frontiers | Frontiers in Education

TYPE Original Research
PUBLISHED 25 March 2025
DOI 10.3389/feduc.2025.1536271

OPEN ACCESS

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RECEIVED 29 November 2024
ACCEPTED 28 February 2025
PUBLISHED 25 March 2025

CITATION
Rivera M, Cortés W, Pino S, Meza M, Solis J and Merino C (2025) Climate change perceptions among Andean schoolchildren in Chile.
Front. Educ. 10:1536271.
doi: 10.3389/feduc.2025.1536271

Climate change perceptions among Andean schoolchildren in Chile

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This study explores the social representations of climate change among schoolchildren in an Andean community in northern Chile, using an ethnographic approach. Through drawings and explanations, students expressed their perspectives, revealing actionable representations that highlight their agency within the natural environment. Contrary to traditional views in scientific education, the findings underscore the importance of integrating local Andean knowledge to address environmental risks. The study involved 11 schoolchildren, aged 7–14, from a highly vulnerable rural school in Caspana, where multi-grade education is common. Data were collected through creative activities, written explanations, and group interviews, then analyzed qualitatively using semantic triangulation. The results demonstrate that Andean children perceive themselves as mediators between urban and rural worlds, capable of balancing environmental and cultural challenges. This research emphasizes the need for scientific education to value local knowledge, fostering sustainability and preserving the cultural agency of individuals in vulnerable yet environmentally significant regions.

KEYWORDS

climate change, perceptions, Andean, schoolchildren, ethnography

1 Introduction

This study addresses perceptions of climate change among schoolchildren in Caspana, an Atacameño community in the Antofagasta Region of northern Chile. This particular context is characterized by its cultural richness, its unique geographic location and the tensions generated by the processes of social, environmental and educational change that have transformed life in the area. By integrating the voices of schoolchildren from the Nuestra Señora de la Candelaria School, this work seeks to contribute to the understanding of the interactions between culture, nature and education in an environment marked by climatic challenges and the need to preserve cultural heritage.

This work contributes to the understanding of how rural communities face the challenges of climate change from a culturally situated perspective. By making the voices of Caspana schoolchildren visible, it seeks to highlight the relevance of integrating local knowledge into educational design, fostering scientific literacy that values cultural diversity and promotes sustainability.

1.1 Literature review on climate change in Chile and sustainable

The reports on climate change are hopeless (Intergovernmental Panel on Climate Change, 2014; 2021), as they warn of the need for intervention of a global agenda to advance in decision-making regarding the anthropogenic effect, governmental containment measures and awareness-raising among citizens. The latter, has a fundamental role on their ability to make decisions in everyday life based on evidence capable of generating a social transformation focused on the care of their immediate environment and their community (Hestness et al., 2017; Unterhalter, 2019). The situated character of climate change is vital in restructuring the various aspects of human life, which intersect ethical, political, scientific and cultural aspects (Canlas and Kazakbaeva, 2023). For this reason, science education is a pillar to generate opportunities for transformation of each student's worldviews, positioning and agency on climate change (Tayne et al., 2021). A faithful reflection of this conflict resides in Chile, considered one of the countries most affected by climate change (Sarricolea et al., 2023). Particularly in the Antofagasta Region, reduced precipitation, receding glaciers and intensified droughts have altered local ecosystems, affecting both human communities and biodiversity. In Caspana, these changes are particularly visible in the reduction of river flow and the transformation of the landscape.

The relationship between climate change and cultural practices in this region has been the subject of previous studies highlighting the need for interdisciplinary approaches to address these challenges. Rivera et al. (2018) note that local knowledge plays a crucial role in climate change adaptation, highlighting the importance of incorporating these perspectives in the design of educational policies and programs.

Given the socio-environmental demands outlined in the 2030 Agenda, environmental education must be able to respond with appropriate knowledge, attitudes, and behaviors to address the forthcoming global changes (OECD, 2023). Integrating Environmental Education into the school curriculum is crucial for sustainable education, aiming to transform students' perceptions and concrete actions toward environmental protection, empowering them as agents of change within their communities (Boca and Saraçlı, 2019).

