

## ORIGINAL ARTICLE

# Climate awareness, anxiety, and actions among youth: a qualitative study in a middle-income country

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**Objectives:** The impact of climate change on mental health is well established, but few studies have examined the perspectives of young people, especially in low- and middle-income countries (LMICs). In this qualitative study, we explored how Brazilian children and adolescents experience climate change. This approach can help inform environmental education, communication, and self-care strategies for this age group.

**Methods:** We conducted focus groups with 50 children and adolescents aged 5 to 18 years in three locations in Brazil. We analyzed the data using an interpretative phenomenological analysis framework.

**Results:** We identified three profiles of involvement with climate change: unaware, disengaged, and engaged. Profiles were largely related to different socioeconomic contexts. We analyzed each profile across the dimensions of space, time, emotions, and actions. Adults were portrayed by participants as stubborn deniers, as neutral influences, or as role models of knowledge and engagement. Due to their age and developmental level, young children had distinctive perceptions of climate change.

**Conclusion:** Spatial and temporal perceptions of climate change are a key element for experiencing and engaging with environmental concerns and vary according to age and socioeconomic differences. Effective communication to foster climate action at individual and collective levels requires narratives that reach different ages. Replication of these findings in other LMICs is warranted.

**Keywords:** Climate change; eco-anxiety; children; adolescents; social inequality

## Introduction

Climate change poses a significant threat to the well-being of ecosystems, societies, and individuals, with an increasing number of studies highlighting its consequences for mental health.<sup>1</sup> Children and adolescents have intrinsic vulnerabilities that lead to an increased risk of experiencing psychological distress as a result of climate change.<sup>2</sup> Some young people also experience emotional distress related to climate change, which is characterized by feelings of anger, guilt, and despair.<sup>3</sup> These feelings are considered an appropriate, adaptive, and non-pathological response to ecological losses.<sup>4</sup> Apathy and inaction toward climate change on the part of those in power, such as adults and governments, reinforce these negative emotions and thought patterns.<sup>5</sup>

The lack of effective communication around climate change has led to a discrepancy between the scientific

community's increasing certainty about anthropogenic human interference in climate and the public's limited concern about effective climate policies.<sup>6</sup> Despite the impact of climate change on children, environmental actions led by young people have been met with ambivalent responses. News media often portray children and adolescents as immature and subject to the will of adults around them. Such portrayals, in addition to devaluing and obscuring young people's subjective experiences and beliefs, further complicate the task of helping young people respond to climate change.<sup>7</sup>

Few studies have sought to understand children's experiences and feelings about the issue; what research does exist tends to center on high-income countries and utilize small samples of adolescents, usually aged 15 or older.<sup>7</sup> Little is known about the experiences of younger children and those in low- and middle-income countries (LMICs). Thus, this work aims to better understand

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children's and adolescents' experiences of climate change in Brazil, a middle-income country marked by social and economic inequalities. Additionally, we seek to elucidate more effective forms of climate-change communication to help young people move from fear and paralysis to hope and action.

## Methods

### *Sample*

Our study represents one branch of a larger research study on young people's perceptions of climate change in France, the United States, and Brazil, conducted in 2021 and 2022. For this study, we interviewed 50 Brazilian children in different regions of the country: the cities of São Paulo (state of São Paulo) and Salvador (state of Bahia), as well as several villages of Ilha de Itaparica (state of Bahia). The participants were children and adolescents between the ages of 5 and 18, sampled by convenience. Some of the interviewees were known to the researchers and were recruited face-to-face, while others were recruited through a school to which we advertised the project via e-mail. Participants and their parents provided oral consent. Two adolescents were invited but could not participate, due to schedule incompatibility with the other focus group participants. We also interviewed three parents of young children; these interviews were audio-recorded, transcribed, and analyzed using the same methodology as the interviews of children and adolescents. The results obtained in the parents' interview provided a better picture of the situations reported, which the young children occasionally had difficulty describing.

### *Study setting*

Most of the participants from São Paulo came from schools in the central-west and central-south zones of the city, regions with a high socioeconomic level. However, four participants were from smaller cities (Santo André and São Bernardo) that are part of the São Paulo metropolitan region.

