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Towards place-responsive climate change education: Mongolian primary teachers' pedagogical judgement across urban and rural contexts

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ABSTRACT

Climate change education (CCE) in primary schools is increasingly recognised as essential, yet how teachers interpret and enact CCE across diverse local contexts remains underexplored. This study examines how Mongolian primary school teachers working with students aged 6–11 in urban and rural contexts interpret and teach climate change, with particular attention to the role of place. Drawing on semi-structured interviews with 20 teachers across contrasting contexts, the study explores how environmental, cultural, and institutional conditions shape teachers' pedagogical interpretations and classroom practices. Data were analysed using reflexive thematic analysis, informed by conceptual frameworks that position place as an active mediator of teaching and learning. Findings show that rural teachers frequently integrated traditional ecological knowledge and lived environmental experience to connect global climate processes with locally observable ecological change, emphasising livelihood impacts and intergenerational ecological memory. Urban teachers, by contrast, framed climate change through anthropogenic pressures such as air pollution, waste, and infrastructure constraints, foregrounding feasible individual actions within everyday school contexts. Across both settings, teachers exercised place-responsive pedagogical judgement by selectively adapting climate content to local realities while navigating curriculum constraints and workload pressures. The study contributes a place-responsive account of teachers' pedagogical judgement in CCE, demonstrating how place functions not only as context but as a condition shaping pedagogical feasibility.

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SUSTAINABLE DEVELOPMENT GOALS

SDG 4: Quality Education and SDG 13: Climate Action

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1. Introduction

1.1. Background

Climate Change Education (CCE) has entered its “blooming” phase (Wang et al. 2024), characterised by rapid growth in scholarly interest and increasing recognition of its importance addressing the climate crisis. This shift marks a move from content-heavy, science-focused models toward holistic approaches that integrate emotional, ethical, and social learning dimensions (Ojala 2023; Stevenson 2007). Traditional methods often built knowledge and concern without necessarily including practical components, while creative pedagogies are not automatically more effective if they fail to prompt meaningful action (Roussell and Cutter-Mackenzie-Knowles 2019). Success relies on aligning instruction with specific learning goals (Monroe et al. 2019). Supporting this direction, meaningful climate education must engage learners in recognising their interconnectedness with ecological and societal systems (Gleeson and Morrissey 2024). Climate responses are also inherently shaped by cultural, geographic, and social contexts, necessitating educational practices that are locally grounded and culturally responsive (Zhai, Dillon, and Dawson 2024). Earlier work identified that educational strategies rooted in real-world relevance, active participation, and community engagement tend to be more impactful (Monroe et al. 2019). Community-focused CCE is increasingly taking place in local partnership contexts, illustrating how learning tied to lived experience and community relationships can deepen understanding and motivation (Trott et al. 2023). Complementing this, pedagogies that foster ethical reasoning, critical dialogue, and deep connection to place and community have been widely advocated as more effective in supporting transformative learning outcomes (Bleazby et al. 2023). Collectively, this literature suggests that climate change education is most effective when it is grounded in place-based traditions of education, and enacted through place-responsive pedagogical judgement that attends to learners’ ecological, cultural, and social realities (Hügel and Davies 2024; Khadka et al. 2021; Walker and Vance 2023).

The effectiveness of CCE depends on the agency, preparedness, and pedagogical vision of teachers, as well as on the design of professional development models that enable them to act effectively and enhance student learning (Drewes, Henderson, and Mouza 2018). As key actors in shaping how young people understand and respond to climate issues, teachers need not only disciplinary knowledge but also supportive institutional cultures that build their confidence, creativity, and emotional competence (Beach 2023; Ennes et al. 2021; Ojala 2023). When schools adopt a whole-school approach that integrates climate change and sustainability across curriculum planning, campus practices, and relationships between schools and their communities, teachers are better positioned to embed these issues meaningfully in classroom practice (Rushton 2025; Rushton, Walshe, and Johnston 2026; UNESCO 2021). At the regional level, reviews in the Asia-Pacific further emphasise the importance of bridging global climate science with local knowledge systems to enhance teacher preparation (Fujii 2022). Despite such advances, challenges persist. Many teachers associate sustainability with awareness rather than pupil agency and action, highlighting the need for targeted interdisciplinary training (Sheldrake, Walshe, and Hargreaves 2025). Persistent gaps in pre-service teacher training, especially in localising climate content and

