activity developed in the online course, Freirean Communicative Educational Situations for Climate Change Education, designed and developed as part of postdoctoral research at the Federal Rural University of Pernambuco, Brazil. The activity aimed to analyze the speeches of the Presidents of Colombia and Chile at the United Nations Climate Action Summit (2019) in a way which approached climate change as a socio-scientific issue. We argue that climate change education should not only involve learning about risk, adaptation, resilience, and basic scientific concepts, but also critical reflection on public policy and discourses and transformative content. This includes consideration of non-formal and informal communications and analysis of how power relations can restrict, motivate, or boost the impetus towards climate change education. These kinds of classroom activities enable teachers to work with a combination of core critical thinking skills, attitudes, and abilities, as well as discussing the details of science and scientific knowledge. This in turn enables the gap between the scientific and political aspects of climate change education to be bridged.

Keywords: climate change education; discourse analysis; policy analysis; environmental education; sustainability education; ideologies; critical thinking

Citation: Mejía-Cáceres, M.A.; Rieckmann, M.; Folena Araújo, M.L. Political Discourses as A Resource for Climate Change Education: Promoting Critical Thinking by Closing the Gap between Science Education and Political Education. *Sustainability* **2023**, *15*, 6672. https://doi.org/10.3390/su15086672

Academic Editor: Karmen Erjavec

Received: 1 February 2023
Revised: 31 March 2023
Accepted: 11 April 2023
Published: 14 April 2023

1. Introduction

1.1. Climate Change and Education

The climate crisis is requiring strategies to be developed in diverse sectors: for politics and the economy, as well as education. Article 12 of the Paris Agreement [1] states that "Parties shall cooperate in taking measures, as appropriate, to enhance climate change education, training, public awareness, public participation and public access to information, recognizing the importance of these steps with respect to enhancing actions under this Agreement". It requires governments to commit to creating policies, programs, and agendas to facilitate this educational process. In that regard, and as UNESCO points out [2], education is an essential element of the global response to climate change. The scientific community has been discussing different concepts of environmental and sustainability education (ESE) for several decades and more recently climate change education too (e.g., [3–10]). Environmental and sustainability education tries to bring the relationship between humans, society, and environment into equilibrium, identifying wicked problems and seeking contributions from the field of education that address them. As Stevenson et al. highlight, climate change education is about learning in the face of risk, uncertainty, and rapid change; at the same time, it presents an opportunity to develop capacities to address the climate crisis [8].

Regardless of which concept one considers, what they have in common is the need to take two variables into consideration: education and the environment. Both of these variables are related to social, political, and economic interests. In addition, assuming that education is managed and delivered through ideological institutions (i.e., governments), schools as institutions are instruments that can assist with switching from a political civil society to a regulated society [11]. If the capitalist economic system continues to be maintained, it will be difficult to achieve the goals of environmental and sustainability education and climate change education, because established social structures have assigned schools the dominant position [12] (p. 22). According to Althusser, "the school teaches 'know-how', but in forms which ensure subjection to the ruling ideology, or the proficiency in its 'practice'. All the agents of production, exploitation, and repression, not to speak of the professionals of ideology" [12] (p. 6). This means that if a government adopts a neoliberal ideology in order to maximize capitalist profit, schools—as apparatuses of the ideological state—will design and develop education from this perspective. Neoliberalism is a complex of values, ideologies, and practices that affect the economic, political, and cultural aspects of society [13] (p. 1). Currently, neoliberal capitalism can be described as a global phenomenon. The effects of neoliberal policies are increasing global and national inequalities and diminishing democratic accountability, and the theory of neoliberalism in education policy is stifling critical thought [13] (p. 11). Given that this form of government is not seriously committed to environmental issues, climate change, and other issues (as it cannot be in the context of a neoliberal doctrine), climate change education will not be reflected in educational programs, curricula, and practice unless communities take the initiative, designing and developing activities locally.

Looking at local activities, we found that educators and communicators from different institutions, agencies, and organizations have developed materials, online courses, and teacher training sessions, and have launched programs to promote understanding of mitigating and adapting to climate change [14]. However, although in few cases content is linked with social issues, it more often deals with concepts such as the oceans and the cryosphere in a changing climate, the greenhouse effect, the impact on the land, and other ecological topics [15]. According to Singh,

> "The climate crisis presents formidable challenges of transdisciplinary complexity, and vast special and temporal scales . . . climate crisis is also a crisis of ethics and justice, disproportionately affecting those who are least responsible for it, including the poor, people of color, the global south, Indigenous people, and the young." [16] (pp. 169–170)

In light of the fact that climate crisis also encompasses social and political issues, this article describes an activity developed by one educator's work on the basis of Paulo Freire's concept of dialog (dialog in this context relates to subjects' encounter with the problems of reality, their communication and their critical analysis of such problems in order to collaborate and transform the world [17]), the nature of science (for Lederman [18,19] this term refers to the epistemology of science, science as a way of knowing, or the values and beliefs inherent to the development of scientific knowledge), and socio-scientific issues (according to Zeidler and Nichlos [20], the expression "socio-scientific involves the deliberate use of scientific topics that require students to engage in dialogue, discussion and debate. They are usually controversial in nature but have the added element of requiring a degree of moral reasoning or the evaluation of ethical concerns in the process of arriving at decisions regarding possible resolution of those issues"). This approach has enabled the researcher to focus on critical thinking and to bring ethical and political dimensions into education alongside biology and geography. The work was developed in the context of the online climate change education-based course, Freirean Communicative Educational Situations for Climate Change Education, which was designed and developed as part of postdoctoral research, as an extension of the Graduate Program in Science Education (PPGEC) and the Paulo Freire Department of Education for Sustainability at the Federal Rural University of Pernambuco (UFRPE), Brazil.

Our assumption was that teaching learners about climate change would help to develop their critical thinking, understood as the capacity to evaluate the epistemic quality of information, and to calibrate their confidence concerning it [21]. Teachers and students receive a great deal of information about climate change through a range of media, such as the internet and television. However, there is also academic work, for instance the Oregon petition (a petition arguing that global warming was not a reality, and was put together by Arthur B. Robinson, President of the Oregon Institute of Science and Medicine, who claimed to have gathered thousands of signatures from climate change skeptics), which opposes the idea of climate change. So we needed to consider whether environmental and academic groups might have different interests and ideologies. According to Van Dijk, discourses are underpinned by ideologies, and it is therefore possible to identify the structures of such ideologies through reasoning [22]. In that regard, if we understand which political reasoning and ideologies the State or these academic groups are promoting, we can take this knowledge into account when designing educational processes. We can also briefly consider the characteristics of science and scientific knowledge, namely the nature of science; according to Lederman, science follows, affects, and is affected by the various elements and intellectual spheres of the culture in which it is embedded [23] (p. 141), for example power structures, politics, and socioeconomic factors.

