



How do sensemaking and climate change education affect climate engagement at the grassroots level? A study of five communities in Southeastern Ghana

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Abstract

This study aims to explore how climate change education and sensemaking can lead to climate engagement and adaptive behavior at the grassroots level. The research focuses on five rural communities in Ghana and seeks to answer three key questions related to how people understand and respond to climate change issues. One strength of the study is the use of sensemaking as an organizing framework, which allows for a nuanced understanding of how people at the grassroots level make sense of complex environmental issues like climate change. The study findings suggest that sensemaking was a critical factor in how people noticed and made meaning of the climate crisis, and that deliberative tools like storytelling, conversation, and listening were important tools for facilitating this process. We also found that climate educators needed to address existing misconceptions before framing climate change issues in terms of science and impact on livelihoods. Linking climate change to rural livelihoods resonated more with people than science, and a strategy of guiding communities to recognize the need for adaptive behavior through individual and collective sensemaking was important. The emphasis on linking climate change to rural livelihoods rather than science is an important finding, as it suggests that approaches that emphasize the impact of climate change on local communities and their ability to adapt may be more effective than purely scientific arguments.

Keywords Sensemaking · Climate change education · Engagement · Grassroots

1 Introduction

Global warming and climate change have become one of the most important planetary challenges of our time (IPCC 2022). Compared to developed countries, developing countries (the Global South) would endure most of the adverse effects of climate change (Eckstein et al. 2021). Facing droughts, floods, extreme heat, and changes in rainfall patterns, resource-induced conflict is likely to proliferate in poorer countries. Indeed, fights over

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grazing and water rights are emerging as important sources of conflict in Sub-Saharan Africa, and elsewhere (Sova 2017). Therefore, a greater understanding of climate change engagement in poorer regions has important policy implications, as progress on climate change adaptation may be necessary for the basic survival of people in developing countries (IPCC 2022).

Emerging research shows that while people acknowledge the importance of climate change and global warming, they tend to prioritize other pressing social issues above them. Many believe that climate change does not affect their local communities, but rather distant places (Spence and Pidgeon 2010). Climate change education is recognized as a crucial factor in promoting environmental engagement. However, its effectiveness may be hindered in areas with low recognition of the local impact of global warming. These findings underscore the need for targeted educational efforts and effective communication strategies to raise awareness about the local relevance of climate change, especially in regions where its significance is not well understood. Framing climate change in the context of immediate concerns and local impacts can be a more effective way to engage people in taking action to address this global issue (Mbah et al. 2021). The barriers to climate engagement may be particularly important in the Global South. For example, vibrant media has often aided the discourse on climate change in developed countries (Ryghaug et al. 2011). In developing countries on the contrary, low levels of education and an underdeveloped media regime mean that understanding the complex phenomena of climate change, especially the scientific components of the global debate on climate change is less understood making education a necessity (Mbah et al. 2021).

The importance of grassroots activity in addressing climate change is important (Rootes et al. 2012). For example, Alam et al. (2015) observed that a better understanding of grassroots responses to climate change will lead to better adaptation and the development of improved climate planning and policy. Despite this recognition, few guidelines exist on what role the grassroots can play in climate change and gaps remain in our understanding of grassroots activity and climate adaptation (Van Oers et al. 2018; Ganase and Sookram 2021). This research fills some of the existing gaps.

Ghana presents an ideal setting to study how people at the grassroots level perceive and engage with climate change, given the low levels of climate education and the direct negative impact of climate change on the country (Ofori et al. 2023). Ghana continues to suffer from the consequences of rainfall and temperature variability because of climate change (Owusu and Waylen 2009). Southeastern Ghana, like the rest of the country, is affected by the warming trends and variability in rainfall, resulting in lower crop yields (Nyatuame et al. 2014). To get greater insights into how individuals and communities at the grassroots level understand and engage with climate change, we pose the following three research questions: (1) How does climate change become a critical issue to people who may be unable to understand the complex nature of environmental issues? (2) How do people create meaning and make sense of climate change issues at the grassroots level? (3) What action repertoires result from education and sensemaking on climate change at the grassroots level? Answers to these questions can inform the development of effective communication and education strategies that consider the local context and cultural perspectives. Additionally, we can get a greater understanding of the strategies and practices that are effective in addressing climate change at the local level. This knowledge can be used to inform the design and implementation of community-based climate programs. Overall, this study seeks to contribute to the understanding of climate change at the grassroots level and inform the development of effective strategies for addressing climate change in vulnerable communities in parts of the Global South.

2 Theory and background

Prior research has explored how individuals come to build understanding around difficult subjects such as climate change (Tisch and Galbreath 2018). Existing research has demonstrated that the use of deliberative discussions is an important way of helping people understand the complex issues of climate change (Öhman and Öhman 2013). Deliberative approaches emphasize personal reflection and group discussion as key tools for helping others understand climate change (Monroe et al. 2017).

Farmers and communities are seeing dramatic changes in their local environments. As Ketelaar et al. (2012) observed, when faced with such changes, people, either as individuals or groups, often try to understand what is happening within the context of their existing beliefs, experiences, and knowledge. This process of understanding has been described as sensemaking (Weick 1995). Vanderlinden et al. (2020, p. 2) observe that making sense of changes in the natural environment involves “the interaction between the individual’s frame of reference and the perception of the situational demands inherent to changes, together with their interpretation of these changes” (Luttenberg et al. 2013).

The emerging literature on sensemaking and climate change may be particularly suitable for understanding how grassroots communities and individuals interpret changes in climatic conditions using both their existing frames of reference and what they see happening. Sensemaking is an appropriate tool for creating shared meaning and spurring collection action (Weick 1995). Taylor and Van Every (2000, p. 40) note that “sensemaking involves turning circumstances into a situation that is comprehended explicitly in words which serves as a springboard for action.” We suggest that sensemaking is a suitable conceptual framework for providing clarity, and relevance, including linking climate change issues to specific ecological locations or for making “place attachment” (Scannell and Gifford 2013). This should be so because climate change is a novel and complex phenomenon. According to Weick (1995), sensemaking refers to how we structure the unknown to be able to act on it. Sensemaking involves a response to events in which “people develop some sort of sense regarding what they are up against, what they sense, and what they need to do” (Weick 1995:635). As Weick (1995) suggests, the basic idea of sensemaking is that “reality is an ongoing phenomenon that emerges from efforts to create order and make retrospective sense of what occurs.” Sensemaking involves noticing, labeling, retrospective thinking, communication, and action. The objective of sensemaking is to make issues clearer. Once clarity is achieved, people can spring to action (Taylor and Van Every 2000). The concept of ecological sensemaking (Whiteman and Cooper 2011) allows us to link sensemaking, the natural environment, and climate change. Whiteman and Cooper (2011, p. 890) describe this collective process of ecological sensemaking as important to how a community makes sense of environmental and ecological changes and develops adaptive responses.