translating concern into pedagogical practice, remain significant obstacle (Boon 2016; Fiel'ardh et al. 2023; Moreno-Fernández 2020). These challenges are compounded by structural barriers such as limited time and unclear institutional responsibilities, which can diffuse accountability and weaken the coherence of CCE efforts (Ennes et al. 2021; McGinnis et al. 2016). In addition to these structural barriers, emotional literacy is critical, as teachers must address both student climate anxiety and their own (Ojala 2023). Professional development programmes that combine robust climate science with solution-focused pedagogy—while connecting global concepts to local ecological and cultural contexts—can strengthen teacher confidence and action orientation (Fuchs 2023). Aligning policies and fostering collaborative networks further amplify teacher-led innovation, supporting CCE adaptation to diverse environmental and cultural realities (Ben Zvi Assaraf et al. 2025; De Rivas, Vilches, and Mayoral 2025). Ultimately, teachers are not passive conduits of curriculum but central agents of transformative climate education. Their capacity to act, both individually and collectively, and to connect global scientific knowledge with local knowledge systems must be deliberately cultivated if CCE is to reach its full potential.

Mongolia offers a theoretically productive context for examining place-responsive approaches to CCE, given the close entanglement of environmental change with everyday livelihoods and schooling (Sattler, Bishkhorloo, and Graham 2021; Tugjamba, Walkerden, and Miller 2021; Yembuu 2021). Processes such as desertification and increased climate variability have direct implications for pastoral and urban communities alike, foregrounding the relevance of place-based knowledge systems, including traditional ecological knowledge, in educational responses to climate change. This knowledge has emerged through long-standing nomadic pastoral practices that emphasise mobility, environmental attentiveness, and adaptive decision-making. However, Soviet-era collectivisation and centralised educational planning reconfigured these relationships by privileging standardised curricular knowledge and externally defined epistemic frameworks, contributing to the marginalisation of place-based ways of knowing and local ecological vocabularies (Yembuu 2016). The legacies of these historical transformations continue to shape contemporary schooling, positioning Mongolia as a context in which tensions between standardised climate education frameworks and place-based knowledge systems are particularly visible.

From this perspective, teachers can be understood as key actors who mediate between curricular expectations, institutional constraints, and place-based knowledge in the enactment of CCE (Ennes et al. 2021; Gruenewald 2003; McInerney, Smyth, and Down 2011). Existing qualitative research indicates that climate knowledge in Mongolia is embedded in everyday ecological practice and intergenerational learning, yet remains weakly articulated within formal curricula and teacher preparation (Tugjamba et al. 2018; Tugjamba, Walkerden, and Miller 2021; Yembuu 2021). This disconnect raises questions about how teachers interpret, prioritise, or adapt place-based knowledge under varying material and institutional conditions, including differences between rural and urban school settings. While previous studies have documented the importance of indigenous and local knowledge for climate adaptation, fewer have examined how such knowledge is pedagogically mobilised within formal schooling (Kim, Asghar, and Jordan 2017; Reid, Teamey, and Dillon 2004). Addressing this gap, the present study examines how Mongolian primary school teachers interpret climate change

through place, incorporate traditional ecological knowledge into pedagogy, and negotiate urban–rural differences in instructional strategies, content, and priorities.

1.2. Research questions

This study explores how the concept of place, understood as both a lived environment and an educational lens, influences Mongolian primary school teachers' interpretation of climate change. It is guided by the following research questions (RQs):

1. How do teachers interpret climate change in relation to the specific environmental and cultural characteristics of the places they live and work in?
2. In what ways do teachers incorporate traditional ecological knowledge (TEK) and local environmental observations from their teaching places into their climate change pedagogy?
3. How do differences in place, particularly across urban and rural teaching environments, influence the instructional strategies, content, and priorities that teachers enact in their CCE practice?

These questions are investigated through semi-structured interviews with teachers from diverse geographic areas in Mongolia, offering a grounded view of how CCE manifests in different educational and ecological settings. Interviews were selected to elicit detailed, context-sensitive accounts of teachers' perspectives, practices, and pedagogical adaptations, making visible how CCE is experienced on the ground across varying places.

1.3. Theoretical framework

What distinguishes this study is its use of a pedagogical lens that treats place not merely as a contextual backdrop but as an active collaborator in the teaching and learning process. Informed by the growing body of work on place-based education (PBE), this perspective centres the ecological, cultural, and emotional dimensions of place in which learning occurs, emphasising that meaningful education emerges through lived relationships with the environment and community (Gruenewald and Smith 2007; Mbah, Leal Filho, and Ajaps 2022; McInerney, Smyth, and Down 2011). To make sense of these relationships, [Figure 1](#) presents the two conceptual frameworks that underpin this analysis: the dimensionality of place, which maps the layered qualities of place, and the pedagogical framing of place, which explores how educational engagement unfolds within those layers.