In order to bring this kind of discussion into the classroom, it is important for both teachers and students to develop critical thinking skills, so they are "capable of relying on correct information, relevant knowledge, and well-established facts" [24] when making decisions. As Hargis, McKenzie, and LeVert-Chiasson point out, "the focus on criticality is essential because of media trends suggesting there are two sides to climate science, which can contribute to a student in confusion at best and mistrust of science at worst" [25] (pp. 47–48). This is even more the case when some contributions to the United Nations Climate Action Summit (2019) are discursive strategies to maintain the dominant ideologies of the market system, and to omit the reality of local policy agendas.

1.2. Toward A Critical Climate Change Education

Climate change education must start from the idea that the role of the educator is to facilitate dialog about specific situations [6]. Education must foster the creative impulse, as Freire [26] points out, which means recognizing that climate change exists, that it affects us, and that it affects some communities more than others. But do teachers have sufficient understanding of climate change? Can teachers identify which concrete situations are linked to climate change?

Social media, politicians, social movements, education, environmental and sustainable education (ESE) research, and other sectors of society all make daily references to climate change. The topic is discussed in many different ways by a wide range of groups. As a result, ESE researchers made the mistake of taking it for granted that the issue is understood by education communities.

ESE research needs to recognize the gaps we have with regard to climate change education. It must not start from ideological, political, or commercial perspectives, because that would result in education by majority opinion, and this is the case with climate change education. The climate change education sector needs to take on board the Freirean concepts of the alienated society, the closed society, and the society in transition [26], because these are linked to the possibility of change and social transformation.

Climate change education is controversial. It is not just about recognizing and assuming that climate change is a reality. Literature reviews of publications associated with this topic indicate that "the US has the largest number of publications on CCE with 39% of the articles. Followed by Brazil with 7.14%, Canada, Australia, Singapore, Mexico each with 6.12%, and UK with 5.10%" [27]. According to Caride and Meira, "in the Manichaean view, the most developed countries are the ones that invest the most in the management and improvement of the environment, and the poor are the least likely to do so" [28] (p. 49). However, this overlooks the fact that many environmental problems are the product of the

large multinationals operating in developing countries, which are responsible for environmental crimes in those countries. Fewer publications in these areas hence do not necessarily mean there are no educational or investigative processes on the subject, but rather that there is a lack of opportunity to generate them.

It is for this reason that any proposal relating to climate change education must also concern itself with social structures. It is here that we can refer to socio-scientific issues, linking science, technology, and society from different perspectives including the social, ethical, economic, and political. In addition, climate change also encompasses technological knowledge, environmental problems (landslides, floods), and health issues (psychological and physical). Climate change education thus requires a context-based learning environment, where learning needs to include knowledge, skills, attitudes, and values [29].

Values also need to be reconsidered, since critical thinking starts from the assumption that scientific knowledge is inferential, creative, and socially and culturally embedded, and takes the view that scientists' work is influenced by their theoretical commitments, beliefs, previous knowledge, training, experiences, and expectations. In other words, science too is driven by values, because it is an activity undertaken by human beings. The human being must be considered in its entirety, and this also implies a complex and holistic vision of the world. This discussion is reflected in social practice through decision making and re-evaluation of decisions. Freire's focus is the oppression of human beings, but nature has also suffered from domination and conquest. It is for this reason that we consider it necessary to bring into education that integral gaze, which is an expression of the housing [30]. Climate change education must recognize that our relationship with nature consists in the progressive transformation of nature into humans. It is impossible to build a culture without transforming our natural environment. The problem is the accelerated transformation that has resulted from capitalism and the homogenization of cultures.

Freire [26] asserts that human beings are beings of relationships, and that one characteristic of such relationships is the way in which humans capture them and make them the object of their knowledge. When humans understand their reality, they can make assumptions about the challenges it entails and look for solutions. Thus, they can transform reality and create a world of their own [26] (p. 38).

Education aimed at achieving social transformation in the context of environmental education, education for sustainable development, or climate change education implies the cultivation of a critical perspective that will enable learners to understand the political and economic dimensions of the power struggle, in which science also has to participate. It might therefore be dangerous to denounce or resist certain hegemonic practices that arise in the context of socio-environmental injustice.

In this context, we are not talking solely about oppression. We are also addressing emancipation, and this can begin with climate change education. Climate change education allows us to rupture these hegemonic relationships; as we progressively transform our practice, we can make our actions more emancipatory. We must think and act collectively, resisting the focus on individuality that we have been sold by capitalism. In the search for emancipation, we need love and solidarity. We need to rehumanize ourselves, because the determinism and mechanistic conceptions of science have led us to forget what it means to be human. Understanding of the human as a bio-psychosocial and cultural being enables us to take a holistic rather than a fragmented view of the human. From this perspective, there are three dimensions to humans: the biological, where we recognize ourselves as part of nature, but are also determined by our organs and systems; the psychological, because humans also have emotional and rational process that comprise our personality; and the social, because we grow up with values, beliefs, roles, and identities depending on our cultural contexts. In other words, humans are mind, body, and environment [31].

2. Online Course: Freirean Communicative Educational Situations for Climate Change Education

2.1. General Presentation

The online course Freirean Communicative Educational Situations for Climate Change Education was offered as training for pre-service and in-service science teachers in elementary and middle schools. The research process involved several design stages before the activity that is presented in this paper. We undertook a review of literature on climate change education and a review of multilateral organizations' guidelines. Thereafter we conducted an online survey, a pilot course in Brazil, which we analyzed before restructuring the final course for Latin American teachers. This was delivered online via synchronous Zoom sessions, twice a week for two months in 2022. Of the 33 individuals who registered, 16 participated in all the course sessions. Participants came from six Latin American countries: Guatemala, Costa Rica, Colombia, Bolivia, Chile, and Brazil.

The final course structure comprised thematic units, thematic axes, Freirean communicative educational situations, and scenarios (Table 1). The thematic units and axes reflected the literature review, our critical perspective as researchers, and teachers' feedback from the pilot course. The Freirean communicative educational situations were based on elements that Freire [26] established as necessary or identified as critical for education seeking to achieve social change. These included the understanding of the human being as a being of relationships situated in the natural world and culture, the perception of reality, the replacement of the idea of the passive citizen with the idea of the responsible citizen; unity in diversity, and the hope of transforming our predatory habits. These elements all presented humans as fundamentally in relationship, both with the human and the not human, and all contended that to be able to change our reality, we first need to understand it. The design of the curriculum was inspired by the proposal by Mejía-Cáceres, Monteiro, and Araújo with regard to Freirean communicative educational situations [32]. The scenarios are the circumstances in which the activity takes place. The purpose of such activities is to foster cultural recognition and promote a better relationship between human beings and between humans and non-humans. The scenarios proposed by Mejía-Cáceres, and Zambrano (2018) are discussion groups, critical reading, provocative questions, case studies, production of written documents, debate, symbolic rooting in context, identifying relationships between culture and nature, recognizing the predominant ethos, and conceptual and educational practice [33].

