Climate narratives in educational agendas: On the value of time for pedagogical research and environmental policies

Las narrativas climáticas en las agendas educativas: sobre el valor del tiempo para la investigación pedagógica y las políticas ambientales

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Abstract:

A matter of time. This could be, in its connotations that are most open to scientific, pedagogical and social interpretation, the principal claim referred to by arguments in which are projected the reflective, methodological, empirical, and documentary concerns of the text we present regarding climate narratives in the educational agendas of the third millennium. In any case, the fact that their approaches raise a wide and varied range of questions about the *value of time* for pedagogical research and socio-environmental policies cannot be ignored. From this perspective, the aim of this article is to emphasise the importance of educating in time, without further delay, about the challenges posed by the climate emergency, promoting systematic and rigorous research on key issues so that they are addressed in education and society; especially when the slow convergence between climate and education policies can be observed, illustrated here by the Spanish case. We conclude by highlighting that educational research must take into account the rhythms of the crisis: from the temporal dimension (synchronic and diachronic) inherent to anthropogenic climate change, up to the dimension that must be incorporated, as a key factor, in any socio-ecological transition that promotes lifestyles that are ecologically and socially sustainable, fair, and equitable.

Keywords: educational policies, environmental policies, environmental education, climate emergency, pedagogical research, social times.

Resumen:

Cuestión de tiempo. Esta podría ser, en sus connotaciones más abiertas a una interpretación científica, pedagógica y social, la principal afirmación a la que se remiten los argumentos en los que se proyectan las inquietudes reflexivas, metodológicas, empíricas y documentales del texto que presentamos en torno a las narrativas climáticas en las agendas educativas del tercer milenio. En todo caso, sin poder obviar que sus planteamientos suscitan una amplia y diversificada gama de cuestiones sobre el *valor del tiempo* para la investigación pedagógica y las políticas socioambientales. Con esta perspectiva, el objetivo principal del texto reside en enfatizar la importancia de educar a tiempo, sin más demoras, en los desafíos que impone la emergencia climática y de promover investigaciones sistemáticas y rigurosas en torno a cuestiones clave para su afrontamiento en la educación y la sociedad; sobre todo cuando se está constatando la lenta convergencia que existe entre las políticas climáticas y educativas, ejemplificado aquí con el caso español. Concluiremos destacando que la investigación educativa debe tener en cuenta los ritmos de la crisis: desde la dimensión temporal (sincrónica y diacrónica) inherente al cambio climático antropogénico hasta la que deberá incorporarse como un factor clave en cualquier transición socioecológica que promueva estilos de vida sostenibles, justos y equitativos en términos ecológicos y sociales.

Palabras clave: políticas educativas, políticas ambientales, educación ambiental, emergencia climática, investigación pedagógica, tiempos sociales.

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1. Introduction

Beyond the characterisation of time as something biological, physical, or mathematical, we invoke it as a social and cultural construct that is present in every individual, starting with our own existence, which is in itself temporal (Merleau-Ponty, 1975; Safransky, 2017). Nothing or almost nothing is foreign to it in our readings of the world and its realities, whatever our perspective on them, historical or forward-looking, circumstantial or universal.

Almost all scientific fields (Araujo, 2020) concern themselves with the time and times into which their symbolic and material components are implicitly or explicitly arranged, not just as an object of study but also as an indicator (more or less objectifiable, measurable or perceptible) of our particular ways of relating to nature and life, including everything that concerns education (Gimeno, 2008).

Temporal coordinates are undoubtedly inseparable from any judgement we make of sustainability. Also from a political position, when this expression is included in proposals regarding sustainable development, essentially since the preparation and publication of what is known as the *Brundtland report*, originally entitled *Our common future*, which defines it as that which meets the needs of the present without compromising the capacity to satisfy the possible needs of future generations (World Commission on Environment and Development, 1992).

The Declaration approved at the Rio de Janeiro Earth Summit of June 1992 used this definition, which was incorporated years later into the main axes of the World Summit on Sustainable Development, held in September 2002 in Johannesburg. Since 2015, it has been one of the principal identifying and conceptual references of the 17 sustainable development goals (SDG) adopted at the 70th General Assembly of the United Nations, with the 169 economic, social, and environmental objectives set out in the 2030 Agenda, converging with the strategies aimed at fighting global warming and climate change.

Time is a fundamental vector in development processes and their links to growth, with the ambiguities that have arisen regarded the maintenance of the rhythms in which it is projected

diachronically and synchronically. The desire to be ecologically and socially sustainable is a risky experiment in the complicated task of giving ourselves time to survive, in a context where any tangible present matters much more than any more or less foreseeable future (Roca, 2016). Insisting that humankind is threatened, however much its crises (economic, environmental, social, health, etc.) worsen, still does not activate ways of thinking and acting that meet up to the urgency of a future that is as uncertain as it is inevitable (Innerarity et al., 2024).

We allude, among other circumstances, to those that since the late 20th century have insisted on decisively and without delay confronting the main socio-environmental problems that the planet and humankind face, subjected (as never before) to the tensions provoked by poverty, hunger, social inequality, armed conflicts, loss of biodiversity, pandemics, the retreat of democracies, and demographic imbalances caused by migratory processes and the displacement of rural communities to cities. The world's population exceeding 8.2 billion people urges us to scale the transitions (ecological, demographic, energy, digital, cultural, etc.) in a way that looks to the future, and as such is temporal, with criteria of justice, equity, honesty, etc., that require changing everything for everyone (Klein, 2015).

The grounds she refers to in her arguments are not new. They come from long ago. So much that we give ourselves the opportunity to read, explain, and interpret the cycles of nature, ecosystemic interactions, processes of development, or the very evolution of humankind and its civilising dynamics, long fostering modes of production, consumption, life, etc., that are damaging for the biosphere and life in all of its diversity. As Riechmann (2004) argued when analysing the ecological crisis in its temporal dimension, the long-time scales of nature, its equilibriums and transformations run into neo-liberal financial markets, political dealings, cyberspace, and the technological networks of globalisation. While we cannot ignore them, we agree that the culture of sustainability demands a different culture of time to the one that has shaped the path of what we identify as progress, development, or well-being.