The literature on environmental education is undergoing changes that encourage the sharing of socially constructed meanings and sentiments regarding sustainability, rather than adopting rigid scientific concepts. Various experiences have prioritized the situated contexts of different human groups in pursuit of their holistic development, seeking to address sustainable concepts and practices based on their local knowledge, policies, and the ethics of their culture (Kopnina, 2015). Through the use of scientific concepts, measures and actions should be adopted that foster a critical and enactive attitude (Shutaleva et al., 2020). Therefore, environmental education should not be viewed solely from a practical perspective; rather, it should invite exploration of new positions that contribute to a deeper understanding of human cognition.

In this regard, several studies position sustainability as a mental state that questions the relationship between our identity, environmental actions, and their implications for nature. Challenging anthropocentrism, Bonnett (2006) proposes fostering human awareness based on the human-nature balance and the belief systems involved, despite recognizing persistent gaps between the paradigms of environmental education and scientific education in addressing this issue from a socio-ecological perspective. The challenge lies in generating greater convergences that enhance motivation and the understanding of natural phenomena, where, from an integral socio-ecological perspective, the scientific paradigm is reconceptualized by combining affective and cognitive aspects, encouraging participation in local socio-scientific issues (Schönfelder and Bogner, 2020; Wals et al., 2014).

This situation is even more pronounced in non-urban contexts, where communities have a direct interaction with ecosystems, linked to their culture, resource extraction methods, and worldviews that shape their social dynamics. In these rural contexts, environmental education plays a crucial role in promoting sustainable practices, strengthening local cultural, identity, and ecological knowledge, as well as fostering sustainable management among students and their families (Silva et al., 2023). Therefore, efforts must be made to explore the particularities of community members and their relationships with their natural environments, including their characteristics, perceptions, and beliefs.

2 Materials and methods

2.1 Methodology

2.1.1 Community contextualization

2.1.1.1 Caspana: a unique physical and cultural landscape

Caspana is located in a valley surrounded by mountains, 84 kilometers east of Calama, at 3,264 meters above sea level. The etymology of the name "Caspana," from the Kunza language, refers to the "children of the hollow," reflecting the intimate relationship between the geographical environment and community identity. This village, with a population of approximately 200 inhabitants, has maintained continuity in its cultural and agricultural practices dating back to pre-Columbian times (Miranda Correa, 2021). Terraced agriculture, river channeling and ceremonies such as "payment to the land" are manifestations of a symbiotic relationship with nature. The community faces, however, significant changes due to the impact of climate change, evidenced mainly in the decrease in the flow of the Caspana River, and tensions between the ancestral and the modern (Hurwitz et al., 2021). The paving of roads by mining companies has connected the locality to urban areas (Calderón-Seguel and Prieto, 2023), which has influenced the classification of the school, which initially rural is now considered "urban," despite the clearly rural conditions in terms of cultural practices and ways of life.

2.1.2 The school as a space of cultural and educational intersection

The Nuestra Señora de la Candelaria School is a microcosm where cultural, social and educational dynamics converge. With only 18 students attended by six multi-grade teachers, the school plays a central role in the transmission of both ancestral and contemporary knowledge. However, geographic isolation and lack of resources present significant challenges for educational development.

The school's teachers, aware of the future transitions that schoolchildren face when migrating to urban environments to continue their studies, have adopted a pedagogical approach focused

on strengthening communicative competencies. According to Gómez and Peronard (2004), these skills are essential for schoolchildren to function in diverse contexts, enabling them to articulate local cultural practices with the linguistic and social codes of urbanity.

2.1.3 Ancestral cultural practices as a framework for community identity

In Caspana, cultural practices such as canal cleaning, religious celebrations and the "call of the water" not only have a functional purpose, but also serve as mechanisms of community cohesion and cultural identity (Jorquera Silva et al., 2021). These activities reflect a deep respect for ancestors and sacred places, values that are transmitted through generations and manifested in the relationship with nature.

Climate change threatens these practices by altering the valley's ecological balance. Decreased rainfall, increased temperatures and progressive desertification impact both natural resources and cultural traditions. In this context, the school becomes a key space to explore how schoolchildren interpret and cope with these changes from a culturally situated perspective (Hikmawati et al., 2020). The concept of social representations, developed by Moscovici (1984), provides a theoretical framework for analyzing how schoolchildren in Caspana understand climate change. Social representations are systems of values, ideas and practices that allow people to interpret and make sense of their reality (Calixto-Flores, 2021).