Bahia belongs to the poorest region of Brazil, where 43.5% of the population lives in poverty (defined as subsisting on less than USD 2/day<sup>8</sup>) and where crime rates are the highest in the country.<sup>9</sup> Salvador is a coastal city, the capital of the state of Bahia, with a population of approximately 3 million; Ilha de Itaparica is an island with a total population around 22,000 and a low population density (176/km<sup>2</sup>). On Ilha de Itaparica, only 9% of the population is officially employed, and 47% earns, at most, half of the monthly minimum wage in Brazil.<sup>10</sup> Many residents of coastal villages make their living from informal work (i.e., beach vendors, housekeepers, delivery couriers), activities related to tourism during the high season (i.e., informal transport or guided tours), and fishing. Most of the children recruited there came from public schools. Furthermore, most of the participants from this region were Black, which can be traced back to vestiges of slavery in Bahia.<sup>11</sup> This heritage,

combined with ongoing structural racism, perpetuates the association between poverty and being Black in this region.

### *Data collection*

Three researchers (DTC, EAN, LB) were native speakers of Portuguese. DTC is of Asian descent, while EAN and LB are White; LB and DTC are female, and EAN is male. The three investigators conducted the interviews using a semi-structured guide consisting of 19 sensitizing questions, which inquired about perceptions of climate change, emotions related to climate change and coping with it, exchange of information about the topic with adults and friends, actions respondents try to take, and possible barriers they face in doing so. Interview groups ranged in size from one to nine participants, with a total of 13 groups. Five focus groups were conducted online (via Zoom) and eight in person. There were no non-participants present at the interview sites. The in-person interviews were audio-recorded, and the online interviews were audio- and video-recorded. The video record was destroyed immediately after the interview. Audio records were transcribed and anonymized to maintain confidentiality. Each interview lasted approximately 1 hour. We offered BRL 15.00 (USD 2.90) as a token of appreciation to each study participant.

### *Data analysis*

We utilized interpretative phenomenological analysis (IPA) for this study. This methodology seeks to understand the lived experience of each person in relation to the phenomenon of interest. However, these subjective experiences cannot be reached in their pure form, but only through the researcher's own conceptions, thus creating a two-stage interpretation process.<sup>12</sup> As opposed to hypothetical-deductive research, inductive research should closely reflect the data collected, not the structure of the interview guide. The authors, prior to the interviews, actively examined their own relationship with climate anxiety, based on existing literature, previous experiences, and embedded within a specific socioeconomic context. As the interviews took place, they took notes on their impressions and thoughts regarding the content of the interviews. The material was read several times over a period of months, allowing time to provide occasions for new meanings to emerge; these impressions were taken to supervision.

Reflexivity, according to Engward & Goldspink,<sup>13</sup> occurs when interview content dwells for long periods of time in the researchers' minds, allowing for the emergence of careful formulations of meaning that reflect the experience of the interviewees. They liken this process to a renter who dwells in the home. According to them, reflexivity is not just a task, but a way of being that takes time – this is what the authors sought to do in the steps described above.

Our aim was to inquire about children and adolescents' feelings and actions regarding climate change. As such, our interview guide included questions about emotions,

perceptions, and actions (engagement) related to climate change (Supplementary Material S1). Two researchers (DTC and EAN) independently coded all the transcripts in Portuguese. All three interviewers discussed their interpretations in Portuguese until they reached agreement through triangulation. After this process, we grouped interview quotes into themes, which we translated into English and further refined in collaboration with the rest of the research team (AM, IT). DTC and EAN are psychiatry residents, and IT is a medical student. All three them have extensive training in qualitative research. They were oriented by LB and AM, two child and adolescent psychiatrists with expertise in qualitative methods.

It is important to point out that, although the results are divided into specific topics, no categorization had been thought of prior to the analysis of the interviews; instead, one emerged from our reading of the data and division into themes and subthemes.

This research followed the Consolidated Criteria for Reporting Qualitative Research (COREQ) guidelines.<sup>14</sup>

### Ethics statement

The research program Earth Emotions among Children and Adolescents: Turning Eco-Anxiety into Eco-Aware Action has received approval upon expedited review from the Yale Human Research Protection Program Institutional Review Boards (IRB Protocol ID: 2000029983).

### Results

Fifty children and adolescents (31 girls), ages 5 to 18, participated in the study. Demographic data are described in Table 1. We also interviewed three parents of young children, to provide broader context to their children's statements. In the quotes presented, the age and gender (female [F]/male [M]) of participants are referred to as follows: a 12-year-old girl will be noted as "(12, F)." When

we analyzed the qualitative data in an inductive way (from data to theory), we noticed that the most striking results were related to the various degrees of awareness and engagement among participants, and that these perceptions appeared to overlap with their social background. For this reason, we developed three categories, unaware, disengaged, and engaged, reflective of these three profiles.