The thematic axes cover socio-scientific issues, the nature of science, and dialog. For example, the thematic axis "what is climate change?" addresses the socio-scientific perspective, for instance, through discussion about whether climate change is accorded increased importance by a sociocultural environment that has different values from the science [34,35]. The "environmental limits of culture" axis brings in the concept of dialog as a means to achieve knowledge, allowing for interaction between the student's knowledge from reading about the environmental problems in their immediate context and the science teacher's knowledge, implying a constructivist approach to education. Another example is the "climate change skeptics and impacts on school social processes" axis, which addresses the nature of science by providing space to discuss the fact that scientific knowledge is never absolute or certain [23].

Table 1. Course structure.

Thematic Units	Thematic Axes	Related Concept
1. Climate Change	1.1 What is climate change	Socio-scientific issues
	1.2 Phenomena associated with climate change	
2. Environmental crises, crises of knowledge and culture	2.1 Environmental limits of culture	Dialog
	2.2 Local environmental problems	
	2.3 Political dimensions of climate change	
	2.4 Climate change skeptics and impacts on school social processes.	Nature of science
	2.5 Citizens as consumers	
3. Pedagogical strategies for climate change education	3.1 Educational sequence 3.2 Teaching materials	Dialog, socio-scientific issues, and nature of science

Source: Course structure, adapted from [36].

2.2. Planning Stage: Preparing the "Political Dimensions of Climate Change" and "Climate Change Skeptics and Impacts on School Social Processes" Thematic Axes

The planning stage drew on prior critical analysis of political discourses. The results of the analysis were used as educational material (lecture and analysis) for the *political dimension of climate change* and *climate change skeptics and impacts on school social processes* thematic axes (2.3 and 2.4), feeding into discussions covering climate change, science, and society.

Preparation of content for use in the classroom involved preliminary discourse analysis of the speeches of the Presidents of Colombia and Chile at the 2019 United Nations Climate Action Summit (23 September 2019 in New York). Below we explain what critical discourse analysis consists of and present the analysis conducted. We believe it is important to provide a brief presentation of the analysis, because this was subsequently given to the course students for analysis.

2.2.1. Critical Discourse Analysis (CDA)

The process of developing public policy on environmental education or on climate change requires knowledge of a wide range of variables, including historical, theoretical, methodological, and legal issues. According to Cerda, "it is imperative to produce a centrifugal diagnosis that generates vertices linked to the central problem, to analyze each vertex and to produce a strategic and functional plan that establishes formal guidelines to support the responsibility of policy for government and society" [37] (p. 63). In this context, it is necessary to recognize the stakeholders in any given territory, identify the collective desires that direct initiatives, and consider both formal and non-formal education, since these are governed by different norms, guidelines, and cultures. Policy must be able to deliver strategies that take into account the demands of the public administration itself, with the participation of the various organs and instances of the law [38].

Therefore, on the basis of critical theory and critical discourse analysis, we view environmental education and climate change education as a network of social practices in which discourses move from one practice to another [39]. These movements can take the form of colonization and/or appropriation, given that when discourses move from one social practice to another, they are recontextualized [40].

Discourse analysis is the analysis of semantic interactions; in other words, it can be applied both to political discourse and to educational processes [41]. Significantly, it can indicate where the power lies in relationships, identities, ideologies, opposition, critical

opinions, etc. We would argue that political discourse is not transparent and that there are interests and motivations that are not openly communicated [42]. These have implications for society and the environment, which can reproduce, and/or transform social ideologies and practices [43–47].

According to Martínez, "the central objective of critical qualitative research transcends explanation in favor of prediction, control or verification of hypotheses, which are characteristic aspects of quantitative investigation" [48] (p. 107). We thus used critical discourse analysis both as theoretical backdrop and methodology. We identify discourse as action, and the social context as an object of observation that cannot be ontologically separated from the discourse. Moreover, in the context of the two dimensions of the structure (government (presidents) and the education system), we agree with Fairclough that "texts are involved in processes of meaning-making and that texts have causal effects that are mediated by meaning-making" [49] (p. 122).

We considered the strategies behind each of the discourses, using the transcriptions of the Colombian and Chilean Presidents' speeches at the United Nations Climate Action Summit. We first undertook a general reading, and then moved on to textual analysis. Our research identified different dimensions of the texts that included generic structure (gender type, gender mix), topics: sematic macro-structures (what the discourse "means" in global terms; includes the main information and explains the overall coherence of the text and the conversation), local meanings (the meaning of words), modality (text types such as epistemic, deontic), speech acts (arguments, questions, demands, offers, evaluations), presuppositions, and intertextuality (other texts and voices that are included and/or referred to), providing for an understanding of the cognitive dimension as set out in Van Dijk's theory [39,50].

We approached the socio-cognitive dimension by identifying modes of operation of ideologies as proposed by Thompson [51], who identifies legitimization, dissimulation, unification, fragmentation, and reification. Typical strategies of the first of these represent relations of domination as being fair and worthy of support. Three strategies of symbolic construction are deployed here: rationalization (rational foundations), universalization (dissemination of representations), and narration (reproducing stories). With regard to dissimulation, Thompson explains that this mode hides, denies, or obscures relations of domination; its strategies are displacement (entering the discussion to add positive or negative connotations), euphemisms (presenting actions in a positive light) and tropes (synecdoche, metonymy, metaphor). Unification uses symbols to construct and generate a sense of collective identity. Strategies here include standardization (where a standard is proposed as a shared foundation) and the symbolization of unity (which deploys symbols such as flags, anthems, and narratives). Fragmentation, as its name indicates, is the division of individuals or groups. Its strategies are differentiation and the construction of an "enemy" identity in the other through polarization and division. Finally, reification represents transient, social, historical situations as if they were permanent and natural. The strategies here are naturalization, externalization, nominalization, and passivization (p. 81).

Regarding the social dimension, we undertook conjecture analysis as propounded by Chouliaraki and Fairclough [40]. According to the authors, the conjuncture they refer to represents a particular path of a network of practices that constitute social structures. With this in mind, we reviewed local newspapers (online versions) to generate an approximation of the social practices associated with the Presidents' discourses.

Our search was conducted on the basis of newspaper names and keywords. For example, the President of Colombia referred to practices associated with the protection of ecosystems, and, in this case, we searched for state and political practices relating to the protection of ecosystems and nature reserves. We identified other types of practices such as bills on fracking, social movements opposing it, and problems with socio-environmental leadership. We undertook the same search for the Chilean context in order to be able to cross-refer between the information in the Presidents' discourses.

2.2.2. Colombia: Climate Change as Economic Rhetoric and Strategy

President Duque's discourse started with a presentation that described a positive picture. Legitimization strategies used in his discourse started with comparisons of gas emissions, went on to set out global energy production rankings (Colombia being ranked 6th), and finally emphasized the importance to the world of two ecosystems, a large percentage of which are in Colombia (badlands (50%) and tropical rainforest (40%)). Other social practices referred to in his discourse included the implication that local policies in Colombia favor the protection of ecosystems, green energy production, water, and agroecology, among others. It was thus necessary to analyze his discourse with reference to realities on the ground in order to understand the level of his commitment to environmental issues.