It is important to note that others can help individuals and communities build an understanding of issues by providing relevant information about climate change. Such facilitative education has been referred to as sensegiving (Gioia and Chittipeddi 1991). Those engaged in sensegiving must have a clear understanding of unfamiliar issues and situations to be able to offer direction to followers engaged in making sense of the issues (Backhaus et al. 2022). Kihlberg and Lindberg (2021) discuss the concept of reflexive sensemaking, a process in which the agent guides followers to create their understanding rather than impose some “fixed reality” on them.

Although a key element for climate action, climate change education is a complex and tricky thing (Weiner et al. 2021; Molthan-Hill et al. 2022). For example, research has shown that how a message is framed has a direct effect on behavior (Gallagher and Updegraff 2012). Framing has been defined as “the processes by which actors influence the interpretations of reality among various audiences (Fiss and Hirsch 2005, p.30). Climate change can be portrayed as a scenario in which engaging with it yields benefits, as highlighted by Weiner et al. (2021) while refraining from involvement results in losses, as emphasized by Levine and Kline (2017). The most profound form of loss in this context is fear. According to Spence and Pidgeon (2010), framing the issue with fear aims to evoke a heightened emotional connection and involvement with the subject.

An outcome of sensemaking and climate change education is climate engagement and adaptation. Adaptation has been defined as “adjustment in natural and human systems in response to actual or expected climatic stimuli or their effects” (IPCC 2022, p.7). The positive outcome of successful climate change communication and education is engagement and adaptation which can be measured in attitudinal and behavioral consequences (Levine and Kline 2017).

3 Methods

3.1 Study context and site

The context of this study is five communities in southeastern Ghana. All the communities are in the Volta Region of Ghana (Please see Fig. 1 with 1b an extracted version of the region). Two of the towns are in the Ho West District (Adaklu, Abutia, labeled as D2) and the other three are in the Hohoe District (Fodome, Wli, and Chebi, labeled as D1). The region falls within latitudes Latitude: 7° 00' 0.00" N, Longitude: 0° 29' 59.99" E. with a land cover of 3,670 mi², and a population of 2.7 million. The region has diverse vegetation, from forest to savannah. The rainfall pattern is bi-modal, the first season is from March to July, and the second is from mid-August to October. A 30-year analysis of the rainfall pattern of the region (1981–2011) shows extreme rainfall variability, the highest annual mean rainfall was 202.6 mm and the lowest was 29.9 mm for the period (Nyatuame et al. 2014). Agriculture is the predominant occupation of people in the area.

Climatic conditions in the region are consistent with what pertains to the country (Dankwa et al. 2021). Overall greenhouse emissions in Ghana increased by 107 percent from 1990–2006 (Asante and Amuakwa-Mensah 2015), with predictions of an increase of 0.6 °C, 2.0 °C, and 3.9 °C by 2020, 2050, and 2080 respectively (Sraku-Lartey et al. 2020). Since farmers have traditionally relied on predicting rainfall patterns to plant their crops, any variability in rainfall patterns affects their productivity and crop yields. The negative effects of temperature and rainfall variability have been manifested in low yields of rain-fed agriculture and food security in the country (Atanga and Tankpa 2021).

The recognition of the country's climate vulnerability has led the government to develop several programs on climate change. Besides the government, several NGOs (non-governmental organizations), and some Churches are active in climate change education and response. Although the government of Ghana does have a climate change agenda on paper, little of that education seems to have percolated to the rural, grassroots level where the present study takes place. The Religious Bodies Network on Climate Change (RELBONET), the Evangelical Presbyterian Church in the Volta Region, and the Ghana Wildlife Society

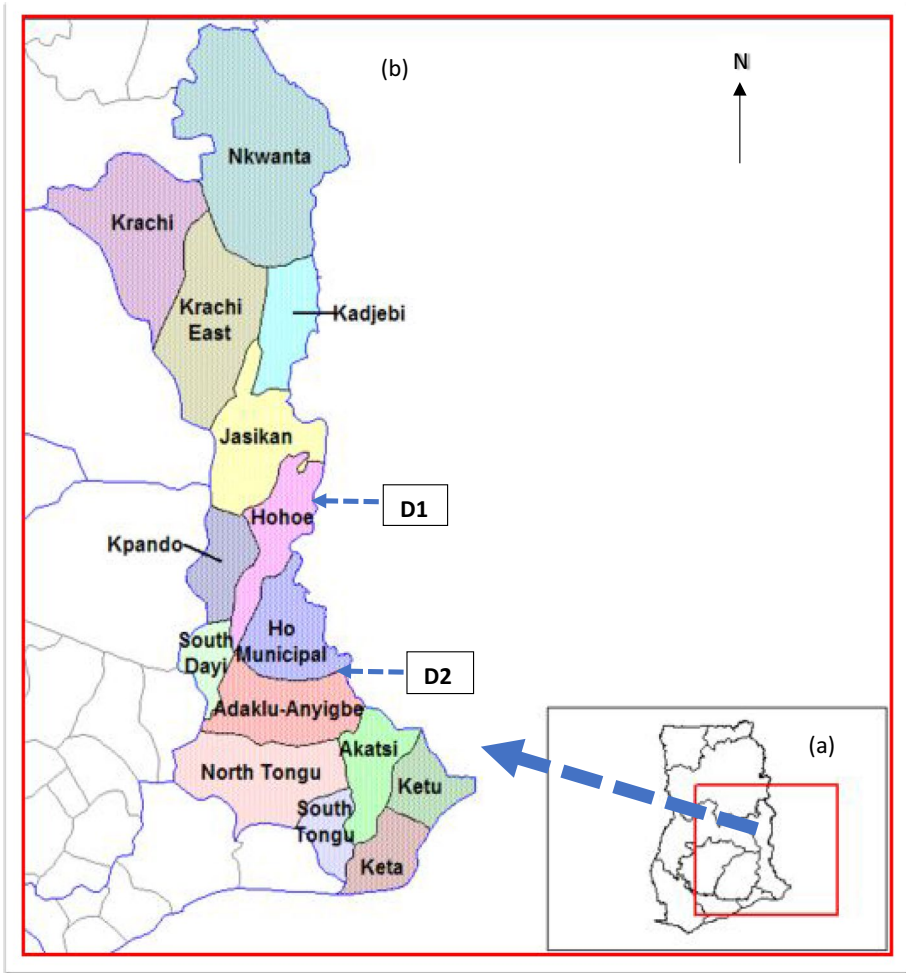


Fig. 1 Administrative Map of Ghana with Volta in light blue

were three of the local NGOs leading climate change education and the protection of ecosystems in several communities.