We developed a model that divided participants into three profiles regarding their awareness of and stance toward climate change: 1) unaware; 2) aware and disengaged; and 3) aware and engaged. We considered each of the three profiles across four dimensions: i) space (proximity of global effects of climate change); ii) time (perception of how long until dire ecological consequences take place); iii) emotions (coping with ecological change); and iv) behaviors (actions taken to prevent further impact).

Certain socioeconomic contexts tended to correlate with engagement patterns. This division was created based on the phenomenological findings and echoes the opinions of some participants from profiles 2 and 3: "There are two types of rich and poor people who deal with this situation: the rich ones either don't care, they only think about money – or are informed and try to do as much as possible, because they have the money for it. There are two types of poor people, who either have no place to find information – or they have information, but they don't have money to afford organic food" (12, F).

The two aware groups had heard of climate change and both were part of wealthier social classes. Many thought that the low-income population did not know about climate change: "The person who has no money may not be very informed because of education" (15, M). Some thought that even if they knew about environmentally conscious actions, there would not be much they could do: "Poor people are not in a position to make much of a difference. They can cooperate by not littering, but if

**Table 1** Sample characteristics

	Unaware <sup>†</sup>	Unengaged <sup>‡</sup>	Engaged <sup>§</sup>	Total
Total	21 (42)	16 (32)	13 (26)	50 (100)
Age, years				
5-12	18 (86)	5 (31)	5 (38)	28 (56)
13-18	3 (14)	11(69)	8 (61)	22 (44)
Gender: female	10 (48)	12 (75)	9 (69)	31 (62)
Ethnicity				
White	1 (5)	10 (63)	10 (77)	21 (42)
Black	20 (95)	1 (6)	1 (8)	22 (44)
Asian	0	5 (31)	2 (15)	7 (14)
Parent employment				
Formal work	4 (11)	22 (76)	17 (71)	43 (48)
Freelance or informal worker	23 (64)	6 (21)	7 (29)	36 (41)
Unemployed	9 (25)	1 (3)	0	10 (11)

Data presented as n (%), unless otherwise specified.

<sup>†</sup> Mostly composed of Black children who live in coastal villages in less-developed parts of Ilha de Itaparica (state of Bahia).

<sup>‡</sup> Mostly composed of White children who study in private schools in the cities of São Paulo and Salvador.

<sup>§</sup> Mostly composed of White children and adolescents who study in private schools in the city of São Paulo.

**Table 2** Quotes for unaware, disengaged, and engaged profiles

Unaware		
Space	Closeness to nature and natural threats	"A lot of water came in through the roof tiles at home. The floor gets all wet." (10, F) "I'm afraid of snakes." (8, M)
Time	Discovery. Learning about climate change for the first time.	Interviewer: "Is it the first time you heard about this?" Participant: "First time." (10, F)
Emotions	No emotions related to climate change	Interviewer: "Are you guys afraid of global warming?" Participant: "No. I'm not afraid of anything." (11, M)
Actions	Ecological but not climate actions	"When there was garbage on the ground, I would pick it up and throw it in the trash, there was a lot of trash on the ground." (14, M)
Disengaged		
Space	Climate change is distant	"It doesn't seem very close, it seems a little bit distant, so I'm not too worried." (14, F)
Time	Shifting attention	"So many things are happening, and I can't do anything. So, I keep on doing nothing." (14, M)
Emotions	Indifference	"I don't know much about this business, because I am not very interested." (11, F)
Actions	Few convenient actions done with optimism	"From this individual action you can help the collective, it is part of something bigger, you know?" (10, F)
Engaged		
Space	Climate change is so close that self-protection is required	"I may be trying to deny that it exists. We all try to protect ourselves and not go crazy." (12, F)
Time	The urgency to act for what is not already lost	"I think there's no going back, it's gone, it's gone." (11, F) "If we don't do anything, the world will end." (14, M)
Emotions	Mostly negative emotions	"It's really something very worrying and it sometimes gives me a little bit of anxiety." (12, F)
Actions	Feeling pressured to act	"We always recycle things. We also do vegetable gardening at home, my father planted corn, he plants lettuce." (11, F)

F = female; M = male.

you really want to make a change, you must do something that would cost more" (13, F). These participants also characterized people of lower socioeconomic status as those contributing the least to climate change, yet who will suffer its consequences the most. They mentioned that homeless people will die because of extreme temperatures, that people who live in slums will lose their homes due to landslides and floods, and people who live in more precarious urban areas will experience more pollution. These participants also portrayed the wealthier segments of society, which included themselves, in a mainly negative light: "Wealthy people may know more about news, but often may not even care about it, caring about more important things in their head? – for example, money" (13, F). A few, however, thought that the rich have more power to act because of their money. There was no mention of environmental consequences that may affect the wealthiest groups in society; only one participant said that they could be affected indirectly by climate change, through the increase in energy costs. For additional quotes by children, see Table 2. We describe the three profiles below.