2. When time dresses itself as climate change: implications and complications for the future of humankind

Climate change (CC), the mirror and reflection of the ecological and anthropological disasters in which we find ourselves, is one of the principal examples of contemporaneity, positioning us before a new era known as the Anthropocene or Capitalocene depending on the radicalism of the positions adopted, as shown in the story of environmental historians such as Foster (1999), Patel (2010), Wallace-Wells (2019), Malm (2020), Merchant (2020), and Moore (2020). The times of the cosmos, of the Earth, and of hominisation seem to have accelerated, meaning that the haste and the "quick, quick" of a society that is open 24-hours-a-day, marked by timelessness (Castells, 1998), becomes a silent enemy, a cause of ecological unsustainability and of the climate risks inherent to it.

The obsessive concern with timing ourselves in the incessant striving to measure, monitor, represent, reinvent, or give new meanings to time (Garfield, 2017) reaches the extreme of computing everything, from the most insignificant happenings to those that will bring about the Apocalypse, calculating the time left to us as a species (Serratos, 2020). As the *Bulletin of the Atomic Scientists* reported in 2024, the clock of Martyl Langdorsf (an artist and the wife of one of the scientists who participated in the Manhattan Project to create the first atomic bomb) puts us 90 seconds from midnight, one and a half minutes from the disappearance of human life (Mecklin, 2024). If this perception is credible, delay and denial are two of the most visible elements in the ideological justification for timid responses by governments to the climate crisis; in any case, without being able to ignore their confluence with other motivations of a religious, moral, economic, etc. nature, present in this cause; as well as in others that affect people's rights individually and collectively.

Narratives that are conducive to providing solutions that mitigate climate emergencies and/or make it possible to adapt to them with a scientific basis reiterate the need for the regulatory-legal framework to be appropriate and effective in the short and medium term, even if this is not

enough. There are other elements that should play a key role in the mobilisation of committed climate action, such as education and communication. Both have fundamental strategies and/or practices for setting out lines of thought, reflection, and action that promote values, action programmes, etc. that increase the capacities of language and of its hermeneutic-interpretative and socio-critical potential. A task to which scientific knowledge, with multi-, inter-, and transdisciplinary focuses, will also have to make substantial contributions.

The importance that must be placed on time in the agendas of social and educational research contrasts with its limited presence until now in hypotheses of progression, from an ontogenetic and historical outlook, showing the indifferences and inconsistencies that both climate literacy and particular conceptions of environmental information and training have committed. As we will see, the use of alternative, disruptive, and unconventional methodologies of inquiry opens up a field of research that is little explored in educational sciences and in the humanities and the social sciences.

In this context it is no surprise that the *uncomfortable truths* revealed in recent decades pose questions that are far from being answered, expanding or diversifying the concerns that situate in time (of the present and the future) the search for viable solutions to a civilisational collapse that for some authors is irreversible (Caride & Meira, 2020; Kingsnorth, 2019; Servigne & Stevens, 2020; Bardi, 2022). This being so, many people have (for years) considered a process of degrowth to be inevitable, whether abruptly and traumatically or through conscious planning intended to reduce consumption of energy, materials, and food (particularly animal-based) to spread the costs of a transition that aspires to be socially and environmentally just (Riechmann et al., 2007; Taibo, 2020, Turiel, 2020; Bordera et al., 2024). So, as Rivas (2020) would say, encouraging refractory hope, we should commit ourselves not only to the world in which we live, but (and above all) to the one we will leave as a legacy. "Nature's mutiny" (Blom, 2019) suggests that it is not merely a matter of changing the climate, but of promoting an integral transformation of human societies: "it is no longer an option. It has become an ecological, ethical and social imperative for survival, with solutions that are viable, realistic and lasting" (Caride & Meira, 2022, p. 27, own translation). Following this path, in a collection with great reach in the media about the state of the planet and its major challenges, the Food and Agriculture Organization of the United Nations (FAO) asked whether we still have time to save it (Yeves & Javaloyes, 2018), emphasising that every one of us (albeit to unequal extents) is part of the problem and of the solution.

Warnings are accumulating both in scientific reports and in the positions taken by institutional leaders and by society itself. Coinciding with the commemoration of World Environment Day, on 5 June 2024, the European Commission's Copernicus climate change service[1] revealed that the Earth's global temperature continues to increase significantly, reaching unprecedented figures. Among other voices, Antonio Guterres, Secretary General of the UN, repeatedly called for the commitments that have already been signed to be fulfilled, reducing greenhouse gas emissions, reducing consumption, and improving energy efficiency. In addition, what is thought to be the largest survey of public opinion of the climate crisis (with 75 000 people from 77 countries participating), sponsored by the UN and carried out by a team from the University of Oxford[2], found that approximately 72% of the sample want the transition from fossil fuels to renewables to be accelerated, with more than 80% calling for their countries to engage (quickly or very quickly) in the solutions that must be provided for CC.

Fernández-Reyes (2024) observes that the social perception of CC as a key threat has grown internationally in recent years, especially in Europe, with it being seen as the most serious problem facing humankind (European Commission, 2023), although armed conflicts are displacing the climate crisis as the greatest perceived threats (Lázaro et al., 2024). Nonetheless, the high level of climate awareness or concern does not lead to a high level of action (Kollmus y Agyeman, 2002). In the case of Spain, eco-surveys and abundant research into public opinion have shown that its citizens are especially worried about CC. One factor that explains this is that Spain is one

[1] See https://climate.copernicus.eu/climate-indicators
[2] See https://peoplesclimate.vote/document/Peoples_Climate_Vote_Report_2024.pdf

of the most vulnerable countries in Europe to this challenge (IPCC, 2021), with the Spanish, after the Portuguese, being the European citizens who are most concerned by CC (European Social Survey, 2018), especially younger people (Meira et al., 2021; González-Anleo et al., 2024). This intergenerational question, which we will not go into, is another of the vestiges of the timelessness in which interpretations, social perceptions and representations of CC, its urgencies and emergencies in the future of humankind and of its civilising processes, are situated.