3.2 Research design

We used a qualitative approach to understand the issues for at least two reasons. First, the study is considered exploratory, given the paucity of empirical research on the phenomenon (Nag and Gioia 2012). Second, qualitative approaches have been identified as appropriate for accomplishing more nuanced explanations, as they allow for the discovery of new perspectives (Miles and Huberman 1994). The church facilitated access to respondents in two communities and in other cases, we approached communities directly. The study used purposeful sampling since our interest was in studying those who were beneficiaries of climate change education and adaptive action that resulted from such interventions. I

developed an interview guide and conducted interviews with respondents engaged in the climate change effort. I used key informants and focus group interviews. Focus group interviews have been determined to be an ideal method for collecting high-quality data in a social context, and for tapping community perceptions (Lloyd-Evans 2008).

3.3 Data collection and analysis

The field research, which took place between May and August 2022, was designed to collect qualitative data for the study. Before collecting data, I made a transect walk to familiarize myself with what the communities were doing on climate engagement. I visited woodlots, and forests that communities were growing as part of their climate adaptation efforts. Data collection consisted of several in-depth, semi-structured interviews, with 57 key informants including educators. The average interview lasted between 60–90 min. In a few cases, I called the interviewees back for clarification when needed. The interviews were conducted in both English and Ewe, the local dialect. Transcription was done by both the writer and an assistant who are both fluent in English and Ewe. We recorded and transcribed all interviews verbatim. We determined that we had reached thematic saturation at a point and decided no additional interviews were needed (Lowe et al. 2018). Additional data came from a review of training videos on climate change education going as far back as 2017 prepared by the former president of RELBONET for training purposes.

3.4 Data analysis

We used a thematic approach to analyze the data because thematic analysis is suitable for the classification and interpretation of data (Miles and Huberman 1984). We adopted a deductive approach based on our existing theory and framework. The analysis proceeded in stages.

First, we read all the field notes and transcripts from the interviews, making notes of the words, terms, and phrases used by the respondents to arrive at categories relating to our research questions. In total, we identified 215 references to words and phrases relating to sensemaking, sense-giving, climate change education, and action. Second, we grouped the 215 references into more general themes. This process was replicated twice to arrive at a more parsimonious list by grouping ideas that related to each other together. We went

Table 1 Summary of themes

<i>Main Theme</i>	<i>Number of times mentioned (N*=215)</i>	<i>Percentage of total</i>
1. Sensemaking, noticing and labeling climatic change	54	25
2. Climate change education	45	21
3. Misconceptions relating to climate issues	39	18
4. Making links between climate change and local context	30	14
5. Climate change engagement and action	26	12
6. Reflexive sense giving by facilitating understanding	21	10

N = number of times key words, phrases were mentioned*

back and forth with this process, and this led to a final list of six themes. Table 1 presents a summary of the frequency with which words relating to our research framework were mentioned in the 215 references. The six emerging themes and subthemes are discussed in the results section. Finally, to ensure data validity and reduce bias, another independent researcher coded a sample of randomly selected interview transcripts. The independent coder first coded one transcript and once we determined that the coding patterns were similar, they proceeded to code 20 percent of the interview transcripts. We used Cohen's kappa to determine the proportion of agreement (Cohen's kappa=0.815). We also content analyzed the videos of training sessions conducted by the National Coordinator of RELBONET, and notes of conversations and used the results to corroborate the findings. We triangulated the interview data with data from the training videos.

Creswell (2007) argues that researchers need to provide at least two methods for verifying their qualitative findings and we provide four methods in the present research. First, the research findings were a result of multiple data sources. Second, we provide direct quotes from the interviews and field notes to support our claims. Third, we provided the results of our study to four of the respondents to verify the accuracy of what they told us. Finally, we adopted reflective interviewing following the guidelines provided by Nardon et al. (2021, p. 5). According to the authors, reflective interviewing has four components (1) giving respondents time to think (2) developing a trusting relationship (3) inviting reflection and (4) supporting the identification of a solution. We explained the purpose of the interviews to participants ahead of time so they could think about the issues, building trust by assuring them that the study was not evaluating their behavior, and by demonstrating that the climate engagement actions they were taking were indeed laudable.

4 Results

4.1 Profile of respondents and educators

The demographic and socio-economic profiles of respondents are provided. Out of the 57 key informants, 23 were female (40%), and 34 were male (60%). Out of these, 5 were educators. The respondent's ages ranged from 25 to 70 years. About 20 percent of respondents had basic education, comprising primary to middle, 55 percent had high school (junior and or secondary school education), and the rest 25 had post-secondary and college education. Most of the key respondents were either full-time farmers or reported that farming was an important part of their daily activities. Mr. Agboklu, a principal trainer, was sponsored by his church to attend national and global conferences on climate change. For example, he attended a Global Conference on Climate Change in October 2016 in Scotland and the 2021 Paris Climate Conference (COP21) in Paris. He worked with other local and foreign experts on climate change to design a curriculum for training climate change educators and had more than 20 years of experience addressing climate change and social justice issues, both in his role as the president of RELBONET and as a private individual. Trained climate change educators were themselves trained in the causes of climate change. Videos and reading materials were used as instructional tools. We found that the trainers were climate literate.

4.2 Misconceptions on causes of climate variability (18%)

The data shows that some respondents had preconceptions about climate change based on religion and traditional beliefs. For example, the belief that rainfall and droughts are attributable to the supernatural was a widely shared sentiment, particularly among the older respondents. The older respondents narrated how the community used prayers and supplications as a way of dealing with periods of drought in the past. Incidentally, other researchers have documented that prayers have been used as a supplication for rains in other parts of Africa (Yegbemey et al. 2017). For some older respondents, the failure to adhere to old customs meant that extended periods of drought were a sign that the gods were upset. A respondent noted:

Our grandfathers used to pour libation and pray for rain to come during periods of prolonged drought. Now, we do not do that anymore because going to church is more important. Some of us think that is why we see what is happening: less rain these days (Interview 21, Respondent 12, D1)

This belief in the nonscientific explanations for the causes of rainfall and the importance of adhering to traditional customs highlights the cultural significance of climate-related understanding in these communities. A respondent noted:

We believe that prayer helps. We have prayed to God for rain before. Here most people believe in the power of prayer (Interview 25, Respondent 40, D1).