In this study, these representations are expressed through drawings and discourses, reflecting the experiences, beliefs and knowledge of schoolchildren about their environment.

From an educational perspective, this work is framed within the framework of critical intercultural education, which seeks to recognize and value local knowledge as a basis for learning. According to Barton (2000), functional scientific literacy should integrate the experiences and knowledge of schoolchildren, promoting an understanding of the world that articulates science with cultural and environmental realities.

2.1.4 Ethnography as a tool for exploring school perceptions

Ethnography allows us to capture the complexities of the interactions between schoolchildren, their environment and cultural practices in a context such as Caspana. This approach focuses on observation and analysis of unstructured data, allowing the identification of emergent categories that reflect the perceptions and experiences of schoolchildren (Muñoz, 2024).

From an approach in science education, knowing the school representations about their natural environments allows observing the authentic student protagonism, including spaces for the exchange of meanings, through dialogic communication, among class members about natural phenomena (Bossér et al., 2015; Bossér and Lindahl, 2019). The above tensions the deterministic and traditional tendencies of science teaching, opening a space to give value to students' epistemes, recognizing their cultural ways of seeing the world (Kayumova and Dou, 2022). In this study, the drawings and explanations of schoolchildren constitute a window into their representations of climate change (Varela et al., 2020). By analyzing these representations, we seek to understand how students perceive changes in their environment and identify opportunities to integrate these perceptions into the design of educational resources that respond to the needs and realities of the community. The case of Caspana illustrates the intersections between the local and the global in the context of climate change. While global climate policies emphasize the need to reduce greenhouse gas emissions and promote sustainability, local communities face specific challenges that require solutions tailored to their contexts (Suryawati et al., 2020). In this sense, education plays a crucial role in empowering students to understand and act on these challenges through evidence-based decision making (Latulippe and Klenk, 2020).

Critical intercultural education, as proposed by Stefoni et al. (2020), should promote principles of otherness, conversation and reciprocity, recognizing and valuing the contributions of local cultures to global knowledge. In Caspana, this approach involves integrating ancestral knowledge and practices into the school curriculum, fostering a scientific literacy that responds to both local needs and global challenges.

2.2 Ethnographic design

The ethnographic approach design makes it possible to describe the representations of schoolchildren through their drawings and discourses and is characterized by the following features: (1) it emphasizes the particular exploration of social phenomena, (2) it works with "unstructured" data, that is, with data that have not been codified in a manner prior to their collection, and generates a set of closed categories, (3) it analyzes data involving the explicit interpretation of social representations the meanings and functions of human actions collected from verbal and nonverbal language with the role of quantification (Pérez, 1994).

In this context, a group of school children were invited to participate in an activity on climate change during science class. For this, they received the following instructions verbally: (1) on a sheet of paper, placed horizontally, draw and paint the climate change in Caspana; (2) on the back write the explanation of your drawing and/or record an audio with the explanation and (3) a group interview was recorded and transcribed about the drawings made.

2.3 Objectives

To explore the representations of climate change among schoolchildren in Caspana, to describe their experiences and cultural knowledge. From an ethnographic approach.

2.4 Participants

The non-probabilistic sample consisted of 11 schoolchildren, between 7 and 14 years of age, who live in Caspana or its surroundings, and are in the first to eighth grade in multi-grade mode at the Nuestra Señora de la Candelaria School in Caspana. The schoolchildren only know the Altiplano or Bolivian winter, which occurs because the high pressures coming from the Amazon region collide with the Andes Mountains and cause rains in summer and river floods during January and February. But they have not studied other climate factors.

The community witnesses, every year, the rain during one of their religious festivals on February 3rd. In 2022, it also rained in March. In this school, the School Vulnerability Index is high, since in the range

of 1 to 100, it reaches 94% (2024). This indicator is used to identify and characterize the risk factors of schoolchildren in their educational paths, according to the National Board of School Aid and Scholarships of the Ministry of Education. The index is calculated using a combination of variables that include socioeconomic, family and school factors. Among the variables considered are: Socioeconomic level of the family, Housing conditions, Educational level of parents, Health conditions of students and Access to basic services.