3. Educating and educating ourselves in time in the face of the climate emergency

As has been tacitly recognised by the UN Environment Programme, created in 1972, and explicitly in the sixth edition of the United Nations Environment Assembly (UNEA-6), held in Nairobi (Kenya) in 2024, time is a transversal element in the environmental and social sustainability of processes of development and lifestyles. For the construction of these lifestyles to be consistent with a progressively decarbonised society requires new forms of distribution and management of times (of work, leisure, transport, etc.). According to Figueres et al. (2017) "when it comes to climate, [chronological] timing is everything" (p. 386), identifying the need for public policies (economic, social, environmental, educational, etc.) to be effective in the timeframe set by the Paris Agreement (adopted at COP21 in December 2015, and taking effect in November 2016) to contain the physical inertias of the climate system. Responding *on time* is still a priority, despite the repeated breaches of the agreements signed by the 196 parties.

Looking to the future of the planet and life without ignoring the present gives time a special place in tackling CC and in the socioecological transition we require to reconcile ourselves with the ecosystems that sustain life. The challenge no longer lies in speculating about the catastrophe, but in how to construct political subjects (citizens) who are capable of accepting, with all of its consequences, a challenge full of uncertainties, without being clear about what to do when, as Ausubel would say (as cited in Rich, 2020), the past no longer serves as a guide for the future. It will undoubtedly be a matter of education and time (Caride, 2020), rethinking (pedagogically and socially) their respective meanings in the societies of the third millennium, between the real and the reified (Barnes, 2004), that which is put in objective terms and perceived:

> what we currently call time changes from one society to another and in its present form is something that members of industrialised societies learn in a process of socialisation ... Time is an expression of peoples' effort to determine positions, delineate intervals, the pace of changes, etc., in this process with the aim of serving its own orientation. (Elías, 1989, p. 51, own translation)

The emergencies with which CC is associated are fully involved in this tale.

We refer to a time of times on whose boundaries we educate and are educated from childhood to old age, in schools and communities, with all of the complexities that characterise the network society (Caride et al., 2020). It is not limited to the times of school or of the education system, of curricular or teaching-learning processes, prolonged in the formative opportunities that, starting by understanding education as a global common resource (Delors, 1996; UNESCO, 2015; International Commission on the Futures of Education, 2022), suggest alternative ways of educating and educating ourselves that are more democratic, just and peaceful, critical of and open to the ordinariness of life.

The report prepared by the International Commission on the Futures of Education (2022) for UNESCO recognises that "climate change and ecosystem destabilization affect education in direct and indirect ways" (p. 32), mentioning risks and impacts that affects learning and cognition, livelihoods, and well-being, gender inequalities, and so on, at a global level and in people's particular communities. The strategies to adopt "should draw on existing knowledge about how to foster deeper learning and the development of civic competency, and on recent research on the development of skills for life and work" (International Commission on the Futures of Education, 2022, p. 35). Curricula, they add, "must enable re-learning how we are interconnected with a living, damaged planet and unlearning the human arrogance that has resulted in massive biodiversity loss,

the destruction of entire ecosystems, and irreversible climate change" (International Commission on the Futures of Education, 2022, p. 69). There are no excuses. It is a priority: it must be done now, in time, enabling people "to correct omissions and exclusions in the knowledge commons and ensure that it is a lasting, open resource that reflects the diversity of ways of knowing and being in the world" (International Commission on the Futures of Education, 2022, p. 80). Contemporary trends in Environmental Education for Sustainability (EES) and its theoretical foundation frameworks support models of sustainability competences (Brundiers et al., 2021; Redman & Wiek, 2021; Bianchi, 2022) that integrate CC transversally in different dimensions: fostering civic values and pro-environmental attitudes (culture of sustainability, support for fairness and climate justice, promotion of nature and pro-environmental behaviours); incorporation of the paradigm of complexity (systemic epistemologies, critical thinking, contextualising problems); anticipating future sustainable scenarios (capacity for future projections, adaptability, exploratory thinking); adopting sustainable discourses and practices (political action, collective and community action, committed and responsible individual initiatives), and so on.

Rieckmann and Thomas (2024) present an international panorama from comparative research that illustrates the diversity of pedagogical trends that take charge of promoting learning that is transformational, interactive, and from innovative perspectives (Rodríguez-Marín et al., 2023) based on service learning, problem- and project-based learning, model-based inquiry, citizen science, co-design, and other disruptive methodologies. In any case, without ignoring the contributions that have been made for decades in the field of environmental education, with anthropological, ethical, pedagogical, philosophical, political, sociological, economic, communicational, etc. outlooks, that range from social reappropriation of nature invoking environmental rationalism (Leff, 2004) and the construction of the educational-environmental field with renovative future options (Arias, 2013), up to the adoption of responses that activate ecocitizenship (Limón, 2019), or that incorporate the eco-feminist viewpoint to rethink the world around the sustainability of life (Herrero, 2022).

4. The urgency of a systemic and agreed research agenda on education for the climate emergency

Research agendas in/on climate education are starting to have their own spaces and times in current scientific literature. Their reach and the achievements to which they refer illustrate the ongoing expansion of academic frontiers from transdisciplinary perspectives that break out of the classical boundaries among the two cultures (Snow, 1987): the social and natural sciences. And that without ignoring the complexity and disciplinary integration vital for training and educational practices in citizen science to transcend curricular teaching and learning processes.

The linguistic dimension has an ever more relevant role. It is undoubtedly relevant as a clear exponent of the historical testimonies that educational research could make use of to study narratives of the climate crisis. But also, in the enquiries that look forwards to predict the future. The proliferation of systematic reviews and meta-analyses reflects this, with exponential growth in scientific production in this field, above all in topics such as education for climate change and in focusses of analysis that complement or converge with its areas of influence, such as human and animal health, environmental and social vulnerability, preventing risks, respect for human rights, etc.