It was important that climate change education first address existing misconceptions around climate because these beliefs are a starting point for interpreting what people notice. The first challenge in communities where existing beliefs contradicted science was to offer some plausible explanation based on science and to dissuade people from their beliefs that changing climatic could be ascribed to other factors besides nature. Climate change educators noted that the strategy was not to be dismissive of existing beliefs but to add that science may also be an additional, and more important explanation for the changing weather and climatic conditions. For example, rather than contradict such existing beliefs outright, educators noted that the strategy was to make links between the presence of large forests in the past and the current reality of dwindling forest covers and reduction in rainfall and human activity, and that grabbed the attention of respondents. A trainer noted:

Our job was to listen carefully to what people had to say and to juxtapose explanations that were science-related. For example, we had to explain how clouds form and why it rains. Linking past vegetation types to rainfall and the disappearance of forests to drought was another important strategy we used (Interview 1, Respondent 3)

A farmer noted:

It was explained to us that in the past we had more rain because of all the forests. He (an educator) reminded us about how the forests are disappearing and that is one reason we have less rain. He assured us that the lack of rainfall had nothing to do with our beliefs that science could explain what was happening (Interview 13, Respondent 6, D2).

4.3 Climate change education (21%)

4.3.1 Framing climate change

The educators framed climate change in terms of both the gains as well as the risks of not changing behavior. Regarding the gains, what seemed to resonate more with the respondents was the link between climate issues and livelihoods. For example, farmers were particularly clear about the harmful consequences of “slash and burn” because of the rampant cases of fire. A respondent observed:

Most bushfires start with someone setting fire to a small patch. If care is not taken, the fire quickly spreads. We have witnessed this a lot of times. We tell people now to be careful when they set fires. We have seen fires burn lots of farms including cocoa farms that are more than 20 years old. We now know how dangerous these fires can be (Interview 23, Respondent 18, D1)

An even clearer understanding of how behavior affects livelihoods was the indiscriminate practice of clear-cutting trees for charcoal fuel for cooking. Respondents noted that charcoal production had become a big business, with the supply chain going from the villages to the cities. Respondents noted that although they knew cutting trees was bad, the educators helped them to see just how much activity over time may be responsible for low rainfall and drought. A trainer noted:

It is not necessary to talk too much about science... well, maybe to some extent. Carbon footprint, emissions, and some scientific terms are not what people understand. What they understand is that certain farming practices and the destruction of forests have a direct effect on what happens here in their communities (Interview 9, Respondent 4).

Another educator avers:

Showing people how their behavior may be harming them was effective. Fires, and the cutting of trees for charcoal, are easy to link to reduced rainfall and low crop yields. We do not forget science. For example, we explain that higher temperatures mean deadlier fires that destroy farms (Interview 21, Respondent 3).

Sharing a similar sentiment, a farmer noted:

You see that this area has no tall trees because they have all been cut for charcoal. We used to grow corn, cassava, and yams in these areas. These days, the yields are low. Even getting small trees to use as a trellis for the yams is a problem. Our behavior will hurt us eventually (Interview 18, Respondent 21, D1).

4.3.2 Framing climate change in terms of positive outcomes

Climate issues were also framed in terms of the positive benefits that would accrue when certain behaviors were changed. For example, the respondents demonstrated that they knew the consequences of certain farming practices and behaviors in terms of drought and rainfall. The data showed that while beneficial, people did not care much about the science

of climate change. Instead, the focus was on how climate change affected harvests and food security. This is not surprising given the level of education of the average respondent and the fact that the scientific explanations of climate change are often complex and not easily accessible to the average person. Linking climate change with what people were noticing about their livelihoods in terms of farming productivity including crop yields and harvests and how that directly impacted food security and poverty resonated with them. For people whose primary means of survival and earnings are linked directly to subsistence farming, anything that disrupts the one most crucial factor in that ecology, rainfall, was viewed as an existential threat. A respondent noted:

When the rain does not come regularly, our farms do not do well. If that happens, of course, we do not have food to feed our families. The rains bring life. Even the river we depend on for water depends on the rains (Interview 5, Respondent 26, D2).

The significance of the connections between deforestation and climate change, as highlighted in these findings, aligns with the scientific evidence (Leon et al. 2022; Lawrence et al. 2022). There seems to be a troubling pattern that reveals a vicious cycle involving deforestation, drought, and reduced rainfall in Ghana (Dwomoh et al. 2019). Additionally, Desbureaux and Damania (2018) uncovered evidence of drought-induced deforestation in Madagascar, and a similar trend is observed in other regions, including the Amazon, as indicated by Staal et al. (2020).

4.3.3 Methods and tools of education

The choice of a climate education strategy has a direct effect on outcomes (Monroe et al. 2017). The educators we studied seemed to have applied several tools in their climate education. First was storytelling. The sense givers noted that they drew on storytelling extensively to link the past and present as a means for both conveying the urgency of climate change and the need for action. Older respondents were encouraged to narrate their experiences with previous rainfall patterns, the presence of vast forests, and bush animals so that everyone could contrast the past with the present conditions. Stories about the past provided a reference point to make comparisons to the present situation so that people would begin to appreciate and think about the causes of the differences. Stories have a way of grasping listener attention because stories create identities and are an important means of transmitting ideas and knowledge in a non-threatening manner (Dillon and Craig 2022). A farmer respondent noted:

Listening to stories about how often it rained in the past, the presence of wild animals in the area, and the presence of large forests made me start thinking about why none of these animals can be found anymore, and how the forests have disappeared. I know something is causing these things. I am not sure what it is, but something has happened (Interview 51, Participant 48, D2).

Second, small group discussions were important. Using small group settings to engage in conversations around climate change seemed appropriate. The intimacy in the small group setting and the conversational nature of the discussions allowed people the opportunity to reflect on what they were hearing. Small group settings seemed less intimidating than large group settings and may have been best suited for some people. A farmer noted:

What liked was the small group discussions. I am sometimes shy to ask questions at large meetings. It is easier for me to ask questions when we are in smaller groups (Interview 46, Respondent 19, D1).

Finally, conversations were an essential element for discussions. Respondents noted that conversations focused on both the science of climate change and the payoffs for behavior change allowed people to create meaning and shared understanding around issues of climate change.