2.5 Data analysis

The analysis contemplated the process of: segmentation of the drawings according to the highest frequencies of drawings and words, technological transcription of the explanation using Trascribe software (version 4.18.3) and the design of the categorical model of codes for the qualitative analysis of the discourses in the Átlas-Ti software (2022) to label groups of relevant data.

To analyze the content, the corpus of the explanations, composed of the audio transcriptions, was formed and validated from the semantic perspective (Bardin, 2002), the emerging categories were identified according to the statistical frequency of appearance, the codes of meaning were described and, finally, the information from the data obtained through the drawings, the explanations and the ethnographic observations in the school was triangulated. In this way, categories were obtained that were not induced but emerged from the explanations of the schoolchildren.

3 Results

3.1 Emerging categories

The representations of climate change elaborated by the schoolchildren of Caspana offer a deep insight into how the girls and boys of this community perceive and conceptualize a global phenomenon from their local context. The 11 drawings analyzed reveal a predominant oppositional explanatory structure, in which schoolchildren contrast an idealized past with a deteriorated present. This binary approach not only reflects their interpretation of environmental changes, but also highlights the influence of cultural practices and environment on their representations.

Of the 11 drawings, nine present an explicit "before and after" structure, a visual resource that symbolizes both the loss and transformation of the environment. A recurrent example is the comparison between fast-flowing rivers and low-flowing rivers, which manifests a direct concern for the decrease in water resources, a highly relevant issue in the Caspana community (see Figure 1A). This dichotomous approach is complemented by representations of lifestyles in a desert landscape, suggesting an integration of cultural elements in their understanding of climate change (see Figure 1B).

The analysis of the graphic and discursive representations made it possible to identify emerging categories that encompass natural, human and social aspects. These categories provide a basis for understanding how schoolchildren organize and prioritize the elements of their environment when reflecting on climate change. Table 1 shows examples of the categories explained below, as well as their description.

3.1.1 Natural elements

The drawings highlight key components of the natural landscape, such as the sun, clouds, rain, trees, hills, rivers and lakes. These images not only represent the geographic reality of Caspana, but also reflect a sensitivity to the elements essential to life and ecological balance. For example, the drawings of leafy trees contrasted with dry trees symbolize the perception of climate change as a direct threat to biodiversity (Figure 2).

3.1.2 Vegetation and fauna

The inclusion of shrubs, flowers and domestic animals underlines the schoolchildren's connection with the local flora and fauna. These elements appear as indicators of environmental well-being or deterioration, depending on their representation. The loss of vegetation and the absence of fauna in some drawings suggest an emerging awareness of the fragility of ecosystems (Figure 3).

Desertification, represented by desert landscapes, with brown hills and rivers that barely hold water, reflects the advance of desertification,

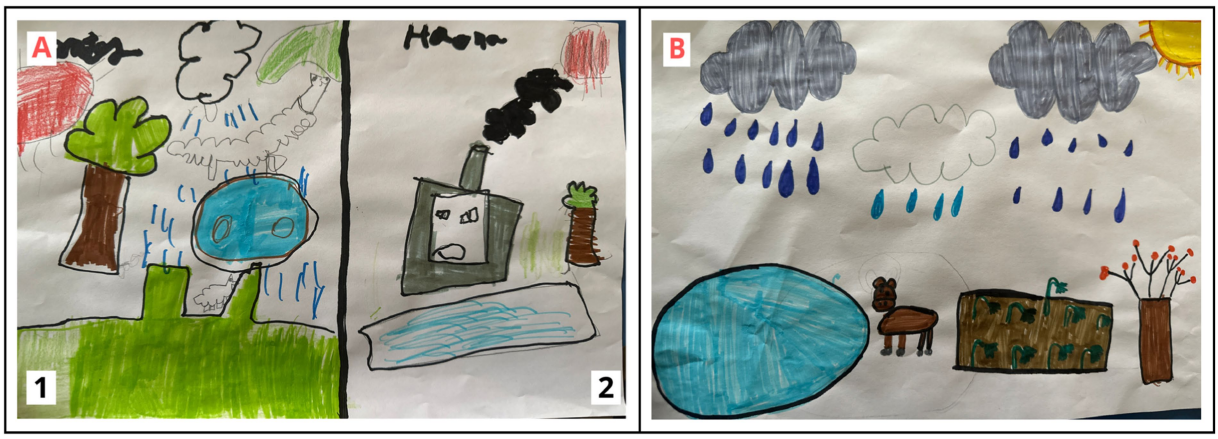

FIGURE 1
Integration of cultural elements in understanding climate change. In **(A)**, 1 and 2 represent "before" and "now" respectively **(B)**.