It is worth highlighting one of his statements:

> "Natural disasters: this situation demands that we act with determination with a sense of urgency, that we understand that this is the greatest challenge, the challenge that requires action on the part of all." (Duque's discourse, 23 September 2019)

What about natural disasters that are the result of human activity? Which social practices to help economic growth had an environmental impact? What was the contribution of local agendas that led to determined and urgent action? Does support for fracking not cause natural disasters? Mejía-Cáceres, Freitas Juliani, Ventura, and Freire argue that "The substitution of social justice for market laws leads to different types of crises, in particular those that lead to deterioration of the conditions that are our basic human right, and which always has the biggest impact on the most marginalized populations" [52] (p. 36). In this context, social, environmental, and human rights leaders are being kidnapped, displaced, and murdered. For example, Francia Márquez, the winner of the Goldman Prize, was attacked during a meeting with local leaders. Her work has protected the ecosystem of her region, and she has denounced the mining and extraction of gold in her region. According to the Presidential Counsel for Human Rights and International Affairs, 289 local leaders were murdered in Colombia between 2016 and 2019 [53].

We found evidence of the strategy of legitimization throughout the Colombian president's speech. We did not find any evidence of contradiction that might work in his interest. For example, he omitted reference to the interest in fracking. The study of Colombia showed that local leaders' voices were camouflaged or absent.

Overall, we found Duque's discourse to evince an interest in the private sector and economic benefit, in contrast to his references to Indigenous and other communities, which are concerned with the benefit of social inclusion.

> "And we have also made a commitment to the private sector, to all companies that fund renewable enery and energy efficiency; we will allow them to exempt 50% of their investments from the corporate income tax." (Duque's discourse, 23 of September 2019)

2.2.3. Chile: Climate Change Proven by Non-Ideological Science

President Piñera's discourse was based on the legitimization strategy, and used science to support his assertions. He started with an affirmation about the impact that all humans can have on the planet, taking an instrumentalist and positivist view of science and affirming that the sciences are neutral, without ideology. This fails to take account of Habermas' thesis about science as ideology. According to Chauí:

> "Ideology is born to make men believe that their lives are a result of the action of certain entities (Nature, the gods or God, Reason or Science, Society, the State) that exist in and of themselves and to which it is legitimate and legal for them to submit [. . .] The role of ideology is to ensure that "true" ideas emanate from dominant groups. Its role is also to make men believe that such ideas effectively represent reality." [54] (p. 34)

In consequence, we found that Piñera's arguments used mathematical and chemical terms, such as "temperature record", "indicators", and "concentrations", in order to increase the validity of his discourse. It could also create the impression that the Chilean President is interested in science and supports it. As he said:

> "The indications that this is extreme climate change are conclusive and overwhelming; they are not the result of faith or ideology, they are derived from science, and we must learn to listen to science better." (Piñera's discourse, 23 of September 2019)

However, Chilean science is having problems with funding: it has been 0.38% of their GDP for a long time, despite academics' high production rates, publications, and the recognition of their contribution in the Latin American context. As Rau and Jaksic put it:

> "In fact, the scientific community's protestations have reached the streets, denouncing the scarcity of funds for scientific research in the country [. . .] the fact that scientific policies on the national level are designed solely on a short-term basis, from 3 to 10 years, has been continuously criticized." [55] (p. 192)

The disagreement between Chilean society and the government about education and science, and pressure from social movements, changed the government's plans to hold COP 25 in Chile. It was moved to Spain. This is a further indication of the disconnect between political discourse and the realities being faced by the people.

The discourse also included positive presentation of Chile's commitment to becoming carbon neutral, which covered the following actions: decarbonizing its energy matrix and replacing it with clean and renewable energy, transforming the public transport system by means of electromobility, establishing rigorous energy efficiency standards in all sectors, and an ambitious reforestation plan. We thus found the discourse to contain macro speech acts referring to "our good deeds", which all arose from the attitudes, judgments, and feelings that were expressed in the speech. Speaking about the "commitment to our children, grandchildren", the President said "it will be sad", thus confirming his presentation of himself, and depicting others as being unclear and not being sufficiently committed.

2.3. Designing the Activity

To address the thematic axes relating to *political dimensions of climate change* and *climate change skeptics and impacts on school social processes* (2.3 and 2.4, respectively), we based our process on the Freirean communicative educational situation, namely, replacement of the image of the passive citizen with the image of the responsible citizen and unity in diversity.

The theory implies that, in order to foster active and responsible citizens, education needs to develop learners' ability to organize their reflective thinking about what can be done. This would then provoke the urge to create, which, as Freire indicates, every human being has [26]. Developing a critical conscience thus enables human beings to transform reality on their own account.

Therefore, educational process would aim to replace a naïve stance, where learners "believe [themselves] to be superior to the facts, dominating them from the outside, and for this reason [. . .] considering [themselves] free to understand them as [they] please" [56] (p. 183), with an increasingly critical stance, which acknowledges "things and facts empirically as they occur, with their causal correlations" [56] (p. 183), and thus helping human beings to take action that is critical and characteristic of society in transition. Responding to the demands of fundamental democratization and inserting themselves into the historical process, human beings renounce the role of mere objects and demand to fulfil their vocation, by becoming subjects.

It is thus evident how much of the political discourses we analyzed took a naïve stance towards climate change, ignoring the facts, evidence, and science (in which context more than 95 % of climate researchers agree that climate change exists and is man-made).

For Freire, to enable learners to develop a critical stance, education needs to be based on (a) an active dialogical and critical method; (b) the modification of the programmatic

content; and (c) the use of techniques, such as reduction and encoding [56]. An active, dialogical, and participatory method is crucial.

Given the theoretical perspective on which we developed the thematic axes, we also designed an activity and a debate that engaged with the relationships between culture and nature. The activity took as its starting point the complexity of nature, which comprises a wide range of social, historical, economic, scientific, linguistic, and cultural dimensions and phenomena. It required students to interpret these relationships and complexity in the context of different cultures [33], and the debate asked them to provide reasoned arguments for and against a proposition [57].

3. Discussing the Presidential Discourses with Course Participants

Having explained the theoretical background, we need to clarify that the thematic axes 2.3 and 2.4 aim to discuss different perspectives on climate change and develop a critical view of the various discourses associated with the subject, linking them to teaching processes. This was achieved through a lecture addressing the characteristics of a closed society, socio-environmental vulnerability, the alienated society, society in transition, critical environmental education, and socio-environmental justice.

The students then listened to the Spanish version of the episode of the Environment and Everyday Life podcast, titled, "Is climate change is it a political problem?"

The second session of axis 2.3 focused on reflection and the organization of thought, dialog, and the nature of science and socio-scientific issues. It also introduced the application of critical discourse analysis to the Colombian and Chilean Presidents' speeches at the United Nations Climate Action Summit, followed by an activity called "articulating with education", which aimed to identify the implications of the discourse analysis for approaching climate change as a socio-scientific issue.