However, and as a counterpoint to this growth, a persistent *braking* effect can be seen, resulting in a worrying lethargy in the adoption of political responses, the burdens of which have consequences of different ecological and social magnitudes and scopes. Educating in time is a major responsibility for those who, as educational professionals, do their day-to-day work in a variety of educational settings, as it is for the scientific community when researching in and on the different circumstances in which the climate emergency demands, proposes, or arranges the pedagogical, formative, didactic, curricular, etc., endeavour inside and outside the education system.

Advocating and designing an agenda that sets priorities, analyses trends, and marks solid future lines of inquiry must make it possible to confront the substance and form of the educational and climate emergencies rigorously. And with them, the risks that its causes and/or effects have for global health, with estimates of as many as 250 000 additional deaths owing to illnesses sensitive to the climate (heat stress, malnutrition, dengue, and malaria) between 2030 and 2050[3]. In addition to these, eco-anxiety (a normal emotional response to an abnormal situation) is eroding people's identity as an effect associated with the anxiety caused by the environmental crisis and the risks it entails (Franquesa, 2024).

At this juncture, with a need to accelerate educational responses, various questions address the responsibility of pedagogical research and, by extension, of educational sciences. Important authors in the field (Reid, 2019a, 2019b) have marked the territory of what is at play in education to address the climate crisis with the required priority. Sharing their arguments, a series of questions must be formulated that guide the objectives and methodological process of the lines of research in which their initiatives could be inscribed, including: what can be learnt from the educational practices in motion to accelerate education's responses to the climate emergency? Are the current focuses of education on the climate crisis sufficient to drive the socio-ecological transition? And if they are not, what would have to change and at what pace to improve education's socio-cultural impact? How will education gain time to respond to the climate emergency and effectively address the goals of educational and climate policies? How can the different spheres of educational practice (school, community, social) be linked to activate the socio-ecological transition in different social contexts and times (family, leisure, etc.)? What role must a disruptive training play with support from technological devices that differ from conventional ones, that is prolonged beyond the school setting and integrates emotional, attitudinal, behavioural, and cognitive dimensions? What pedagogical quality requirements should be incorporated into educational programmes, resources, and materials to promote socioecological changes that are effective and real locally and globally?

Among the questions to be resolved in this emerging line of research, some key ones are absent that should inform and position topics, problems, or future focusses of interest, around which relevant questions for research agendas to resolve are posed. In this sense, and taking as structuring axes the *temporal* and *climate* semantics, new questions can be asked: why is no question asked about the required pace of these changes? When does the climate appear in the EE agenda? To what extent do the foundational documents contemplate the climate crisis from its origins as one of the most significant environmental problems? What new aspects does the idea of emergency add to the classical concept of time? What are the adjectives, signifieds, signifiers, and contexts of use? What semantic field have we constructed in the last two decades in relation to the topic of the *climate crisis*? How do these signifiers relate to the time vector in educational scenarios? Why do we procrastinate in the response to the climate crisis?

Linking EE to the culture of sustainability and the climate emergency, as this work does, considers its challenges at the same time as proposing others that are awakening the interest of research teams with prominent track records in these lines of research: what are the principal challenges that must be considered to educate in response to the climate emergency and process of socioecological transition? Are there transnational and intercultural patterns that help to increase the perceptions on the causes and consequences of climate change? What are the priority challenges to take into account to build curricular and social contexts in favour of EE, the culture of sustainability, and the climate emergency in contexts conditioned or influenced by resistance from popular culture? What formative actions, materials, and educational resources should be favoured to promote EE in people, over different levels of training? What educational and community experiences favour the transformation of lifestyles in the current socioecological transition, accentuated by the climate emergency?

The scientific community must find systematic, rigorous, and convincing responses to these questions from different types of methodological and empirical focuses, in line with the scope and scale of each question raised. It should also promote relevant research in connection to evaluation of the efficacy and efficiency of educational programmes that are associated

[3] See https://www.who.int/en/news-room/fact-sheets/detail/climate-change-and-health

with curriculum policies relating to CC. In any case, without ignoring other options for a complementary exploration through documentary analysis and historical research that allow *kilometre zero* analyses to be performed, reports on the state of the art of advances and setbacks, enquiries into the state of knowledge in the field, systematic reviews on its progress, evaluation of achievements associated with curriculum reforms, the impact of regulatory transpositions and curriculum implementation of framework legislation, institutional declarations, etc. Now is the time to "write history with accountability", in the sense that Costa (2023, pp. 108-109, own translation) gives to the term when he considers that it is a matter of interpreting what goes beyond the supposed notarial and accumulative chronicle of information, in any case seeking to position itself in the mindset of the period studied and not to fall into anachronism, that is to say, into the temptation to project current values onto past phenomena, or presentism (the present is projected and shapes the vision of the past), which would lead us to subjective recreations.

5. The demands for a transdisciplinary dialogue in the construction of temporal and climate semantics

Having a research agenda that is agreed on in the field of the climate crisis is more than justified and requires dialogue across disciplines: establishing criteria of quality, delimiting guidelines for traceability, providing reliable explanations, defining internal and external patterns of interdisciplinary and transdisciplinary comparability making the most of the shared and specialised potential of the climate sciences (social and natural, humanistic, artistic, and technological). This pathway must contribute to the construction of well-founded and justified explanations for many of the questions mentioned. They particularly require it to assess the potential for transference and impact of climate policies on educational policies and practices, aspiring (among other achievements) to construct a genealogy of the presence and treatment of the climate crisis in the institutional, regulatory, etc. declarations that are most representative of EE.

It will undoubtedly be necessary to analyse the place the temporal dimension occupies in the transposition of advances in scientific knowledge about contemporary problems. And also to identify and/or define timelines in territories, countries, etc. that delimit a particular geography; for example, in Spain and its Autonomous Communities, making visible the interactions between agencies, agents, events, and relevant facts in climate narratives and their impact on EE: "over time, these contributions are a very valuable measure that makes it possible to carry out multi-voiced studies, integrative meta-analyses, and systematic secondary reviews of longitudinal growth in the field and of the patterns of productivity that they fit" (Gutiérrez et al., 2020, p. 820, own translation).