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TABLE 1 Examples of the categories.

Emerging categories	Description	Author's explanation	Example
Natural elements	The drawings include elements such as the sun, clouds, rain, trees, hills, rivers and lakes.	*Climate change*	
Vegetation and fauna	The drawings include vegetation, such as trees, bushes and flowers, which is a recurring theme. Animals are also included in some drawings.	*This river, for me, means something sacred, because they have never harmed this place. How they have left it here intact and to continue with its nature. There are some animals: toads, little birds, fish and that*	
Landscapes and scenarios	The drawings include various landscapes and settings, such as deserts, snowy hills, and paths leading to places like school.	*I drew the path from the school to the post office, along the way you can find trees, houses, threshing floors, plants and other things.*	
Climate change	The drawings include depictions of the impact of climate change, showing differences in the environment before and after climate change. This includes comparing landscapes at different times, such as fast-flowing rivers versus slow-flowing rivers, and lush vegetation versus withered vegetation.	*Because it does not rain and there is a little less water, because the grass in front of our house is drying up and the trees are withering.*	
Characters and human activities	The drawings include people and their activities, such as a person talking about the decrease in rainfall, or a building storing water.	*It does not rain as much as it used to.*	

FIGURE 2
Representation of the perception of climate change. The word cloud shows "it does not rain like before".

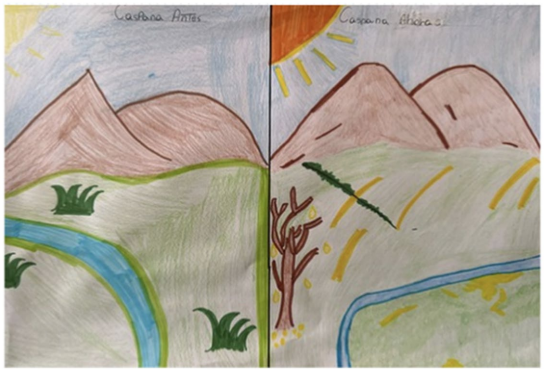

FIGURE 3
Illustrative drawing on environmental deterioration.

a direct threat to agriculture and life. This transformation of large rivers into rivers with little flow and the disappearance of lakes show a critical concern for the availability of water, a fundamental resource in an arid environment such as Caspana.

3.1.3 Landscapes and sceneries

The desert landscape and snow-capped hills are recurring representations that reinforce the geographical identity of Caspana. The paths that lead to specific places, such as the school, indicate a recognition of the interactions between people and their environment. These elements are narrated as witnesses of environmental changes, positioning the landscape as a protagonist in the narrative of climate change. The reduction of rainfall is a recurring concern, a phenomenon visualized through clear skies and arid landscapes, which underlines its relevance in the daily life of the community that values the bodies of water, visible at a discursive level:

> *"This river, for me, means something sacred, because they have never harmed this place. How they have left it here intact and let it continue with its nature. There are some animals: toads, little birds and fish"* (PST_3:1).

3.1.4 Climate change

The comparison between "Caspana before" and "Caspana now" constitutes one of the most powerful narratives. The students illustrate this contrast through the transformation of rivers, vegetation, and temperatures. This approach shows the internalization of concepts related to climate change, such as desertification and global warming, framed within their local experience.

The increase in temperatures is represented by intense suns and warm-colored sun rays, which denotes a clear perception of global warming as a central factor of climate change (Figure 3). Likewise, their perceptions at the discursive level are reflected in consequences for daily life.

> *"Because it doesn't rain and there is a little less water, because the grass over there is drying up and the trees are withering" (PST_1:2).*

3.1.5 Human characters and activities

The inclusion of human figures interacting with the environment, such as people talking about the lack of rain or constructions designed to store water, highlights an initial understanding of the relationship between human activities and environmental changes. These representations suggest an emerging awareness of the need for adaptive solutions to mitigate the effects of climate change.