Climate change and other controversial societal issues have considerable scientific, technological, political, and environmental implications that can be considered in science classes to encourage students to participate actively in discussions, and to enhance pupils' personal and social growth [47]. Course participants were divided into four groups to discuss the following questions. Given that the socio-scientific debate has a number of dimensions, how would you use political speeches on climate change to prompt discussion on education? How would you use discourse analysis to address the political dimensions of climate change within an education debate? How could this political dimension be considered alongside other dimensions such as the environment, ethics, and education? We analyzed the output of groups' discussions using ATLAS.ti software, creating in vivo codings and networks.

The groups' responses to the first question—how you would use political speeches on climate change to prompt discussion on education—were as follows:

> "To promote social commitment to communities and sustainable development, fostering a harmonious and respectful approach with the environment. To promote a horizontal dialog with the whole student body." (Group 1)

> "The contradiction of the discourses on climate change could be evidenced, with students describing the existing problems in their own territories and analyzing news reports on the key issues referenced in the Presidents' speeches, and considering interviews with experts where socio-scientific data is available on the issues addressed." (Group 2)

> "We would use it as a prompt for reflection and verification of knowledge and scientific data with regard to the fight against climate change and the improvement of pedagogical practices. We would actively care for *Pachamama* [Mother Earth], for instance by visiting particular sites, or picking up garbage, to encourage respect for the natural world and awareness of the solstice, the equinox, and the cycles of life. It is better to take action than to get lost in the discourse." (Group 3)

> "You could compare the information on the biological, cultural and political biodiversity of each country, showing the realities of each, their variety and the ways they have changed." (Group 4)

Participants' answers on this topic led us to conclude that the use of this kind of discourse can help to develop critical thinking, allowing them to "mobilize mechanisms for identifying the real intentions of their informants, and to assess the depth of their knowledge [21] (p. 4). In this context, we highlighted words such as "evidenced", "contemplate", "verification of knowledge", "comparison", and "analysis", which referred to assessing the quality of information, or as Sperber et al. put it, epistemic vigilance [58].

We also saw how the discourses, in order to validate the information they contained, made use of the legitimization mode of operation, deploying the symbolic construction strategy of rationalization. To address this, participants proposed collecting information from various sources, and contrasting it with the reality in the territories in question.

Our basic concept of the socio-scientific nature of science and the importance of dialog was also reflected in students' answers, as was environmental activism. Connecting science more strongly with the use of the political discourses in the classroom enables discussion about the nature of science and scientific knowledge, for example: the distinction between observation and inference; scientific laws and theories; and how science is never neutral, but is prompted and guided by knowledge that can never be absolutely proven (Figure 1).

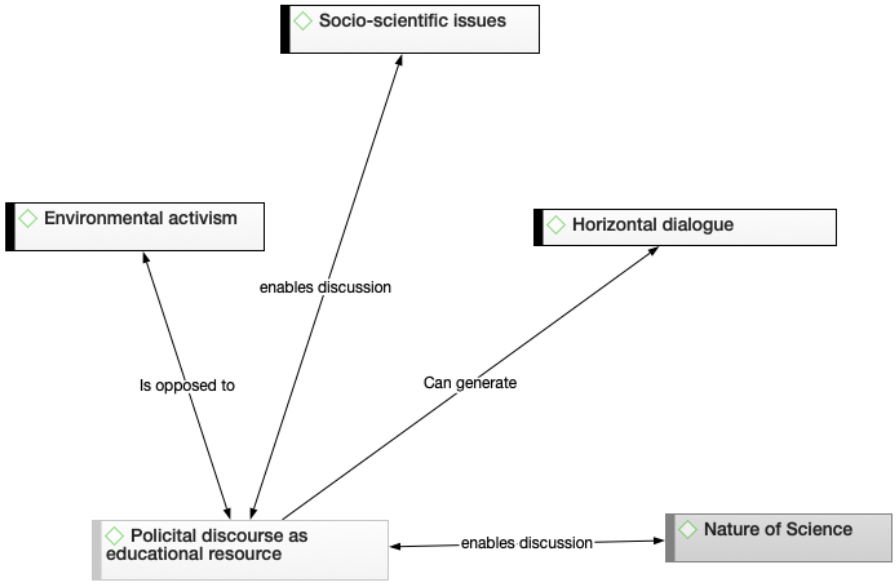

Figure 1. Basic concepts of the framework in participants' discussions.

It is possible to work on the nature of the sciences not only by deducing analytically correct propositions but also by developing synthetically valid statements. Habermas [59] cites Peirce's three forms of inference (deduction, induction, and abduction): "the deduction proves that something has to proceed in a certain way, the induction that something abduction that something supposedly proceeds that way" (p. 183). The last two are important from the point of view of research logic, since "the information that flows from the experience enters our interpretations through these routes" [59] (p. 184).

The Presidents' speeches can thus be understood as correct statements, but they provide a basis for discussion of how "on the one hand, the validity of a probable argument cannot result from the determination of objects, from a fact; on the other, such an argument can also cannot be reducible to that form that is valid regardless of how the facts may be" [60] (p. 245).

In addition, participants' answers enabled us to identify the four dimensions of every social event, as set out by Bhaskar: our material interaction with nature, our interaction with others, the social structure, and the stratification of our embodied personalities [61]

(p. 150). In line with Bhaskar, the teachers' discussion of interactions with nature covered the importance of a harmonious and respectful relationship with it, which in turn was linked with the stratification of personalities because of its connection with our internal structure (calm instead of anger), practices of care for the *Pachamama* (Mother Earth), enjoyment of the landscape, and being in harmony with nature (equinox, solstice). With regard to interaction with others, participants referred to horizontal dialog. Discussion of social structures dealt with the political configuration of their countries. It is important to remember here that social structure includes human agency, and one group referred to this, highlighting the need not to focus only on the discourse but also to take practical action.

Pasquinelli et al. highlight "the necessity of specific education in order to achieve a proper understanding of what counts as evidence, the existence of a developmental path (and the role of experience) for both assessing informants, and for placing one's confidence correctly and explicitly" [21] (p. 5).

With regard to the second question (how would you use discourse analysis to address the political dimensions of climate change within an education debate?), the groups responded as follows:

> "As a strategy for prompting analysis of and inquiry into social knowledge, contrasting it with scientific knowledge." (Group 1)
>
> "Given that discourse analysis allows us to determine the intentions of the "speaker", and what they are trying to persuade their audience of, one could identify recurring concepts and their relationship with the context of the discourse, so that intentions could be interpreted. To the extent that the meaning of expressions can be revealed, political intent can be identified." (Group 2)
>
> "Discourse analysis can help us shape policies to combat climate change. It highlights inconsistencies in speeches. It contributes to improvement in the economy, policy, and education." (Group 3)
>
> "The President of Chile's speech focuses on statistics, mathematics and chemistry and the President of Colombia's speech on the emotional aspects of climate change. To address the political dimension of climate change in each country, a round table could be held, with half the students discussing each speech, analyzing the points made in order to illuminate the two different points of view and contexts. The groups could be asked to analyze and report on whether what the speech promised had been delivered or complied with, designing a campaign to transmit the knowledge learned from each country in the form of an illustration, thus showing the reality behind each speech." (Group 4)

In this second question, we found that, as well as addressing how the discourses could be used, participants also considered why they should be used, for example to "determine intentions", and "make [agendas] visible". We thus concluded that this kind of discussion in the classroom can help raise awareness of how individual consciousness is shaped. The denial of what is publicly recognized as a reality, as evidenced in a political discourse, in turn prompts discussion on the empirical nature of the sciences. As Habermas says, "in the dialogical clarification of metatheoretical issues, researchers' communication uses knowledge of mediated symbolic interactions, which is a prerequisite for the acquisition of relevant knowledge, without it being able to justify itself by means of the categories of that knowledge itself" [59] (p. 223). The answers highlighted the importance of critical thinking skills when judging the credibility of sources, the use of existing knowledge, and the process of inference [62]. We also found that the speeches could be used for inquiry-based learning, which helps students to develop problem solving skills [63].