### Unaware

The first group could be described as unaware, as they had little or no knowledge about climate change.

Interviewer: "Have you heard about climate change?"; Participant: "Yes, it's that the earth is moving closer to the sun" (10, F). Most of them lived in coastal villages, in less developed parts of Ilha de Itaparica; most of their parents had informal jobs (e.g., beach vendor, housekeeper); and most attended public schools. A few children mentioned with pride that their parents had a formal occupation (e.g., supermarket cashier) and 95% of the participants from this group were Black.

### Experience of space

We did not find any spatial relationship in this profile with climate change; however, children expressed closeness to nature and awareness of natural threats. Many of them lived near the ocean and spent much of their free time playing outside. They saw garbage dumped in the streets and on the shore. All had witnessed massive floods less than 3 months before the interview: "We had to travel by canoe between the houses" (12, M).

### Experience of time

These participants spoke little about the future and the past, focusing more on their everyday experiences. For many of them, it was the first time that they had heard about climate change: Interviewer: "Is this your first time hearing about it?," Participant: "The first time" (10, M).

### Emotions

Participants in this profile expressed no worries or anxiety related to climate change. Their fears were related to nature and animals: “I am afraid of drowning” (14, M); “I am only afraid of snakes” (11, M). Despite a lack of environmental knowledge, these participants expressed appreciation of and happiness concerning nature. “Nature is very beautiful. It can leave a beautiful smile on a person’s face” (7, F).

### Actions

Participants in this profile did not report engaging in climate action, but proudly described ensuring the cleanliness of their immediate environment. Teaching children to refrain from dumping garbage in public spaces appeared to be a central role of schools, and children mentioned picking up litter from the beach and planting trees.

### *Disengaged*

Some of the children interviewed could be described as aware of climate change, but not engaged in ecological action. All children in this profile attended private schools and had access to the internet and television. Most of their parents were full-time employees or entrepreneurs working as professional managers or service providers (e.g., airline pilot). When we mentioned that we would give BRL 15.00 to each participant, some said that would not be necessary. We then used the money to buy fruit, which the participants received as a snack during the focus group.

### Experience of space

Even though the natural damage occurring in Brazil raises global concerns,<sup>14</sup> most the children from this profile thought that climate change occurred in distant places: “It’s a topic that doesn’t interest me, because of the distance, it’s not so close to us” (14, F). Despite the initial perception that climate change happens in a distant place, news about natural disasters in Brazil was beginning to change this perspective for some participants: “I was watching the news about the floods in Minas Gerais, buses that were totally submerged in water, and there were 30 people missing. It was a big shock” (17, F). When climate change directly impacted members of their family, some participants felt proximity to the topic, but this did not necessarily lead to increased engagement with climate action: “When water came into my grandmother’s house, I started to get scared and commented to my family, but nothing too extensive” (15, F).

### Experience of time

Participants described discussions around climate change being fleeting rather than something that remains on their minds: “The subject ends quickly. We talk, but we don’t go deep” (18, M).

### Emotions

Participants in this profile expressed a sense of indifference, or emotional disengagement: “[Global warming] doesn’t seem very close, it seems a little bit distant, so I’m not too worried” (14, F).

These participants also viewed the topic as ordinary. They attributed their numbness to their continuous exposure to uncomfortable issues: “I never felt any real sadness. I see pollution daily, and garbage on the street. Things like that are so normal here that we end up forgetting about it, so it doesn’t cause such a big impact anymore” (15, M).

### Actions

Participants reported taking some simple and convenient actions against climate change, such as recycling and trying to save water, but nothing that involved significantly changing their daily routine. In doing these actions, most of them expressed an optimistic outlook: “It shows that there is still hope for us to fix it” (17, F). Nevertheless, some participants felt powerless to some degree after encountering news about climate change: “I haven’t done anything, there is nothing I can do” (18, M).

### *Engaged*

We found that this profile was mostly composed of children and adolescents whose parents were more engaged in environmental action or were students of private schools that fostered climate awareness as part of their curricula: “My mother is a journalist, so I always know what is going on. My parents have always been very responsible in making me aware of this kind of thing” (12, F). Such children considered climate change to be a problem of the utmost importance. Interestingly, we conducted several interviews in a private school in São Paulo. The coordinator responsible for recruiting the students declined our offer to give BRL 15.00 to each participant because she thought that they did not need this money and should participate out of generosity. Further, for children of this socio-economic class, BRL 15.00 is an insignificant amount and thus not a meaningful token of appreciation.