> *"There we can tell them not to use so much water, but because we have animals, we use too much water, about one hundred and twenty-two liters almost every day. And the water is using a lot because we don't have water anymore" (PST_1:4).*

3.2 Negative aspects, perceived effects of climate change

School children's drawings and explanations clearly identify the negative impacts of climate change on their surroundings (see Table 2). These aspects include:

a) Droughts and reduced rainfall: Reduced rainfall is a recurrent concern, expressed in the drawing of an adult man who says "it does not rain as much as it used to." This phenomenon is observed in drawings with clear skies and arid landscapes, which underlines its relevance in the daily life of the community.
b) Desertification: Desert landscapes, with brown-toned hills and rivers that barely conserve water, reflect the advance of desertification, a direct threat to agriculture and life in Caspana.
c) Global Warming: Rising temperatures are represented by intense suns and warm-colored sunrays, denoting a clear perception of global warming as a central factor of climate change.
d) Loss of vegetation: The depiction of dry trees and withered vegetation symbolizes the loss of essential natural resources for the community. This deterioration is a reflection of the combined impact of drought and climate change on local ecosystems.
e) Impact on bodies of water: The transformation of fast-flowing rivers into low-flowing rivers and the disappearance of lakes are evidence of a critical concern for the availability of water, a fundamental resource in an arid environment such as Caspana.

3.2.1 Code: environmental culture-disorder, a semantic interpretation

The analysis of the representations made it possible to identify the code "Environmental Culture-Disorder," which encapsulates schoolchildren's perceptions of the relationship between climate change, cultural practices and the environment. This code combines elements of tradition, social responsibility, nostalgia and environment, revealing a complex interaction between cultural and natural dimensions.

a) Environmental culture: This component of the code reflects a deep connection to ancestral traditions and the perception that climate change threatens not only the physical environment, but also the cultural identity of the community. Nostalgia for a more balanced past and emerging social responsibility are integrated into school children's explanations.
b) Disorder: "Disorder" manifests itself as a mixture of confusion, curiosity and distraction, reflecting schoolchildren's perception

TABLE 2 Environmental culture-disorder code.

Group interview content. Examples	Related codes. Examples
Yes, I have noticed a lot, it is true that the water now comes out more like it has chlorine and the river is already rising in water. So, it is more difficult to cross. So, yesterday we could hardly clean because now we have to wear shoe protection because the water has risen a lot and almost the entire river is already wet.	Environmental Culture: Natural Changes, Environmental Culture: Environment, Disorder: Flood
Because it does not rain and there is a little less water, because the grass in front of our house is drying up and the trees are withering.	Environmental culture: Environmental concern
Gathering them in the village or in a local. There we can tell them not to use so much water, but since we have animals, we use too much water, approximately one hundred and twenty-two kilos almost every day. And we are using a lot of water because we no longer have water.	Environmental culture: Social responsibility, Environmental culture: Sustainability, Disorder: Scarcity of resources
I do not know, there is very little water now, and it is running out because there is not enough water to give the animals to drink and if we do not give them water they could die just the same with the grass. So, then, then the water is running out, because it does not rain much anymore because the water comes from the mountain ranges and now the mountain ranges are running out of snow. So, now that it does not rain anymore, there is not as much snow anymore, that's why they have run out of water a little or sometimes some go to look for it in the pond.	Environmental culture: Environment, Disorder: Water scarcity
This river, for me, means something sacred, because they have never harmed this place. How they have left it here intact and to continue with its nature. There are some animals: toads, little birds, fish and that	Environmental culture: Connection with nature, Environmental culture: Respect for the environment

of changes in their environment. This component suggests a tension between intuitive understanding and the need to structure scientific knowledge to interpret climate change.

The results align with the stated objectives. Therefore, describing the contextual characteristics in which the study was conducted allows for the establishment of an anthropological learning threshold that should be made visible during the scientific and functional literacy of communities. This is particularly important in more isolated and vulnerable communities to contribute to their full development.

4 Discussion

The reports on climate change are hopeless (Intergovernmental Panel on Climate Change, 2014; 2021); therefore, the results obtained in this case study illustrate possible actions that emerge from the explanations of schoolchildren about their own drawings. They integrate ethical, political, scientific, and cultural aspects to make climate change visible despite not having training in sustainability (Canlas and Kazakbaeva, 2023). This identifies them as agents of change within the Caspana community (Boca and Saraçlı, 2019). Therefore, environmental education can be incorporated into the school curriculum from the ethnographic perspective of intercultural communities, which allows making their beliefs, identities, and relationships with their natural environments visible.