4.4 Linking variabilities in rainfall to local human activity (14%)

Scientific evidence strongly associates variability in rainfall with human activities, as highlighted by the Intergovernmental Panel on Climate Change (IPCC 2022) and research by Putnam and Broecker (2017), and some traditional methods of farming and economic activity may have amplified the effects of climate change (rainfall patterns in particular). These are: (1) shifting cultivation (2) "slash and burn" and the use of (3) monoculture. Farmers have historically used these methods of farming and were unaware that some of these practices were bad for the environment. Indeed, respondents failed to make links between human activity and climate change until they were educated on how some of these activities were plausible explanations of rainfall variability.

Shifting cultivation, the practice of alternating the cultivation of plots of land to allow the land to fallow for a while before it is cultivated again is widespread in Sub-Saharan Africa. While the fallow period may allow for some soil protection and regeneration, the problem is that there is not enough time for the land to fallow before it is cultivated again, given population increases and demand for land. Farmers now return quicker to their plots than they did in the past. Another harmful practice was the clearing and burning of vegetation each year in preparation for farming. Besides the environmental hazards of burning, such practices were often the cause of wildfires. Convincing people of the need to change both these practices was a major task. (3) Finally, was the practice of growing limited varieties of crops. Although not strictly a form of monoculture, there was a lack of diversity in terms of crops grown on each plot of land. This meant that any crop failure had a direct and severe impact on food security and livelihoods. Videos and material used by the former president of RELBONET, and his associates addressed these issues. The harmful effects of shifting cultivation, "slash and burn" were addressed at great length. A respondent noted:

We have always used fire to prepare the land for growing crops at the beginning of the rainy season. Now we understand that we need to reduce this practice. Wildfires are indeed a result of people burning their fields (Interview 19, Respondent 16, D1).

A trainer explains one important strategy was convincing people that this practice was harmful:

Changing people's minds on practices that have been around for a long time was not easy. The strategy here is to show the most harmful effect on one of the practices that did the most damage: the burning of brush and the link to destructive bushfires (Interview 19, Respondent 1).

This theme highlights the importance of understanding ingrained beliefs and practices that may contribute to climate change. To succeed in this and related tasks requires cultural sensitivity. An educator observed that:

It helps that we are native to the area, we know what people believe, what they do, and how to show empathy to both what they believe and what they should now do (Interview 8, Respondent 4).

4.5 Individual and collective sensemaking (25%)

Our data uncovered cases of both individual and collected sensemaking. Sensemaking has several dimensions. Those that are most relevant in this research include (1) noticing and bracketing (2) labeling (3) retrospective thinking, and (5) action.

First is noticing and bracketing. What people notice about a situation, particularly if it is a crisis, is influenced by what is consistent with their “predetermined programs of action” (Weick 1979, p.32). Our data revealed this aspect of sensemaking. A respondent stated:

We agreed that growing woodlots and controlling bushfires would help us. People also began to understand that cutting trees indiscriminately for charcoal was bad for the environment. We changed our farming methods, growing multiple crops as we were taught. We knew that these were important things we could do (Interview 36, Respondent 31, D2).

Sensemaking was aided by how people understood what was happening. Individuals started noticing what they observed and started drawing comparisons between the past and present. Climate change educators encouraged people to compare rainfall patterns between the past and present and highlighted the stark differences. In making sense of the situation, individuals looked for what was “reasonable” not necessarily what the scientific facts were about global warming. This is plausible thinking. According to Helms Mills and Mills, “plausibility is a feeling that something makes sense, feels right, is somehow sensible, (and) fits with what you know” (2000, p. 5). When faced with ambiguous situations, people settle for what is plausible (Weick 2001). Even if respondents did not seem to understand the science behind climate change, what they saw around them in terms of changing rainfall patterns was accepted as an indication that something important was happening. A farmer noted:

We see that the rain is not what it was in the past. The river used to rise in the rainy season and there were lots of fish. Now, it is just a small stream. Years back, the river did not flow anymore. We just had puddles along the riverbed. Everyone was talking about it... they all saw something was wrong (Interview 2, Respondent 3, D2).

Second, respondents began labeling what they were noticing. Our data uncovered that people started describing what they thought was happening in terms of all the indicators of climate change in their communities: changing rainfall patterns, drought, and fires. Describing what people thought was happening was important because that was how they related their lived experiences or their understanding of climate change. A critical element of sensemaking, the sharing of individual understanding of the climate change indicators was important to both individual and community sensemaking. A farmer noted:

I was always wondering why the rain no longer comes as regularly as before. I have watched years of failed harvests now. It used to rain so hard that schools had to break for the rain. Those days may be gone forever...I do not know yet, but I started

realizing something was different. I just did not know what was causing these things (Interview 13, Respondent 6, D1).

Third is retrospective thinking. According to Weick (1995), we can only make sense of some unknown situation or issue after reflecting on an action that we have taken. There were several instances of this sort of reflective thinking on the part of respondents. A representative quote:

We are glad that we gave our land up for the reserve. We noticed that once the trees on the mountain grew back, there were fewer fires (Interview 42, Respondent 6, D2).

A respondent in another community noted:

Growing the woodlots has helped, even animal species we thought were extinct are now appearing. We are happy with what we did, thinking back now. In the beginning, some people were not convinced we had to act. But now they are all believers (Interview 33, Respondent 41, D2).

In addition to individual sensemaking, our data revealed how communities or collectives made sense of climate change. Individual sensemaking is influenced by others and to that extent, sensemaking is partially social. Collective sensemaking was important to how people built a new understanding of the patterns of rainfall, fires, drought, and flooding that had now become the norm in their areas. Collective sensemaking was facilitated by community members sharing similar perceptions of risk and values. In other words, these communities had become “interpretive communities” (Spence and Pidgeon 2010, p.51), sharing similar views of climatic issues.

Again, storytelling was an important means of sensemaking. Respondents noted that older people in the group shared stories about how it used to rain consistently in the past, and how farming and the rainy seasons were more predictable compared to the present. The group members noted the sharing of stories and group discussions helped them to build a better understanding of climate change issues. Respondents noted that small group discussions led by climate change educators gave them the chance to ask questions, reflect on issues, and share ideas amongst the group. The former National Coordinator of RELBONET noted that in meetings and training sessions, it was important to listen to everyone carefully and be clear and transparent in everything they did, thereby helping people come to their realizations about what was happening and their individual and collective roles in developing action repertoires. A church leader and active community member on climate change engagement noted:

Our meetings after church were important. We often held discussions about what we had been taught and tried to understand what was happening. The catechist and the other leaders often played a key role (Interview 36, Respondent 16, D2).