Proposing agendas and subjecting them to continuous revision should become a practice that is cyclically revisited, as it is an action that is necessary before a topic–problem that is subject to constant tensions and controversies in a geopolitical setting that is far from being true to itself and to the severity of a climate crisis that is evolving at a faster pace than was estimated only a decade ago (Hansen et al., 2023). When observing its realities and focussing on the semantics that have been generated both from a climate-environmental reading and from readings that consider its historical-future evolution, there is an abundance of expressions that make it possible to identify a polyphonic linguistic corpus displaying the turns, interests, trends, or absences of what scientific research has explored up to now, anticipating or delineating what the primary lines of future research might be. As a whole, they comprise a rapidly growing corpus of terms, neologisms, technicisms, and resignified neoclassical terms that have become established and invaded the collective imagination over recent decades, in time with the, more or less systematic, work of scientific communities, pro-environmental organisations, government agencies, citizen groups and, above all, of the media and social networks.
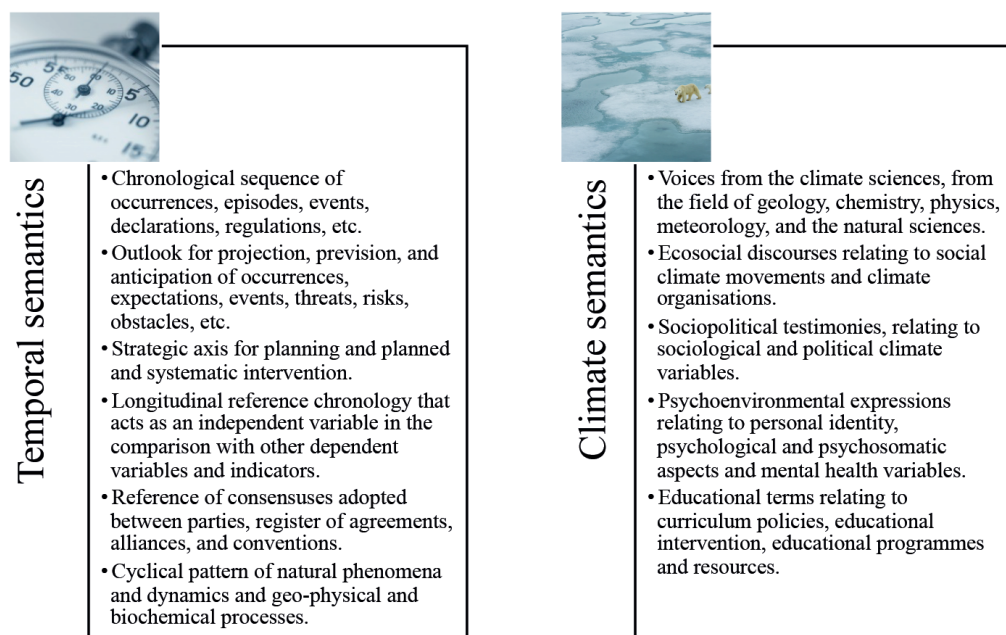
In seeking to establish the preliminary levels of a conceptual demarcation that differentiates the two dimensions that are the object of study, we present some convergences and

divergences apparent in the evidence that name the temporal vector in their relationship with the evidence that mentions the climate crisis (see Figure 1).

Establishing the levels of macro and micro conceptual aggregation that exist in the broad and diverse range of words that the semantics of the climate crisis embrace, identifying the timelines that explain its genesis and evolution, contextualising uses, delimiting signifieds and signifiers, etc., are important paths for exploration in the research we propose, with two principal structuring axes:

Figure 1. Temporal semantics versus climate semantics.

Temporal semantics
- Chronological sequence of occurrences, episodes, events, declarations, regulations, etc.
- Outlook for projection, prevision, and anticipation of occurrences, expectations, events, threats, risks, obstacles, etc.
- Strategic axis for planning and planned and systematic intervention.
- Longitudinal reference chronology that acts as an independent variable in the comparison with other dependent variables and indicators.
- Reference of consensuses adopted between parties, register of agreements, alliances, and conventions.
- Cyclical pattern of natural phenomena and dynamics and geo-physical and biochemical processes.

Climate semantics
- Voices from the climate sciences, from the field of geology, chemistry, physics, meteorology, and the natural sciences.
- Ecosocial discourses relating to social climate movements and climate organisations.
- Sociopolitical testimonies, relating to sociological and political climate variables.
- Psychoenvironmental expressions relating to personal identity, psychological and psychosomatic aspects and mental health variables.
- Educational terms relating to curriculum policies, educational intervention, educational programmes and resources.

1. On the one hand, the axis that takes *temporal semantics* as its reference, at the very least making it possible to attribute different connotations to time, such as a) a sequence of occurrences; b) the outlook for projection and forecasting, c) the variable of evolutionary comparison; d) the strategic axis of planning and development of actions based on analysis of needs and intervention proposals; e) a temporal series of magnitudes associated with making comparisons of chronological series of measures and changes; f) a social construct or category that is the referent of the consensus between parties to register agreements, alliances, and conventions; and, finally, e) a cyclical pattern in geophysical or biochemical processes and natural phenomena.

    Among the agreements reached in temporal terms, ones promoted or backed by public policies and administrations should be noted; for example, in the case of Spain, the Plan de Acción de Educación Ambiental para la Sostenibilidad (PAEAS, Environmental Education for Sustainability Action) (Gobierno de España, 2021), the Plan Nacional de Adaptación al Cambio Climático (National Climate Change Adaptation Plan), or the LOMLOE.

2. And on the other hand, *climate semantics*. The lexicon of the climate crisis accepts levels of organisation and classification that make it possible to differentiate, as a minimum, between a) specialist voices from the climate sciences; b) eco-social discourses that embody human responses to the climate emergency; c) sociopolitical testimonies that try to identify alternative mitigation/adaptation pathways; d) psycho-

environmental expressions, that explore perceptions, representations, evaluations, and behaviours in relation to CC; d) educational voices, that try to integrate responses to the climate crisis into the pedagogical narrative.