The anthropological tensions present in the drawings, such as the predominance of natural landscapes, are of interest because we mentioned earlier that the school is classified as urban since it has connectivity through a paved road; however, it is not the urban element that predominates but the natural landscape. It should also be considered that the paved roads are urban works of the mining companies in the sector and, therefore, are not managed by the community since they do not promote the urbanization of the place. Another aspect that draws attention is the fact that few houses, agricultural, livestock and religious activities are drawn, which constitute identity practices of the community.

The schoolchildren represented climate change through concrete elements such as natural landscapes and living beings, in these landscape drawings the socio-scientific phenomenon of the decrease in river flow is reflected, an object of interest for the Caspana community, according to the problematic prioritization they gave to this topic at school. In previous ethnographic studies (Rivera et al., 2024; Rivera, 2018; Rivera, 2021) we found, following Vosniadou (2019) that children do not represent their scientific experiences, but tend to reproduce what science texts say; this confirms that the development of science understanding occurs, since they are young, they understand the physical world according to everyday experiences through framework theories. "Framework theories are different from currently accepted science and impose restrictions on how schoolchildren understand scientific explanations of phenomena, leading to the creation of fragmented or synthetic conceptions." This author argues "that in order to understand science, schoolchildren need to make important changes in the way they represent and explain the physical world, as well as in their ways of reasoning. During the development of scientific knowledge, schoolchildren must create new concepts and belief systems that do not necessarily supplant their framework theories but coexist with them." He states that "these developments are gradual and slow and follow a learning progression" and that the effectiveness of science education will depend on making schoolchildren aware of their intuitive understanding. He goes on to recommend providing science information gradually and in accordance with the learning progressions of schoolchildren and developing the reasoning skills and executive function skills of schoolchildren.

In contrast to the above, we consider it a finding that this study evidences territorial, rural, and intercultural Atacameño elements with which students experience and construct scientific knowledge about climate change. These anthropological thresholds (Rivera, 2018) are composed of their knowledge, experiences, opinions, and beliefs about the changes they perceive in the landscape. Particularly, regarding the oppositions they express and explain about their drawings of the river with low flow compared to the high flow, dry lakes, the effects on the dry trees, the excess sunlight, the decrease in rainfall, and only one animal.

Finally, this study highlights the importance of environmental representations as anthropological thresholds and the need to make them visible in didactic co-designs to promote functional (Barton, 2000) and scientific literacy in critical intercultural education contexts that encourage learning based on students' personal experiences, integrating knowledge from their places of origin and current experiences, strengthening the didactic training of rural teachers through the principles of alterity, conversation, communication, flexibility, and reciprocity (Stefoni et al., 2020). These principles are present in Andean cultures (Fernández, 2000) and in ancestral practices that we must value and preserve.

5 Conclusion

The ethnographic analysis of the drawings and speeches of the schoolchildren from Caspian allowed for the identification of complex and deeply significant representations of climate change. These representations not only reflect an intuitive understanding of the phenomenon but also a narrative articulation structured in temporal oppositions of "before" and "after," highlighting the negative effects of climate change on their immediate environment.

- Key elements in the representations: Students prioritize natural components such as the sun, rivers, trees, and clouds, reflecting a direct connection with the resources they consider essential for their daily lives and the ecological balance of their community. The decrease in rainfall, desertification, global warming, loss of vegetation, and the impact on bodies of water emerge as the main environmental concerns.

The perceptions of the schoolchildren are deeply linked to the cultural practices and the natural environment that define life in Caspana. These connections are reflected in the emerging categories, which combine environmental, cultural, and social elements, highlighting the central role of community identity in the interpretation of climate change.

- Relationship with the natural environment: The students represent climate change through transformations in the landscape, such as the decrease in river flow, the loss of vegetation, and desertification. These elements are explained from a local perspective, indicating a perception of climate change as a phenomenon that alters both natural resources and the ways of life dependent on them.
- Linkage with cultural practices: The representations include elements that transcend the environmental to incorporate cultural and spiritual dimensions, such as references to ancestral ceremonies, the importance of water in community cohesion, and respect for ancestors. This demonstrates that climate change not only affects the physical environment but also the cultural values and traditions that sustain Caspaneña identity.