4.6 Reflexive sense giving (10%)

A related theme is how sensemaking was facilitated. We found that climate change educators facilitated sensemaking by giving individuals and communities the tools they needed so that they could think for themselves, rather than imposing some meaning on them. The primary responsibility of the educators was to give information, educate, and remind people of the sort of events they needed to look at to build a better understanding of what was happening so that they could begin to evaluate what they could do, both

individually and as a community. The educators used formal lectures, workshops, and informal community meetings to provide information about climate change and how local activity could affect the climate. For example, inviting people and communities to share local knowledge on agriculture was an important means of allowing local input into the process as well as helping ensure that people came to understand the causes of climate change at the local level and the action repertoires they developed and used were reflective of some of what they already knew. Engaging communities in producing actions and solutions to what they saw happening to the environment, rather than giving them already-developed solutions is a form of reflexive sense-giving (Kihlberg and Lindberg 2021). Our review of the videos of the training session by the former National Coordinator of RELBONET demonstrated that he and other educators, were careful to shift the focus from themselves, instead focusing on what people thought they could do to engage with climate change. Using videos, illustrations, and PowerPoint Slides, the leaders conducted training sessions on agriculture, fire prevention, and control. An educator declared:

Our job is to help people understand climate-related issues and help them understand the sort of behavior changes they need. We do not impose anything on them. They understand now what the issues are. We just facilitate things. Our support in terms of supplying basic implementation and training is helpful. But the groups oversee their effort and work (Interview 27, Respondent 4).

Confirming the sort of collaborative approach the educators used in the communities, a community and church leader noted:

The Chairperson (referring to the National Coordinator) and his people explain things to us. They do not force us to do anything. They ask us what we think, they seek our opinion and input (Interview 5, Respondent 18, D2).

4.7 Climate engagement and action (12%)

The data shows that several factors seemed to have helped climate engagement. This included education, the provision of the necessary tools, motivation, and trust needed for people to act. By connecting climate change to local livelihoods, it was easier for people to understand how climate change affected them and why it was essential to act because people are more likely to engage with an issue when they feel a personal connection to it. The provision of training and material support empowered people with the knowledge and tools to act. It seems that because the educators were seen as inspiring people who shared the same experiences as the community, people were more likely to trust and engage with them. The outcome of both climate change education and sensemaking, both individual and collective was climate engagement.

4.7.1 Adaptation and behavior change

There were behavior changes that we can link to both sensemaking and climate change education. First, the communities began to diversify the crops they grew. The farmers interviewed noted that mixed cropping ensured that even if one crop failed, some other crops at times fared better. Second, respondents noted that they had reduced both burning and shifting cultivation. In the latter case, respondents noted that they are leaving their plots to lie fallow for longer than they used to. Third, communities agreed to set aside land

that became a forest reserve. Finally, communities started discouraging people from cutting down trees to produce charcoal. One respondent noted that the volunteers in his community had taken it upon themselves to educate people on the harmful consequences of cutting down trees for charcoal. For example, one respondent noted:

At the end of the day, we realized that it was important for us to grow these trees. The church group supplied us with the seedlings. We were happy to grow them. As you can see, they have grown well, and we see the results already. We think these trees will help us in the future. For example, small bush animals that we once thought had disappeared are now coming back. We are proud of what we have done (Interview 8, Respondent 4, D2).

Growing woodlots was another important example of engagement. Tree species with commercial value that were grown included teak, mahogany, *afra*, acacia, and *moringa olifera*. The National Coordinator of RELBONET reported that with the assistance of the Evangelical Presbyterian Church of Ghana, communities planted over 26,000 seedlings in 2012 alone. The adaptation of farming practices also included sensitization on the use of fertilizers, including the timing and how much fertilizer to apply, and the growing of multiple crops together. Respondents noted that their behavior changes may have helped soil fertility and crop yields, as well as the return of animal species they thought had gone extinct. A respondent noted:

We did not think we still had deer in the forest. Now people have started seeing deer in the growing forest. It showed us that good things will happen if we do not destroy the forest (Interview 14, Respondent 36, D1).

Another respondent noted:

These days we try as much as possible not to burn when we clear the land for farming. We try to plant crops like beans and other food (Interview 23, Respondent 18, D1).

Two conditions may have positively amplified climate change engagement: (1) the provision of material support and the presence of a core group trained in fire protection in two of the communities and (2) the fact that the educators shared lived experiences with communities. Firstly, our data showed that the provision of direct material support to the communities was a key factor in climate engagement. In poorer communities, the provision of direct material assistance to communities seemed to have helped engagement. RELBONET provided basic tools such as farming boots, cutlasses, and hoes to help with the work of the core group of volunteers. In addition, RELBONET introduced beekeeping to the core group of volunteers as an alternate means of livelihood. Respondents noted that such help made a significant difference. For poor farmers, such direct assistance may have been an important motivator.

It helped a lot that we were provided with boots, cutlasses, and other things. I say we need more of this assistance. Our boots are torn now and some of us cannot afford new ones (Interview 42, Respondent 57, D2).

Respondents who were part of volunteer firefighting brigades noted that the training in bushfire prevention was particularly useful in preventing the destruction of the woodlots that the community grew. A farmer noted:

At least now we know how we can try to prevent fire outbreaks. We try to educate people in the community about the dangers of setting fires. The group

of volunteers tries to be ready during the dry season. Of course, we can only put out small fires. But we try to avoid the fires to start with. Educating ourselves and other people is important (Interview 38, Respondent 22, D2).

Finally, the data also showed that people were inspired by climate change educators who shared similar lived experiences, as well as linguistic, and cultural ties with the communities with which they were working. This shows the importance of having representation and relatable role models in environmental education. Speculation suggests that the fact that some of these educators were also senior church leaders may have contributed to their respect and admiration, highlighting the potential influence of faith-based organizations in promoting environmental stewardship. The perceived importance of the educators' work, coupled with the belief that it was aimed at helping communities, played a crucial role in legitimizing their efforts and gaining acceptance from the people they were educating. A climate educator noted:

Well, they listen to us because we are one of them. We see the same things they see and share the same problems and hopes about the environment. It also helps that we speak the same language (Interview 19, Respondent 4, D2).

Respondents affirmed their respect for the educators. A representative quote from a respondent was:

We know the trainers well. Most came from the church leadership. We listen to what they say. They are all respected members of the community. We know they care about the community. We can see that the things they tell us are important and make sense—for example, what they taught us about the link between cutting down all the trees for charcoal and rainfall. We very much respect what they do for us. Everyone in the group will say the same thing (Interview, 19, Respondent 13, D2).