### Experience of space

Participants in this profile saw climate change as an issue that was [emotionally] close to their hearts and [cognitively] very present in their thoughts: “We are already living through it, so I worry a lot” (13, F). They were self-aware that their urge to distract themselves was an attempt to protect themselves from an unbearable reality: “I’m going to make a pact with the devil so that I can create my own dimension where climate change doesn’t exist” (12, F).

### Experience of time

Most children in this profile experienced climate change as a threat to the future of humankind: “Maybe humans will be unable to save nature, and they will end up dying

because of it. I fear that maybe trees need a lot longer to grow than they need to fall" (12, F). Some expressed fear that the next generation will be affected: "What if my child has no future?" (11, F). Others even felt that their own lives were in danger: "I don't know if I will make it past the age of 12" (12, F). The possible absence of a future led to a sense of urgency to act in the present: "I get worried that I might not have a future if we don't think quickly about what to do" (13, F). Moments of joy shared with friends were experienced as a precarious respite when facing a bleak future: "Soon we won't be able to live life as well as we do, so we just try to laugh as much as we can, even though it is not the time to laugh" (12, F).

### Emotions

Participants in this profile reported different emotions, mostly with negative characteristics, such as anger or anxiety: "I ended up having an anxiety attack, in which I get nervous, I can't breathe right and it's weird" (12, F). The perception of climate inaction increased the emotional distress experienced by participants: "How is it that everybody, 100% of people, are not talking about this all the time? It is very alarming. The thing is here, next door" (13, M). For some participants, the anxiety was so great that it disturbed their sleep ("I felt scared, at two in the morning it came to my mind that we could die because of that" [14, M]) or made them want to avoid learning more about climate change ("I'm trying to deny that it exists, we're trying to protect ourselves and not go crazy" [13, F]). However, some children maintained a degree of optimism and believed that by making the necessary changes, progress could still be made: "Hope is the last thing that dies. Fight until the end to make a difference" (14, M). One participant expressed ambiguous feelings about humanity's tendency to surpass itself for better or for worse: "I have two totally opposite emotions – sadness that humanity is self-destructing, and I can't say if it is exactly happiness, but that the whole of humanity has managed to prosper in such a good way, generating new technologies, things that were never imagined" (15, M).

### Actions

Most participants of this profile felt pressure to act: "We have to do something more than just classes" (14, M). All participants took concrete actions to reduce their carbon footprint, such as using bicycles instead of cars, reducing meat consumption, saving electricity, recycling, and composting organic waste. One participant referred to an agroforestry owned by their family. (Agroforestry is defined by the U.S. Department of Agriculture as "the intentional integration of trees and shrubs into farming systems to create environmental, economic, and social benefits"). Other participants mentioned planting their own vegetables to reduce their consumption of processed food. Many participants mentioned that their schools encouraged them to take action against climate change: "We had a competition to see who could spend a week using the least energy" (13, M).

### *Younger children: the development of climate awareness*

Thirteen participants in our sample were 5 to 9 years old. This group contained children from different socio-economic levels, present in the unaware, disengaged, and engaged groups, but with important differences in relation to other older children of these profiles.

Most of them spoke less than the older children during the interviews, but their perceptions of climate change shared some common characteristics. A few younger children from the "unaware" profile knew slightly more about climate change than the older participants. This may illustrate the fact that, in impoverished communities in which most adults have minimal education and where the educational content provided in public schools is limited, any degree of informal education provided by parents produces visible differences in knowledge between peers, independent of their age or grade in school.

Some younger children from families that were very engaged in climate action recalled learning mnemonics at school and at home: "The school talked about the three Rs: recycle, reduce, and reuse" (7, F). In contrast with older children who feared the global consequences of climate change, younger children feared the direct effects on themselves and their families: "I can't swim well, so we are taking lessons, and we are afraid of flooding" (9, F). They also engaged in environmentally conscious behavior, learning from their parents' actions: recycling, composting, and avoiding the purchase of unnecessary electronics. One mother in this profile reported that she educated her children by explaining the causes of climate events and emphasizing practical actions, so as to avoid making them feel scared and paralyzed.