The study shows that the perceptions of climate change among the schoolchildren of Caspana are deeply influenced by their local experiences and cultural practices. These perceptions, far from being fragmented or disconnected, constitute a system of meanings that articulates science, culture, and the environment.

- Relevance for intercultural education: The representations of children highlight the importance of integrating local and ancestral knowledge into the school curriculum. This not only allows students to understand climate change from their context but also promotes a critical intercultural education that values cultural diversity and fosters functional scientific literacy.
- Contribution to the design of educational policies: This study reinforces the need to adapt educational programs in rural contexts, considering the cultural and environmental particularities of the communities. In the case of Caspana, the findings underscore the importance of designing educational resources that connect scientific knowledge with local experiences, promoting meaningful and culturally relevant learning.

5.1 Deepening the analysis, the construction of meanings in intercultural contexts

The representations of climate change analyzed in this study are not mere descriptions of an environmental phenomenon, but cultural expressions that integrate the knowledge, beliefs, and experiences of the schoolchildren. The dichotomous structure of "before and after" reveals a collective perspective, characteristic of Andean practices, that articulates the impact of climate change with the identity and current experiences of the community.

In an intercultural context like Caspana, these representations acquire an additional meaning by reflecting the tensions between the ancestral and the modern, the local and the global. The integration of religious elements, such as the cross, and references to local architecture suggest that the schoolchildren interpret climate change not only as an environmental issue but also as a cultural and social challenge.

5.2 Implications for environmental education and scientific literacy

The findings of this study have important implications for environmental education in rural and intercultural contexts. By making the local perceptions and knowledge of the students visible, the need to design educational resources that integrate these perspectives into the school curriculum is highlighted. Functional scientific literacy, as proposed by Barton (2000), should articulate scientific knowledge with local experiences and knowledge, fostering an understanding of climate change that is culturally meaningful.

In summary, this study confirms that schoolchildren's perceptions of climate change are deeply rooted in their natural and cultural environment. Their visual and discursive representations evidence an integrated understanding of the phenomenon, enriched by cultural practices and community values. This approach highlights the importance of making local perspectives visible and valuing them in educational design, promoting environmental education that articulates science, culture, and sustainability in intercultural contexts.

5.3 Recommendations

According to the conclusions obtained, we recommend the following actions:

Develop ethnographies that identify and describe the representations of climate change of schoolchildren, in their own contexts, since these representations constitute anthropological thresholds that emerge from the communities and allow scientific learning to be anchored.

Incorporate the anthropological thresholds of climate change in environmental education materials that make visible the observations and concerns of school communities.

From the anthropological perspective, the links or strong representations of climate change will move schoolchildren to action by articulating science, local knowledge, and sustainability in intercultural contexts.

Data availability statement

The original contributions presented in the study are included in the article/Supplementary material, further inquiries can be directed to the corresponding authors.

Ethics statement

The studies involving humans were approved by the ethics committees the Pontificia Universidad Católica de Valparaíso: BIOPUCV-H 581–2023. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation in this study was provided by the participants' legal guardians/next of kin. Written informed consent was obtained from the individual(s), and minor(s)' legal guardian/next of kin, for the publication of any potentially identifiable images or data included in this article.

Author contributions

MR: Conceptualization, Data curation, Formal analysis, Investigation, Methodology, Supervision, Validation, Writing – original draft, Writing – review & editing. WC: Validation, Writing – original draft, Writing – review & editing. SP: Formal analysis, Software, Writing – review & editing. MM: Investigation, Supervision, Writing – review & editing. JS: Data curation, Formal analysis, Methodology, Writing – review & editing. CM: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Project administration, Resources, Writing – original draft, Writing – review & editing.

Funding

The author(s) declare that financial support was received for the research and/or publication of this article. This work was funded by Fondecyt Project 13220048, National Agency for Research and Development (ANID) Government of Chile.

Acknowledgments

The authors thank the students of the Caspana School for developing the activity that allowed the generation of data.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2025.1536271/full#supplementary-material

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