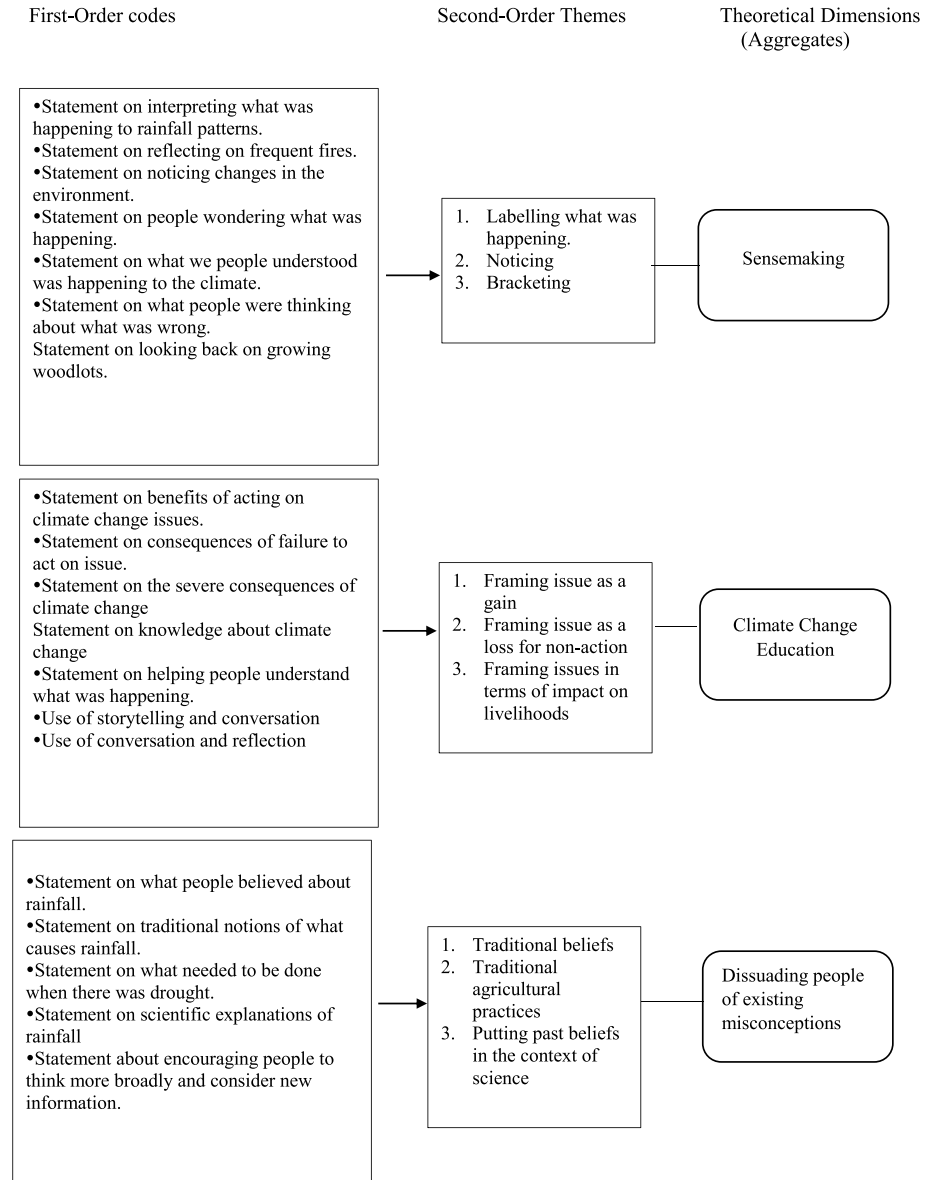
Table 2 presents a summary of the data structure. It highlights the key statements, emerging concepts, and theoretical constructs of the study.

5 Limitations and future research

Sensemaking is difficult to study because it is retrospective, ongoing, and involves multiple actors (Nardon and Hari 2022). Although we interviewed multiple actors, this study explored sensemaking at a particular point in time. Given time and resources, a longitudinal study may be the best option for capturing the ongoing nature of sensemaking around climate change. Also, the findings in this study may be limited in their generalizability. Perception of climate change may be partly a function of culture, historical experiences, and institutional conditions (Petersen-Rockney 2022) and this study focused on a small area in Ghana. While the findings may be generalizable to other parts of Ghana, the applicability of findings outside of the country needs to be carefully considered. Finally, in this study, key informants were active participants in climate change efforts, and that limited our sample size. Purposeful sampling certainly has its strengths: it allowed us to reach those who had experience with the phenomenon of interest, and respondents were knowledgeable and informed about what they were saying (Patton 2002), but this limited the size of those we could study.

There are some areas for additional research. First, it would be interesting to explore the impact of different communication strategies on climate change education and engagement.

Table 2 Data Structure



Further research could explore the effectiveness of other communication strategies, such as peer-to-peer communication, and social media campaigns, on climate change engagement. Second, this study focused on rural communities in Ghana. It would be valuable to explore climate change education and engagement in urban contexts and to compare the differences and similarities between rural and urban communities. Finally, an important contribution would be to study individuals from the general population who have not been reached by any education and compare their knowledge of climate issues with those we have studied.

Table 2 (continued)

First-Order codes	Second-Order Themes	Theoretical Dimensions (Aggregates)
<ul style="list-style-type: none"> •Statement on what to do now. •Statement on planting trees. •Statement on training in fire prevention. •Statement on changing farming methods. •Statement on growing multiple crops. •Statement on leaving land to fallow. •Statement on agreeing to set land aside for a reserve. •Statement on growing woodlots 	<ol style="list-style-type: none"> 1. Developing action repertoires 2. Behavior change 3. Taking purposive action 	Climate Change Engagement
<ul style="list-style-type: none"> •Statement on charcoal production destroying forests. •Statement on fires destroying environment. •Statement on need to protect environment. •Statement on land belonging to future generations •Statement on necessity of acting and not expecting non-natives to solve problems. 	<ol style="list-style-type: none"> 1. Recognizing impact of local behavior 2. Recognizing need to protect local environment. 	Linking climate change to local context
<ul style="list-style-type: none"> •Statement on inviting local input. •Statement on collaborating with communities. •Statement on engaging communities •Statement on incorporate indigenous ideas. •Statement on putting focus on communities. •Statement on adopting emergent approaches. 	<ol style="list-style-type: none"> 1. Helping people formulate own understanding of issues. 2. Playing a facilitative role 	Reflexive sense giving

Such an effort would further strengthen our understanding of the value of climate change education.