In the model of the inquiry process developed by Justice et al., students take responsibility for their own learning, engaging with a topic and developing basic knowledge, coming up with a question, determining what they need to know, identifying resources, gathering, assessing and synthesizing data, and communicating and evaluating their new understanding [64] (p. 19).

We derived a model (Figure 2) from the groups' answers, in the form of an activity that other teachers could apply in the classroom. The groups identified the political dimensions of climate change as an engaging and controversial topic. The question might be: how are the political dimensions of climate change addressed in your country? What are the intentions of those who speak on the topic? Then the task would be to determine what needs to be acquired, in this case climate science knowledge and the skills to identify discursive strategies. Resources would be a range of data drawn from science, newspapers, and other media. Students could use critical reading strategies in order to assess data, and, to synthesize their conclusions, they could do a focused, informal writing task based on their reading, for example connecting it to a previous lecture or prior knowledge, comparing/contrasting it with other material, critiquing/evaluating it, or applying the content to a specific scenario. Finally, they would discuss the task in small groups [65].

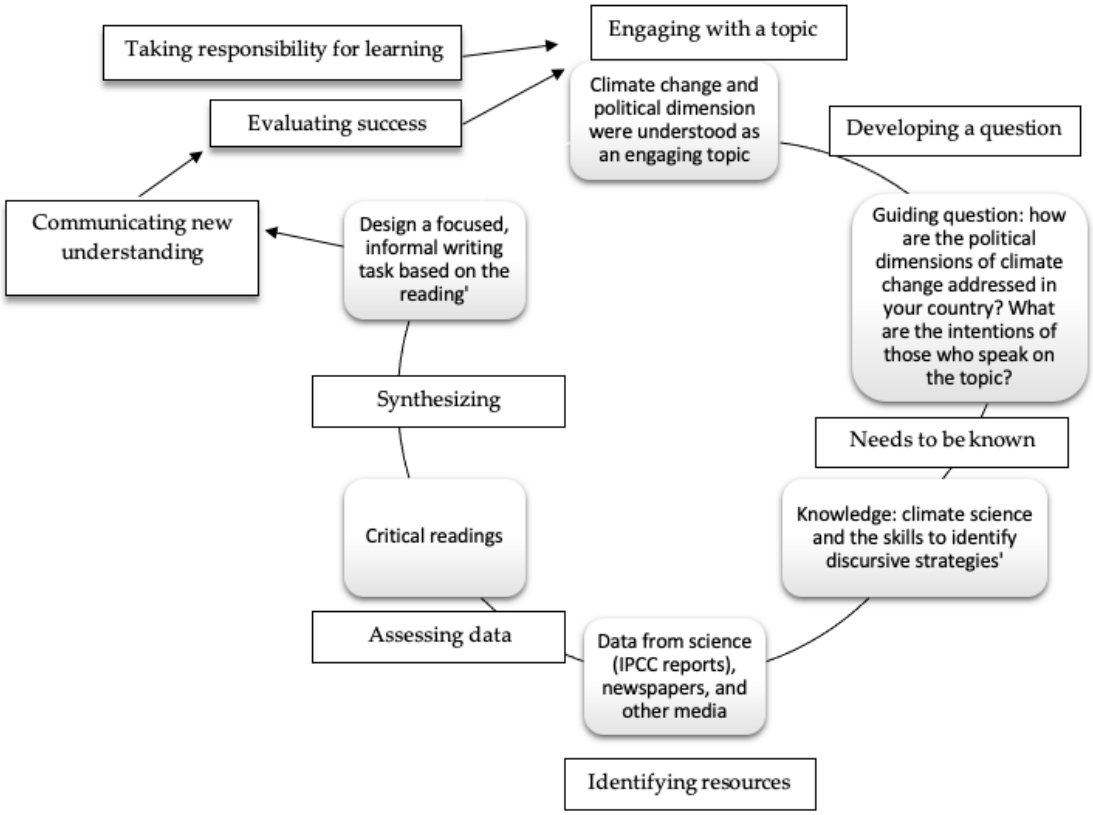

Figure 2. Inquiry process model: policy discourses as educational resources.

Although it is not clear from course participants' responses whether this would be a one-off activity to develop students' critical thinking skills, our knowledge of experience-based learning leads us to suggest that it could be used to complement a series of mini-projects, where students would investigate scientific facts in order to understand climate change and how it is being interpreted in their communities. This would enable them to learn to relate different aspects of the subject to each other and to the real world and to learn to interpret and understand reality in a different way [66] (pp. 27–28).

Groups' responses to our final question (how could this political dimension be considered alongside other dimensions such as the environment, ethics, and education?) were as follows:

> "Ethics must be a dimension that cuts across both education and the environment. There must be a dialog between the different types of knowledge. Education should promote an appreciation of the natural world." (Group 1)

"To the extent that the political intentions of discourses are revealed, the vision of the environment, the ethical perspective and the vision of education that is implicit in such discourses can be identified, and the identification of these elements provides the opportunity to uncover other perspectives on the environment and ethics that relate to alternative political discourses, fostering an emancipatory education that seeks to take a critical stance towards established discourses." (Group 2)

"It is necessary to plan reflective and practical community activities to improve the environment; this is an ethical way of behaving and an integral part of education. It is important that this problem be addressed in practical terms by systems and institutions, and that it is addressed by individuals on an ongoing basis throughout their lives. It is essential that governments and each person take seriously the challenge of improving the environment from an ethical and aesthetic point of view." (Group 3)

"Political decisions impact on the environment, so leaders (politicians) should have principles and values that do not override the needs of the community and the natural world. Different communities need to be included and involved in education, taking action to combat climate change." (Group 4)

The principal practical aspects we identified were critical thinking, the ability to engage in dialog, and reflective and practical community activities (Figure 3).