With the due precautions, we recognise that the field is not free from uncertainties that demand revision, resignification, and/or self-criticism of the terminology used; in all cases, we are aware of the neocolonial bias engaged in by the interventions and linguistic structures installed in the collective memory (Burde, 2017; Novelli & Kutan, 2024). According to Lozano et al. (2014, p. 146, own translation),

> owing to its frequency and relevance, the planetary risk of CC provides a discourse that the media make hegemonic, questioning the items on the agenda in the struggle against CC that governments, institutions, and businesses accept. The communicative practice of the media might then contribute to creating a "second reality" that is superimposed and that involves paying greater attention to the debate on CC than to the origin of and alternatives for solving this environmental crisis.

6. Climate language and its narratives in the development of educational research

Scientific study of climate language as a field of educational research has very recently become established as a line of inquiry with its own identity and form. The team from the University of Bergen (Norway), led by Professor Fløttum (2017), has been making significant contributions to this, focussing its analysis on the role of language in the construction of narratives on CC. This author differentiates between macro- and microlinguistic analysis of the multiple voices that the climate crisis yields in order to establish typologies of rhetoric by sectors and media: either based on evidence coterminous with the discourse and literary style of its researchers, with differential shades depending on their disciplines of origin; or centred on persuasion or counter-argumentation, frequent, among others, in politics, condemnation and confrontation of climate movements, verbal and written information, communication, and journalism; a field, in this last case, with very significant contributions on different fronts (Escrivá, 2024).

Fernández-Reyes (2024) explored the lines of argument of denial and provides an exhaustive catalogue of rhetorical tactics for responding forcefully and rigorously to disbelievers and sceptics, employing counter-argumentation standards and guidelines applied to the image (television and photography), verbal messages (radio), and written information (for the press in different formats). Questions can be inferred from his analysis that relate to language, semantics, and reasoning that can be extrapolated, with the necessary adaptations, to different levels and spheres of pedagogical action–intervention:

> What should we do with people who deny climate action or call for it to be delayed?; how should we respond to them? When we do this, do we help them make their voice stronger?, what should we do about these "infectors" of doubts about the need for and urgency of climate action in the social body?, who are these "infectors"?, what subgroups exist among them?, where do their funders come from?, what different tools do they use?, what can we learn from the already long relationship and forced coexistence with these boycotters? (Fernández-Reyes, 2024, p. 5, own translation)

In Spain, the Asociación de Periodistas de Información Ambiental (Association of Environmental Information Journalists) (2023) has contributed to this inquiry with proposals from the specialist professional field of journalism, with a list of tools derived from the latest generation of studies on communication and CC. Journalistic style guides and detailed linguistic analyses that bring to light the need to increase multidisciplinary research on these topics:

> We are living in an emergency; we must say this clearly. Do not doubt it in any way. That said, we must take care not to trivialise the term, even if we do use it correctly. What does emergency mean? After what we saw with the covid-19 pandemic, which turned our lives upside down from one day to the next, we must be careful with words If we say that CC is an emergency, we must be ready to act as though it were one. There is no point in declaring a climate emergency, as so many

governments (state, regional, and local) have done, while continuing to cause it, without changing anything other than the colour of the make-up. (Escrivá, 2024, p. 139)

Empirical works from the field of journalistic information and communication provide pathways that can be extrapolated to pedagogy in relation to methodologies to implement in educational programmes relating to communication strategies and progressive transmission of messages and counterarguments in the face of positions of denial (León et al., 2021; Fernández-Reyes, 2023; Heras, 2014, 2023; Ramos et al., 2024). The adoption and development of educational research agendas must be strengthened without delay, contributing significantly to the social responses required by the accelerated anthropogenic alteration of the climate. Reiterating what has been said in previous contributions, "if we had to select one verb to account for how to direct educational action with regards to the climate question, this would undoubtedly be *accelerate*. Educational research cannot ignore this imperative" (Gutiérrez et al., 2020, p. 823, own translation). Our position here is not original. The IPCC (2018) in perhaps the most momentous report that this body has prepared from the social viewpoint uses this verb to frame the role of education among the strategies with a possibility of limiting the scale of CC and its consequences in this century.

We are aware of the need to give the analyses a greater empirical component, and so below we address, again in an exploratory way, the existing combinations in climate policy and in educational policy in Spain, as one of the lines of educational research, that must be considered in greater depth to identify pedagogical and social keys to accelerate responses to the climate emergency in Spain.

7. The slow convergence between climate and education policies in Spain

Despite the advances recorded in the declarations and proposals endorsed by international bodies (UNESCO & UNFCCC, 2016; UNFCCC, 2016), no education system has meaningfully integrated the challenge of the climate emergency (Dawson *et al*., 2022; Eilam, 2022), fundamentally in regard to contributing to mitigating greenhouse-gas emissions to moderate the mean increase in the Earth's temperature, in accordance with the Paris Agreement. The delay in educational responses converges with the exasperating slowness of the adoption of effective global, regional, and local policies (environmental, energy, economic, food, etc.) that put humankind on the path to limit warming to +1.5 °C or +2 °C by the end of the 21st century.

As well as the functional weakness of policies, social and educational responses to the climate crisis must overcome another major obstacle that comes from the temporal dimension: the pace of climate change caused by human interference is too fast (and becoming faster) compared to natural changes in the climate, but too slow when it comes to establishing the social perception of their risks and consequences. The effects of climate change are seemingly only visible in slow motion and too late, after they have caused unwanted impacts on natural and human ecosystems. The difficulty of grasping timing among the bio-physical and social changes that underlie CC is especially notable in more *advanced* societies, with less vulnerable populations and with more resources to protect themselves or lessen the short-term reach of the more serious impacts. The indifference or inhibition with which CC has been treated in education systems reflect, among other eventualities, the shortcomings associated with this delay. As general considerations, they also apply to Spanish society.

The wording *climate emergency* makes it possible to go further than the connotations of the expression *climate change*. Firstly, it makes educational practice pay more attention to the political, social, and socioenvironmental dimensions. It also focusses attention on the temporal factor in the response. This does not in any way diminish scientific contributions and the knowledge they provide from academic perspectives for an action that brings about an eco-social transition that, as well as being technically viable, is also socially just and environmentally sustainable.