6 Discussion

This research builds on and extends the emerging research on local perceptions of climate change and action at the grassroots (Dankwa et al. 2021; Alam et al. 2015). The farmers we studied have benefited from climate change education and are engaged in adaptive behavior. The results indicate that people’s pre-existing beliefs on climate-related issues

may be influenced by tradition, history, and culture. It is not surprising, as most individuals approach discussions about nature with pre-established perspectives, leading to potential misconceptions about climate change (Monroe et al. 2017). Dispelling these misconceptions is an essential prerequisite for effective climate education. Therefore, educators must examine individuals' prior knowledge of climate-related issues before any education because no one approaches these issues without some pre-existing ideas. More importantly, initial perceptions are a fundamental part of sensemaking that needs to be considered (Weick 1995).

Another implication of the findings is that the understanding of climate change is often shaped by the social context (Lehtonen et al. 2018). To help people develop a clearer understanding of climate change, it is essential to employ educational tools like sensemaking and sense-giving. These tools allow individuals to draw on their perspectives and experiences, making climate education more personally meaningful (Vanderlinden et al. 2020). It is worth noting that many rural communities lack knowledge about the human-caused sources of climate change, emphasizing the need for tailored education programs that consider local contexts (Guodaar et al. 2021). The study underscores the importance of relating climate change education to local contexts.

One of the challenges in climate education, as previously documented, is how to inspire action (Monroe et al. 2017). Our research has revealed that making climate change issues relevant and connecting them to survival is a pivotal motivator for encouraging people to act. This finding is in line with prior research indicating that people are more inclined to engage in adaptive behavior when they see it as personally beneficial (Soglo and Nonvide 2019). While the scientific aspects of climate change unquestionably have their place in climate education, it appears that personal relevance, rather than intricate science, may be more effective in catalyzing action. Our respondents did not exhibit a strong interest in the scientific aspects, yet this lack of interest did not hinder their engagement in and adoption of adaptive measures. This finding aligns with previous research, which demonstrated that a limited understanding of the scientific intricacies of climate change does not necessarily deter adaptive action (Petersen-Rockney 2022). The key message may be that in regions with lower educational levels such as the Global South, placing less emphasis on the complex science of climate change in favor of establishing direct connections to local ecosystems and the consequences of climate change may yield more meaningful results in motivating action than a focus on science. This notwithstanding, it is crucial to recognize that science cannot be separated from policy and education, particularly in the context of addressing climate change. Therefore, collaboration between scientists and educators is important. However, there are indications that the constructive interaction between science and policy in the realm of climate change action and sustainability might not be as robust as it should be (Kaaronen 2016).

There is an acknowledged need for collaboration among scientists, policymakers, and educators, given the intricate nature of climate change issues (Maas et al. 2022). Despite this recognition, the actual implementation of such collaboration may be lagging (Maas et al. 2022) and calls have been made urging scientists and stakeholders to join forces in addressing the challenges posed by climate change and sustainability. Examples from Finland and the Netherlands illustrate how the integration of science, policy, and education in the context of climate change and sustainability could be effectively implemented (Maas et al. 2022; Kaaronen 2016).

Another implication of the findings is that effective climate change education may benefit from the use of dialogue, storytelling, and empathy between educators and trainees.

Notably, storytelling has been acknowledged as a powerful tool in climate education (Neas 2023). Educators can establish trust by offering hope to participants, assuring them that changes in attitudes and behaviors can lead to better outcomes, a particularly essential element in climate change education due to prevailing skepticism about climate issues. Relatedly, the specific methods and techniques employed in climate change education are important. For climate education to be impactful, it must hold personal meaning and demonstrate practical benefits, motivating people to act. In general, a conversational approach is most useful. Educators stressed the importance of active listening and encouraged their audiences to reflect on the information they received, a practice that aligns with reflexive sense-giving (Kihlberg and Lindberg 2021).

The present study also highlights the need for climate change education programs that are culturally appropriate and relevant to the specific needs and contexts of the target communities. Local messaging is important for sensemaking (Weick 1979) and for climate engagement (Spence and Pidgeon 2010). It is important to engage with local communities and involve them in the process of finding solutions to climate change, rather than imposing top-down solutions that may not be appropriate or effective. The emphasis on a bottom-up approach that considers local knowledge and beliefs is particularly valuable, and the findings have important implications for policy and practice. The findings suggest that climate change education can be effective in engaging communities in acting toward mitigating climate change if the approaches used by the educators are adapted to fit the cultural and social context of the location. This points to the need for facilitating local understanding, rather than imposing formulaic solutions developed elsewhere and parachuted to different contexts.

While the importance of climate change education is widely recognized, the question of who should be responsible for imparting this education remains ambiguous. Our research underscores the significance of the credibility and authenticity of those engaged in climate change education. It is crucial to acknowledge that individuals who are not part of a community or who come from outside, including scientists, may perceive climate change and its impacts differently (Vanderlinden et al. 2020). Therefore, having educators who share lived experiences with the communities they serve can help reduce conflicting interpretations of the issues and mitigate maladaptation. Educators who have a profound understanding of the specific region are better equipped to interpret the changes observed by the individuals they are educating (Whiteman and Cooper 2011). Prior research has shown that utilizing relevant context can be instrumental in constructing narratives and shaping the sensemaking process of others (Rouleau and Balogun 2011). Climate educators must be climate literate. Climate literacy encompasses the knowledge, skills, and attitudes required for individuals to effectively address the global threat of anthropogenic climate change (Dupigny-Giroux 2010; Leve et al. 2023). We have some evidence that our educators possessed climate literacy, underscoring the necessity for climate educators to be climate literate.

7 Conclusion

The findings from this study have important implications that can inform climate policy in the Global South. It is crucial to consider the local context, including existing knowledge and beliefs when designing climate education programs. Educators should focus on

facilitating local understanding and making direct links between climate change and livelihoods to increase engagement. National governments should prioritize grassroots-level education and involve individuals with lived experiences in educating their communities to enhance legitimacy. Overall, a holistic and context-specific approach to climate education and adaptation is crucial for successful climate policy in the Global South.

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Data availability Research data is not shared due to the sensitivity of the human data collected and the request of respondents to remain anonymous.

Declarations

Ethics approval and consent to participate Institutional IRB and ethical approval and consent to participate granted. The study conforms with all Quinnipiac University, Hamden, CT, USA ethics standards at the time of the fieldwork.

Consent for publication The author gives explicit consent to submit the manuscript.

Competing interests The author declares no competing interests.

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