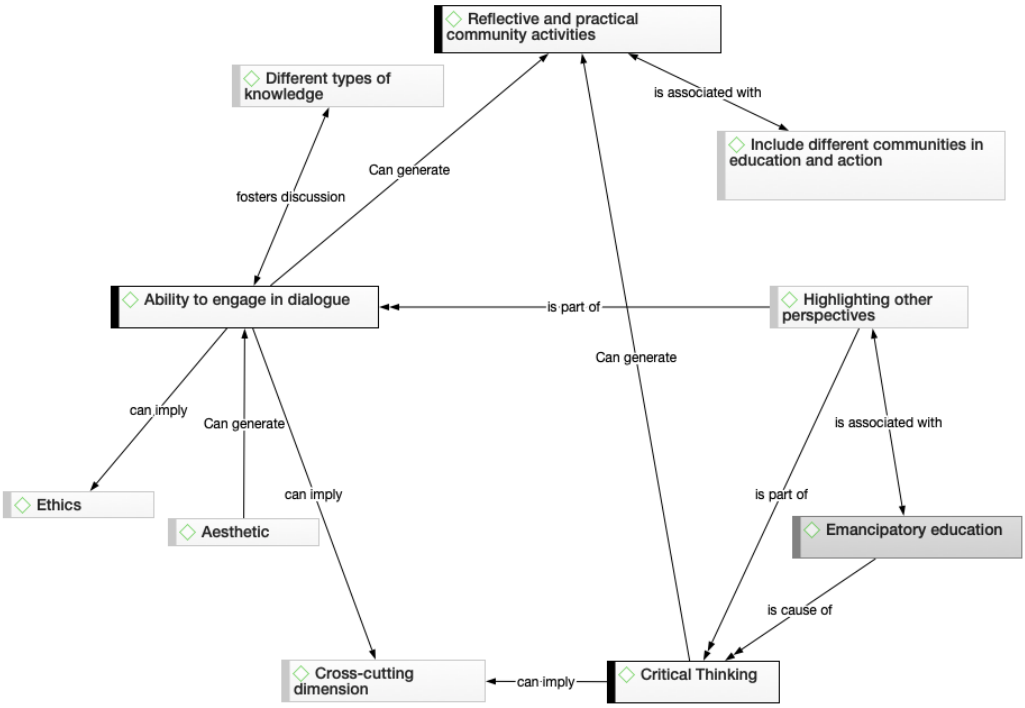

Figure 3. Practical aspects of using political discourses.

In the groups' discourses, we identified a relationship between emancipatory education as a promotor of critical thinking and ethical and aesthetic dialog. Of relevance here is Dewey's definition of reflective thinking as the consideration of any belief or supposed form of knowledge in the light of the grounds that support it and the further conclusions to which it tends [67] (p. 9). The relationships set out in Figure 3 seek to identify the ideal traits of critical thinkers, for example, being well-informed, open-minded, and alert to alternatives (knowing other perspectives and knowledges); taking a position; and changing it when there is sufficient evidence and reason to do so. All of these will help with the planning of reflective and practical community activities.

In this context it is relevant not only to discuss critical thinking, but the Freirean perspective, given that emancipatory education implies a critical and liberating dialog, which in turn implies action. For Freire [17], the oppressed must continually recognize themselves as human, with an ontological and historical vocation to improve themselves and to reflect on their specific circumstances: practical action must be the result of such reflection, and political action is a cultural initiative to increase freedom. Freire emphasizes the importance of the community for this. Care must be taken not to descend into revolutionary sloganeering or liberating propaganda. If there is no awareness of the struggle of the oppressed or dialog with them, there is nothing. For Freire, the solution is the practice of a humane pedagogy.

Freire says that educators and learners (leaders and the masses) both exist within reality. They are in a defect in which both subjects act, not only to reveal the reality, and thus to know it critically, but also to recreate this knowledge. This implies that core critical thinking skills—knowledge construction, evaluation of reasoning, and decision making—must be applied simultaneously to produce the desired outcome. Knowledge construction involves identifying gaps, selecting information, identifying patterns, and making connections. Subsequently, it involves the application of logic, the identification of assumptions and motivations, and the justification of arguments. Finally, it requires criteria for decision-making to be determined, options to be evaluated, and implementation to be tested and monitored [62] (p. 12). In this way, the oppressed must be involved in the search for their liberation, and we should be committed to ensuring that this is more than pseudo-participation [17] (pp. 77–78).

For Freire [68], teaching also involves aesthetics and ethics. For him we are historical, social, and ethical beings, who are able to compare, evaluate, intervene, choose, decide, and break. Noguera takes the view that environmental philosophy, and for us, climate change education, must become part of the poetic (aesthetic) memory of the world [30]. This involves overcoming the accumulation of cold concepts, and the banking of education. In Freire's terms, education "must poeticize the relationships between human beings and the earth; build an ethics and aesthetics of respect, gratitude, emotion and worship among human beings, who are symbolic and symbiotic entities in a symbolic and symbiotic world." [30] (p. 45).

Dialog is another essential element in Freire's view of the educational process [50]. It is a horizontal relationship between A and B. Born of a critical matrix and generating critical thinking, it is nourished by love, humility, hope, faith, and trust. Only dialog can communicate. When the two poles of dialog are linked in this way, with love, hope, and faith in the other, they become central to the search for meaning, and a relationship of empathy arises between them. Only then is there communication.

It is dialog that enables us to oppose the anti-dialog, which is so intermingled in our historical and cultural training and so omnipresent and simultaneously so antagonistic to climate change. The anti-dialog that implies the dominance of A over B is the opposite of all that. It is unloving. It is not humble. It is hopeless, arrogant, and self-sufficient. The relationship of empathy between poles that characterizes dialog is broken. Anti-dialog does not communicate. It makes pronouncements [56] (pp. 141–142).

Educational processes thus need to be based on a pedagogy of communication that will enable us to overcome the lack of love in anti-dialog. Unfortunately, for a number of reasons, anti-dialog has been the most common trend in Latin America. This is education that kills the creative power not only of the learner, but also of the educator, to the extent that the latter becomes someone who imposes, or in the best case, delivers "formulas" that are passively taken up by their students. Do not believe those who impose or those who receive. Education and atrophy is no longer education.

Thinking about other educational paths leads us to consider an education that promotes freedom rather than alienation or domestication, and this changes the relationship from human-as-object to human-as-subject, which in turn implies a conception of society

itself as a subject. An education that emphasizes reflection and self-reflection leads to the deepening of awareness and to the cultivation of active citizens rather than spectators [32].

4. Implications for Climate Change Education

To identify implications for climate change education, we first consider Ball's policy cycle [69], which explains that policy has three aspects: influence, production of text, and practice. Climate change is thus interpreted by governments and international institutions, such as the World Bank, which then draw up international policies that influence national policies. These international and national policies have an impact on the practice of different sectors, including communications, transport, health, education, agriculture, and industry. We highlight these sectors, because the Presidents' discourses only refer to industry sectors. As we have explained, every sector has an impact—and is impacted by—climate change. Communications and the media inform all citizens about risk, vulnerability, mitigation, and education. Transport contributes to emissions of pollutants. Every political decision affects micro processes and social stakeholders in diverse ways. In a context that privileges industry, the harmful impact normally affects the more vulnerable population, which in Latin American countries include the Indigenous, farmers, and workers. However, climate change education enables these hegemonic relationships to be discussed from a critical perspective. It enables all society's stakeholders to understand not only climate change crises, but also all macro and micro social processes that influence the processes of adaptation, mitigation, and policy-making (Figure 4).