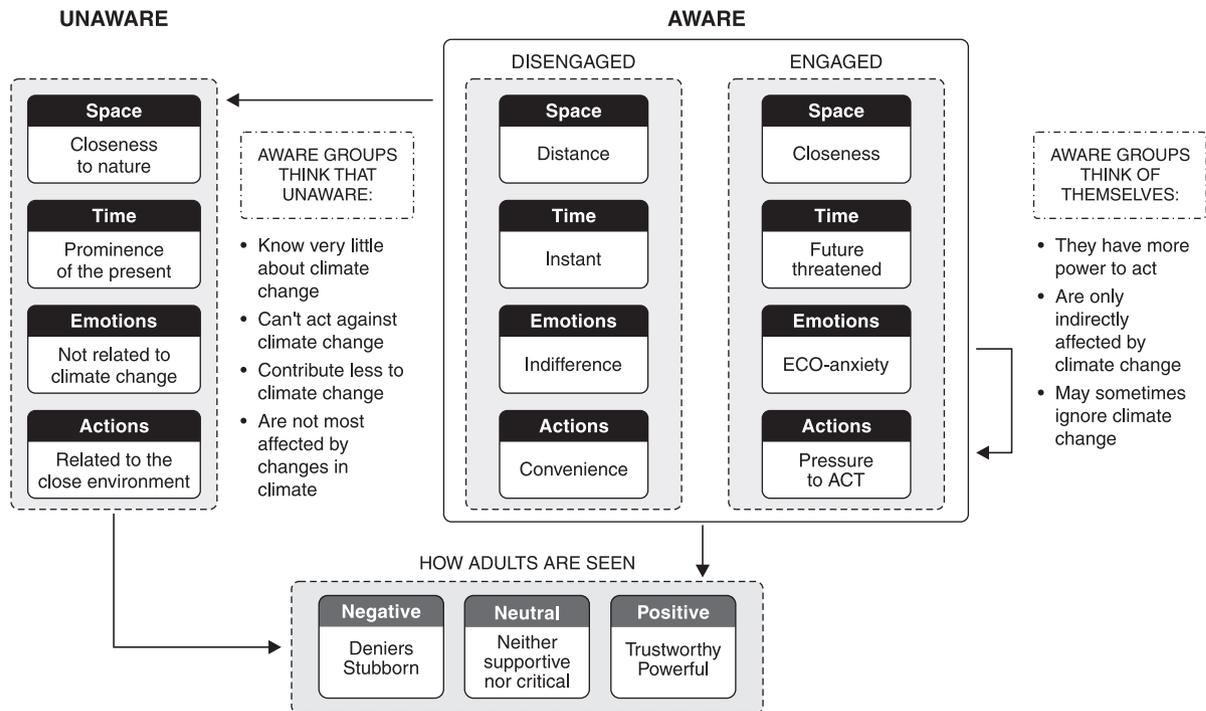
### *How participants described adults*

#### Negative

Some of the participants knew adults who did not believe in climate change, and believed adults were stubborn ("Most adults are all hardheaded, it's difficult" [14, M]) and less open to changing their minds "because they have already experienced everything, they think [their] mind is already made up" (14, M). This participant also felt that it was the duty of children to teach their parents about climate action: "The children have to influence the parents" (14, M).

#### Neutral

Parents were also perceived as not critical of climate actions, but also not encouraging. Some even tried committing to climate action, albeit not very successfully: "My mom sometimes decides to stop eating meat, then she goes back [to eating meat]" (15, M). One participant lamented that his parents did not model ecological actions for him: "It's not that my parents don't support me, but I think it's good to have an inspiration. So, if they eat meat, I will eat meat" (15, M).



**Figure 1** Youths' stance on climate change and the adults in their lives.

### Positive

Some participants described adults as interested in the subject of climate change: "They are aware and want to know about these things" (12, F). They viewed their parents as reliable sources of information and felt that adults pushed them to learn about climate change: "With adults' encouragement, it makes you more willing to be aware" (11, F). They also portrayed adults as the ones who could truly influence others and make change: "Adults have more power of speech than children and adolescents, people listen more to them" (13, M), "They can do many things and we can't, we're just children" (12, F).

Figure 1 is a graphic summary of the different child and parent profiles.