As the timeline shows (Figure 2), the European Parliament declared a climate emergency in November 2019. The Spanish government did the same in January 2020, identifying 30 priority measures in its declaration; among others, it would take on strengthening the incorporation of content associated with CC in the education system and approve a Plan de Acción de Educación Ambiental para la Sostenibilidad (PAEAS, Environmental Education for Sustainability Action Plan), which was launched in 2021. Its media impact would capture the echoes of COP25 held in Madrid in late 2019. Since then, and apart from the occasional isolated initiative, the Spanish education system and social education proposals have not offered signs that communicate to society the severity of the climate crisis, and even less the need to act urgently to mitigate, without delay, its causes and impacts from everyday reality. The climate crisis is far from occupying a leading position among the questions that concern educational policies in Spain.

The application of Organic Act 3/2020, of 29 December, amending Organic Education Act 2/2006, of 3 May, known as the LOMLOE might lead to some changes or many changes, as for the first time it incorporates the concept of *climate emergency* into Spanish education legislation. It does this in its preamble, linking it to following the UN's 2030 Agenda and materialising this in a two-part curriculum proposal: on the one hand, through *education for*

FIGURE 2. Timeline of educational and climate policies in Spain.
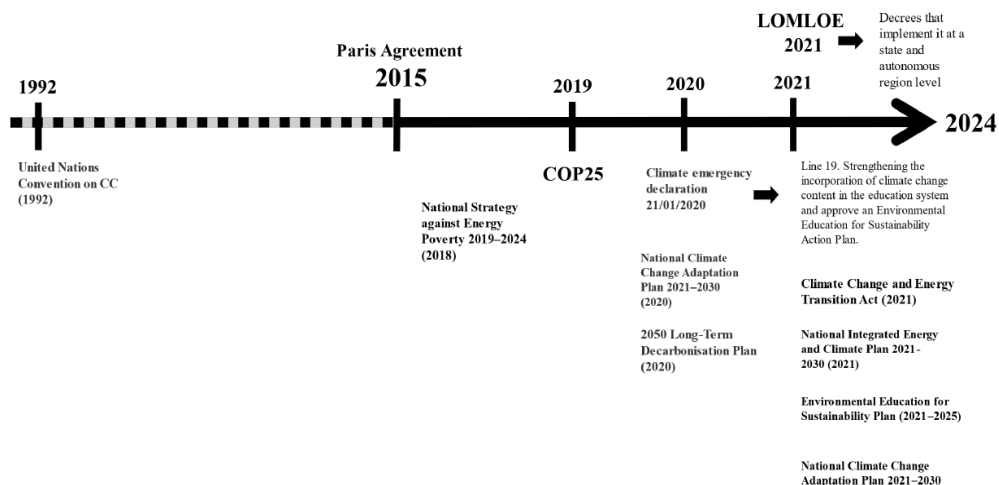
sustainable development (EDS) and global citizenship; and, on the other, what is known as *education for the ecological transition*. Its ideological and pedagogical turns are controversial (Meira, 2015), but it is surprising that the act does not include the concept *environmental education for sustainability* when this framework is used by the Ministry for Education and Professional Training, in collaboration with the Ministry for Ecological Transition and the Demographic Challenge, in preparing the PAEAS (2021-2025), the strategic priorities of which give a central role to the climate emergency.

It should be added that the concept *climate emergency* is also included in the decrees that govern the minimum content of Obligatory Secondary Education (ESO) and the Baccalaureate. In ESO, it features in the specific competences and basic knowledge of Civic and Ethical Values and Geography and History subjects. Its presence is important but it does carry the urgency of responses from the education system into the curriculum framework. So, beyond the LOMLOE's conceptual innovations, it is necessary to insist on the need to explore the bases of a climate emergency curriculum, positioning this crisis and its exceptional nature among the priorities that must be considered at all educational levels and at the level of social education initiatives,

with at least a triple purpose: (1) sending society a clear and forceful message about the risks we face, (2) connecting different agents from the education system and their communities of reference with the mitigation and adaptation policies, and (3) using the cultural and socialising tools from the education system and the field of social education to accelerate the changes that the socio-ecological transition demands (González et al., 2020)[4].

Analysis of the international educational panorama also does not reflect the importance of the climate challenge. A study by the International Bureau of Education on the presence of CC in the national curriculum frameworks of 78 countries found that only 35% of the total included the topic of CC in the text (IBE-UNESCO, 2016). A repeat of this study (UNESCO, 2019) shows that the panorama has barely evolved. These studies and others (Colliver, 2017; MacIntyre, et al., 2018; Monroe, *et al*., 2019; Eliam, 2022; Dawson et al., 2022) underline that treatment of the climate crisis when it is incorporated into educational practice tends to be reductive, linked to bio-physical science content, and paying little attention to its human, ethical, and social dimensions.

Furthermore, the limited action orientation of the dual mitigation and adaptation perspective should be noted. The cultural challenges of the socio-ecological transition and descarbonisation are usually absent from official curricula and have a marginal presence in extracurricular educational processes. The limited application of the PAEAS reflects the marginality of educational policies to tackle the climate emergency, hindered by the lack of consistent funding mechanisms and by inaction at other levels of the Administration, above all at the local and autonomous-region level. In view of the precariousness of the educational responses, Whitehouse (2017) argues that it is necessary to move CC "towards the centre of curriculum practice" (p. 64). Heras (2014), for his part, had already indicated that we not only need to put CC at the centre of the curriculum. In his opinion, educational resources that do not belong to the school system must also be strengthened, activating processes of social learning through the creation of peer knowledge networks, without ignoring the weight of the gender variable (García-Vinuesa et al., 2020), to involve all of society in action against CC, as suggested in the Action for Climate Empowerment (ACE) strategy promoted by the United Nations (UNESCO & UNFCCC, 2016; UNFCCC, 2018).