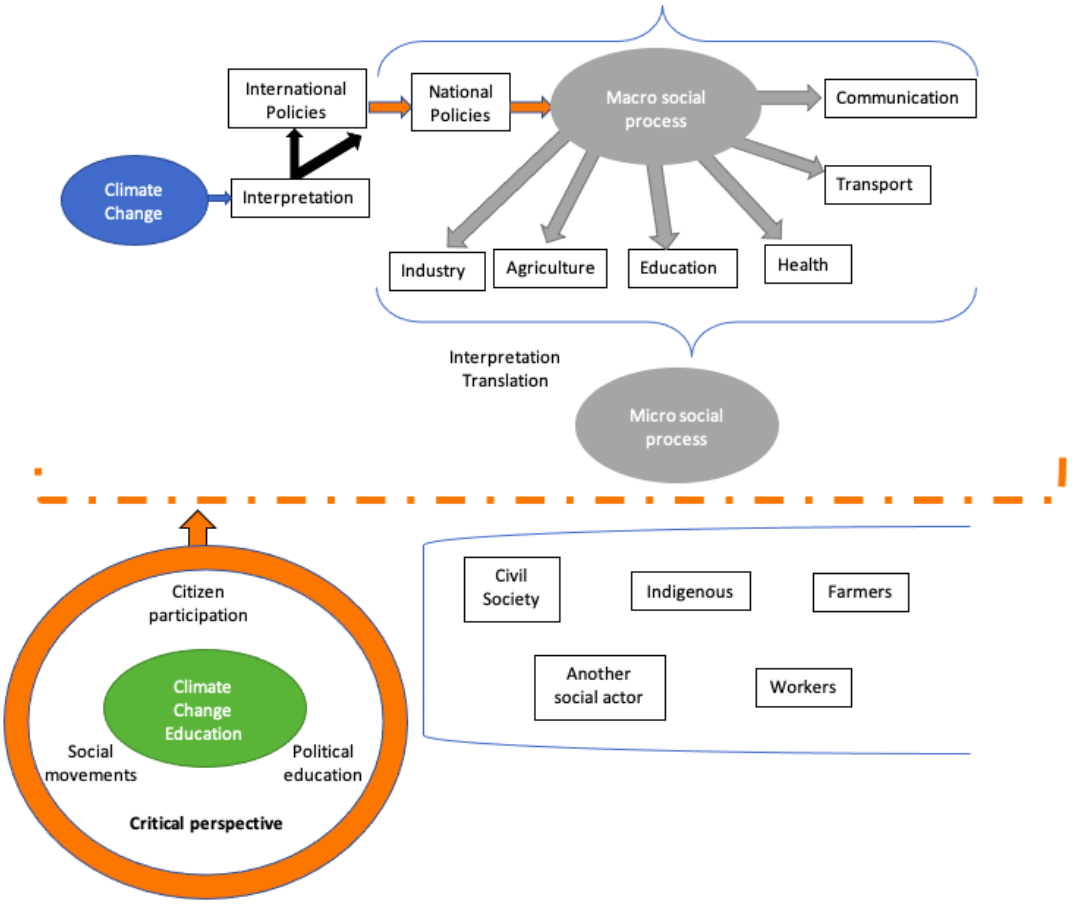

Figure 4. Climate change education and its relationships in society.

We believe that climate change education must also be political education (cf. [70,71]), presenting vulnerability, social and environmental injustice, and the capitalist system and structures as topics of discussion alongside alternatives such as degrowth, providing the

citizens of the future with the knowledge they need to participate in public debates about the future, and *Buen Vivir*. *Buen Vivir* is a concept originating from South America that prioritizes the well-being of individuals, communities, and the natural environment, over economic growth and material consumption. It emphasizes the interdependence between humans and nature and promotes harmony and balance in all aspects of life. This implies that climate education needs to incorporate "political education from a global, critical, non-partisan perspective, addressing concepts such as governance and governability, the uncertainty of communications, doubt, reflection and criticism based on the values of justice and democracy" [39] (p. 249). Creating various communicative events (social interactions that take place in a specific space and at a specific time [72]) that engage with uncertainty contributes to the development of critical thinking, providing a scenario where students need to develop their abilities, apply reasoned and reflective thinking, take account of evidence, and deploy logic to decide what to believe or do [73,74]. Bringing a diversity of discourses to the classroom fosters other activities associated with critical thinking such as analysis argument, evaluation of credibility, use of existing knowledge, separation of factual information from inferences, inductive inferences and arguments, and, at the same time, the evaluation of such thinking on the basis of evidence, searching for and drawing on information from different sources [75,76].

We have discussed the dominance of neoliberal doctrines as the framework for learning, leading to "the learning crisis . . . [namely] children's inability to understand concepts like human dignity or to engage in planetary or relational thinking, affecting also their ability to be responsible" [77] (p. 5). Another effect of climate change education is thus the consideration of issues that used to form the basis of human relations, but that due to the influence of the neoliberal framework have been relegated over time, such as community and collectivity, and the rediscovery of values such as solidarity. As Lacey said [78], to find emancipation we must overcome structural obstacles such as individuality.

So political education and critical thinking are part of climate change education, and this also means there is a need to foster creative schools that value the community, recognize its beliefs and daily practices, and promote intercultural dialog, taking social and cultural contexts into account, and trying to avoid being coercive or hegemonic instruments of the state or the reproduction of colonizing practices.

5. Conclusions

This study illustrates how using discourse analysis in the context of climate change education can help develop critical thinking skills and avoid the dominant tendency to associate climate change solely with scientific knowledge. The findings of this paper demonstrate that climate change education should not only involve learning about risk, adaptation, resilience and basic scientific concepts, but also critical reflection on public policy and emancipatory, critical, and transformative content. Consideration should be given to non-formal and informal communicative events in the development of critical thinking, and analysis of how power relations can restrict, motivate, or boost the impetus towards climate change education [39]. In this way, the gap between climate change education as science education and climate change education as political education can be bridged. The interpretation of climate change policies promotes the generation of breakpoints, which can be reflected in new, more aware curricula involving non-formal spaces and phenomena such as social movements.

The present study identifies a need for proposals that contribute to political education, including the social dimension of climate change, which is relevant both to evidence-based learning and to the development of critical thinking.

Author Contributions: Conceptualization, M.A.M.-C.; methodology, M.A.M.-C.; validation, M.A.M.-C., M.R. and M.L.F.A.; formal analysis, M.A.M.-C.; investigation, M.A.M.-C.; writing—original draft preparation, M.A.M.-C.; writing—review and editing, M.A.M.-C., M.R. and M.L.F.A.; supervision, M.L.F.A.; funding acquisition, M.L.F.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by FACEPE (Fundação do Amparo a Ciência e Tecnologia do Estado de Pernambuco), grant number BCT-0331-9.25/21.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: All data is included in the paper.

Acknowledgments: The authors wish to thank FACEPE and the research participants. In addition, the authors would like to thank four anonymous reviewers for their helpful comments on an earlier version of this manuscript.

Conflicts of Interest: The authors declare no conflict of interest.

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