## Discussion

### *Time and space*

The international scientific community has found increasing evidence for the impact of human actions on climate change in the past two decades; despite this, there have been few concrete actions to address the problem, creating what Stoknes<sup>15</sup> calls the psychological climate paradox. He attributes this phenomenon in part to a lack of effective communication about climate change by the media and educational institutions. One of the main barriers to effective communication described by Stoknes<sup>15</sup> is portraying climate change as distant, both in time and space. Media depictions of climate change as occurring far in the future or in distant regions of the

planet deflate the sense of urgency around climate action.<sup>16</sup> From an evolutionary perspective, humans tend to prioritize short-term threats and immediate cause-and-effect relationships.<sup>16</sup> As a result, the mental images and judgments we form regarding climate change carry less emotional weight and less impetus for action than other subjects that the media frames more prominently.<sup>16</sup>

One recent example of this cognitive bias is the coronavirus disease 2019 (COVID-19) pandemic, when much of the world's view was of a remote disease that emerged in Asia and spread through Europe. This scenario illustrated the human difficulty to envision a threat that had not yet harmed any person one felt connected to. Lived time and space are not equivalent to factual distances, but to a person's perceptions. Similarly, personal experience with the consequences of climate change can affect our perception of risk about it.<sup>17</sup> More concrete conceptions of climate change replace our abstract mental models and reduce our psychological distance from it, which in turn can motivate actions to fight climate change.

It is important to note that not everyone experiences time and space in the same way. Young children in our sample – even those who had learned about climate change – focused on its direct impact on their close relatives. Egocentrism, a "state in which thought is centered on the self," was proposed by psychologist Jean Piaget<sup>18</sup> in 1923, and is typical of preschool-aged children.<sup>19,20</sup> Children are limited in their ability for "topological displacement," meaning a non-dimensioned movement in space and/or time from one's immediate experience.<sup>21</sup> This limits their understanding of climate change as a large-scale, networked, and global problem

with causes in the past and present as well as indirect consequences in the present and future. It is important to recognize that egocentrism is not a fixed stage, but rather a continuum, which children gradually overcome through interaction with other children,<sup>22</sup> imitation, play, role-playing, and language acquisition.<sup>23</sup> However, not everyone overcomes egocentrism; depending on the degree of their education and development, many adolescents and even adults maintain largely concrete thinking and focus only on the immediate reality in which they are immersed.<sup>19</sup> In our study, the older children and adolescents from the “disengaged” profile did not feel pressured to act against climate change as long as they did not feel directly affected by it.

As children move through school grades, they begin to develop an ability to conceive of the future as a hypothetical. In this study, children in the engaged profile who were around 11 or 12 demonstrated a capacity for abstraction and imagination of the future, but some painted a rather bleak picture, often bringing up themes of death and destruction of the planet. At this age, a greater openness to the future<sup>24</sup> may bring increased existential concerns, the most prominent being death anxiety.<sup>25</sup> In this case, the prospect of damaged ecosystems contributed to a pessimistic view of the future, which resulted in psychological distress.

### *Social inequality*

Our study pointed out important socioeconomic differences between the assessed groups. BRL 15.00 were given to each participant after the interviews; adults in the Ilha de Itaparica community instructed the children to give this money to their parents to buy food or school supplies and reminded them that the money had been given by the researcher, as their parents would be concerned that the children had earned it through illegal activities or from someone untrustworthy. We observed that children in São Paulo did not find much value in this amount. Differences in young people’s perceptions and experiences of climate change are mediated not only by age, but also by social class. It is known that low-income populations contribute less to greenhouse gas emissions<sup>26</sup> and yet are more vulnerable to the direct effects of climate change on agriculture and food and water insecurity. These effects exacerbate pre-existing poverty, a well-known risk factor for mental health disorders,<sup>27</sup> leading to forced migration and, consequently, reduced access to social services and support networks.<sup>28</sup>

The poorest communities suffer from both the natural consequences of climate change and a lack of information on the subject. In our study, participants from poor communities referred to garbage dumping, which is a well-known problem in Brazil, even in coastal areas depending on beach tourism.<sup>29</sup> They had also experienced floods of unprecedented magnitude that affected northeastern Brazil in December 2021.<sup>30</sup> It is more difficult for poorer communities to access reliable information about climate change,<sup>31</sup> which may lead them to experience natural disasters without awareness of their

connection with climate change. In our study, we came across children from poor villages who were totally unaware of climate change but spoke about small environmental actions with pride, indicating an inability to assess the limits of their knowledge. Our findings corroborate what Braat<sup>32</sup> described regarding the Dunning-Kruger<sup>33</sup> effect: “Individuals incompetent in the field of climate change, compared with their more competent peers, will dramatically overestimate their ability and performance relative to objective criteria.” On the other hand, some participants from wealthier social groups in the disengaged profile mentioned that they would only be indirectly affected by the effects of climate change. Distancing oneself from the issue is a defense mechanism similar to what often occurs in relation to other “uncomfortable” topics, such as social inequalities.<sup>34</sup>