The LOMLOE is taking the first steps in this direction. However, the pace is still too slow. It might help promote a climate emergency curriculum in the short term, but it is necessary to identify what exceptional pedagogical focuses can be adopted, given the demand of the urgency of responding to the climate crisis. The lessons deriving from the recent health emergency caused by the covid-19 pandemic suggest that the education system can react and change significantly in a very short time period. The challenge is in how to turn the climate emergency into a problem that is relevant and meaningful for the different agents in the education system (political leaders, teachers, students, educational communities) and in the population as a whole. In other words, to ensure that it is no longer just another problem among the ones to which school and social educational practice must respond, and to make it a priority in the short and medium terms.

Curriculum theory has sufficiently demonstrated that one of the keys to any transformational process that is coherent with priorities of reforming and improving the education system is the initial and continuous training of teachers so that they can integrate new thematic, ethical, or methodological demands into their practice, in the classroom and in projects and initiatives that can be undertaken in educational centres as well as in the relations established with the

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[4] It should also be noted that this article's aim is not to assess exhaustively the changes that a specific law, the LOMLOE, and its regulatory implementation might make to the treatment of the climate emergency, but rather to draw attention to the slow pace with which educational systems, in general, are integrating transition policies aimed at mitigating and generating processes for adapting to the ongoing climate crisis. Despite its potential (which is still only performative), the LOMLOE arrives almost a decade after the Paris Agreement and at the moment in which everything indicates that the aims of limiting the increase in temperature by the end of the 21st century that were set in this agreement are already unattainable and so the delay will have more serious practical consequences.

communities in their surroundings. Integrating the climate emergency into everyday curricular practice is no exception[5].

Beyond the regulatory framework that governs education, it should be noted that section 35 of Spain's Climate Change and Energy Transition Act 7/2021, of 20 May, states that

> the Spanish education system shall promote the engagement of Spanish society in responses to CC, strengthening knowledge of CC and its implications, training for a technical and professional activity that is low in carbon and is resilient in the face of climate change and the acquisition of the necessary personal and social responsibility.

It assigns to the government the duties to review "the treatment of CC and sustainability in the basic curriculum of the teachings that form part of the education system" and to encourage "actions that guarantee adequate training in this subject for teachers".

8. Conclusions

Systematic reviews of scientific and informative literature about the climate crisis display significant shortcomings, limitations, and biases in the agendas being adopted in both educational and environmental policies. In so doing, they significantly compromise many of the commitments that have been made nationally and internationally, both in regards to the objectives that have been agreed for sustainable development and for adapting to, mitigating, and reversing climate change. In this context, it is on longer hidden that climate change and destabilisation and destruction of ecosystems greatly exceed the planet's limits in terms of production, consumption, and waste of materials, affecting education directly or indirectly, as stated in the report delivered to UNESCO by the International Commission on the Futures of Education (2022), which states that "our strategies should draw on existing knowledge about how to foster deeper learning and the development of civic competency, and on recent research on the development of skills for life and work" (p. 35).

With this aim, we have positioned a good part of our contributions in a critical, historical, and forwards-facing reading of the treatment given to various topics, interests, and priorities in contemporary educational research, with a double perspective: on the one hand, promoting educational and environmental policies in the configuration of agendas aimed at confronting the climate emergency; on the other, emphasizing the presence that in its proposals and lines of action has time as a variable, dimension, or vector coterminous with any process of development that aspires to be sustainable ecologically and socially. An undertaking that poses multiple questions that are still seeking the best answers. Although interest and a progressive increase in empirical output can be observed, the temporal vector of the climate crisis is absent, requiring more effort and attention. Works of a historical-phenomenological nature with emphasis on linguistic aspects will, in this sense, be able to open an innovative window on the reinterpretation of climate narratives on educational and environmental policies.

In any case, it is clear that the expression *climate emergency* makes it possible to go further, from a temporal perspective, than with what is more usually identified as *climate change*. In this sense, as there is no indication that education systems are meeting the challenges that such an emergency presents, accelerating the educational responses will be necessary, informing society of and educating it about the true nature and reach of the crises. This requires active participation of all sectors of society and joint responsibility and commitment from different scientific disciplines, with an interdisciplinary and transdisciplinary outlook being demanded

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[5] Beach (2023) reviews the theory of and research into the preparation of pre-service teachers to address the climate crisis, identifying seven principal challenges: (1) accepting variation in state standards relating to climate change teaching in schools, (2) providing valid knowledge about climate change, (3) acquiring positive attitudes and a sense of self-efficacy about climate education, (4) providing training for a transdisciplinary curriculum focus, (5) integrating environmental justice topics, (6) adopting a systemic focus, and (7) using case study methods to organise learning processes around local experiences of climate change.

ever more by the exceptionality, uncertainty, and risks that this crisis entails at a local and a global level. Environmental education and the construction of a culture of sustainability, in conjunction with the programmes and initiatives adopted regarding education for climate change, must contribute to this by exploring new methodologies for reflection, inquiry, knowledge, and action, contextualised territorially and socially.

Consequently, our proposed education research agenda seeks to explore what these focuses might be and how they can be promoted and *accelerated* from evidence proven by basic and applied scientific inquiry. From this outlook, the climate emergency presents an unprecedented challenge for the field of education, largely because of the temporal dimension that its genesis as a socio-environmental problem entails. Also because of the required speed of social responses, in a broad sense, to mitigate or limit risks to the human species. The drive for research in conjunction with the educational policies that are promoted must make it possible to introduce meaningful curricular, cultural, and social practices that connect the school and community experience with the climate emergency, as well as to design alternative and innovative resources and educational-social strategies to speed up the socio-ecological transition by acting on the lifestyles and developmental dynamics that foster these resources and strategies.

Authors' contributions

José-Antonio Caride: Conceptualization; Project administration; Resources; Visualization; Writing (original draft); Writing (review and editing).

José Gutiérrez-Pérez: Conceptualization; Resources; Writing (original draft); Writing (review and editing).

Pablo-Ángel Meira-Cartea: Conceptualization; Resources; Writing (original draft); Writing (review and editing).

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