### *Education for action*

One means of communicating more effectively about climate change is harnessing the power of narratives. Stoknes<sup>15</sup> argues that portraying climate change as an inevitable apocalypse, occurring as a punishment for human actions, only leads to anger, helplessness, fear, guilt, and despair. Instead, portraying the issue as a challenge to be overcome and emphasizing opportunities and hope generates greater engagement.<sup>15</sup> This is not to say that the unpleasant aspects of climate change should simply be avoided. What captivates a reader of stories is precisely that the most creative solutions emerge from conflicts. This is the idea behind the pedagogy of discomfort, an educational strategy in which participants are pushed beyond their comfort zone regarding some topic, bringing up emotions that cause them to confront their own beliefs, habits, and practices. This leads to self-reflection, opening the way for individual and social transformations.<sup>35</sup> The Yerkes-Dodson<sup>36</sup> law also illustrates this idea: it postulates that a state of moderate vigilance and stress can contribute to better performance on challenging tasks.<sup>36</sup> It should be noted that this process needs to be faced in a safe, ethical, and responsible manner that takes into consideration children’s socioeconomic context and the risks involved to their mental health.

Another key element to effective climate change communication in the context of LMICs is language that is accessible to different levels of knowledge and socioeconomic realities. Such communication connects climate change to the daily lives of audiences and seeks to engage them in concrete action. Individuals tend to form risk perceptions that agree with their values, a phenomenon known as the “cultural cognition of risk.”<sup>37</sup> Narratives about climate change that speak to universal values can help overcome this bias. Strategies that try to recognize children as part of an interconnected planet and not only of their own country or social context are effective to show that they can act from their place in the world. Schools could promote activities that support the development of empathy towards the self, others, and the planet.<sup>38</sup> Additionally, collective actions are associated with lower levels of anxiety and negative mental

health outcomes<sup>39</sup>; this relationship highlights the importance of encouraging collective actions as a means of creating a sense of participation and agency in the face of climate change. The São Paulo Climate Coalition (Coalizão pelo Clima SP) is a broad organization that brings together collectives and individuals to raise awareness and organize actions to address the climate crisis,<sup>40</sup> while the Solutions Network for Sustainable Development in Amazonia (Rede de Soluções para o Desenvolvimento Sustentável da Amazônia [SDSN Amazônia]), an arm of an international network, has a specific branch for young people with the goal of finding strategies for sustainable development.<sup>41</sup> These organizations, along with a number of others, came together to host the III Brazilian Conference on Climate Change (III Conferência Brasileira de Mudança do Clima) in 2021, fostering the proactiveness of Brazilian society in facing the climate crisis.<sup>42</sup>

Beyond encouraging collective action, adults can also help children by protecting them from despair and supporting their resilience. Children often have adults as their main role models and mirrors for climate action, and if adults show more environmental self-efficacy, this will enhance children's abilities to learn and act environmentally.<sup>43</sup> As children grow older and enter adolescence, this role migrates to their peers and close friends, as they develop the maturity to translate their attitudes and beliefs into concrete actions.<sup>44</sup> Adults should empower children to take action, rather than invalidating, diminishing, or ignoring children's climate concerns as a defense mechanism against guilt about their inaction toward climate change.<sup>5,45</sup> Another important mistake to be avoided is adultification, in which adults praise children while offloading onto them the responsibility of taking on climate change.<sup>5</sup>

One limitation of this study was our sample, recruited in only two geographical areas (states of São Paulo and Bahia) of a country that is geographically, socially, economically, and culturally diverse. Additionally, we did not encounter participants of lower socioeconomic background who were engaged in climate change. This absence does not mean young people of this socioeconomic class do not exist, as many have been observed participating in social and political movements with environmental themes, such as the Black Brazilian movement, which took agendas on climate racism to the COP26, a World Health Organization Conference about climate change.<sup>46</sup> Future studies could include Brazilian children from relevant minority groups, such as the indigenous population or riverine and rural inhabitants – populations whose cultures have historically been linked to nature and affected by climate change, which could provide interesting insights on the subject.

Understanding children's and adolescents' subjective experiences is a crucial step to creating effective communication strategies for climate education and helping them manage their feelings of anxiety and distress around climate change. Their perception of time and space directly impacts the emotions they will experience and their level of engagement in climate action. In the context of LMICs,

different perceptions may reflect children's socioeconomic characteristics, educational level, and level of development. Therefore, narratives on climate action should be multiple and address the different realities experienced by these children, so as to empower them to act locally as global citizens.

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