The dimensionality framework, elaborated by Ardoin, Clark, and Kelsey (2013) and expanded by Yemini, Engel, and Ben Simon (2025), articulates place as composed of four interrelated dimensions: biophysical (climate, geography, local ecosystems), psychological (emotional and sensory attachments), sociocultural (shared narratives, traditions, and practices), and political-economic (access, resources, and structural systems). Together, these dimensions shape how teachers and students experience and respond to climate-related change, including through first-hand observations of shifting pastureland, differences in infrastructure between rural and urban schools,

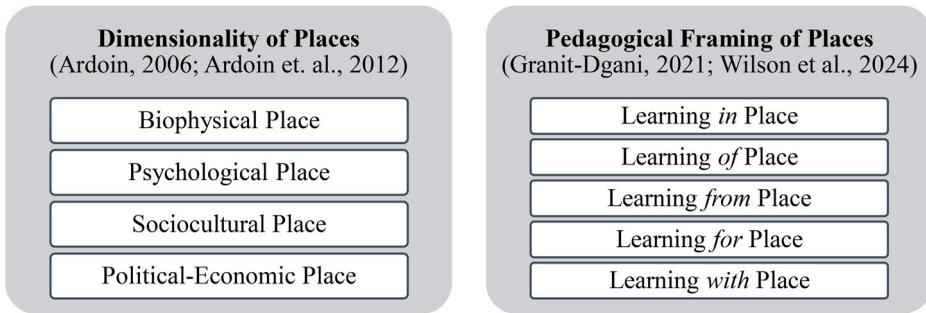


Figure 1. Main analytical framework utilised in this study.

and engagement with family traditions that carry ecological knowledge. While the dimensionality framework maps the structural and experiential qualities of place, this study extends its conceptual reach by introducing a pedagogical framing of place that examines how educators and learners engage with place in teaching and learning processes, rather than how place is characterised as a context. Building on the contributions of Granit-Dgani (2021) and Wilson et al. (2024), this framing identifies five orientations that illuminate different forms of engagement with place. These include *learning in place*, in which lessons are situated in local settings to support sensory and contextual engagement; *learning of place*, which focuses on the study of ecological, historical, and cultural systems to strengthen students' situated understanding; *learning from place*, where local phenomena serve as a basis for developing broader insights and relational thinking; *learning for place*, which foregrounds ethical responsibility toward sustaining and restoring communities and environments; and *learning with place*, which recognises the environment as an active contributor to learning processes. Rather than proposing prescriptive teaching strategies, these orientations are used as an analytical lens to interpret how educators navigate CCE, enabling closer examination of how global scientific knowledge and local lifeworld narratives are connected within place-specific educational practice.

Additionally, this study takes up critical pedagogy of place by grounding it in Mongolia's particular historical and socio-political trajectories of social change. In Mongolia, relationships to land and pastoral landscapes have been shaped through sustained state intervention over time, beginning with socialist collectivisation under Soviet governance and followed by a transition toward a market economy (Yembuu 2016). These shifts have interacted with patterns of rural to urban migration and have progressively influenced herding practices, settlement patterns, and access to pasture and other resources.

Engaging with critical pedagogy of place does not suggest that primary students are expected to analyse these processes in abstract or explicitly political terms. Instead, it functions as an interpretive lens for examining how teachers frame CCE through locally familiar experiences that align with learners' developmental capacities. Within this framing, attention is directed toward place-based knowledge systems that emerge from long standing relationships between people and their environments. In this study, traditional ecological knowledge is understood as locally grounded knowledge transmitted through nomadic lifeways and everyday land-based practices, consistent

with earlier research conducted in Mongolia (Yembuu 2021). TEK is understood not as static folklore but as a dynamic and evolving way of knowing that teachers may draw upon selectively when linking climate change education to students' local environments, while remaining attentive to learners' age, the characteristics of place, and curricular constraints (Eijck and Roth 2007; Hosen, Nakamura, and Hamzah 2020).

This focus on TEK reflects an awareness of both the tensions and the possibilities involved in bringing global scientific knowledge into dialogue with local lifeworld narratives. As Bowers (2008) cautions, the uncritical incorporation of such knowledge into CCE risks reproducing abstraction and forms of cultural erasure unless educators attend carefully to the cultural commons, understood as the shared ecological practices and forms of wisdom that sustain community life. Echoing this caution, Zeyer (2022) argues that the challenge lies not in folding local knowledge into scientific frameworks but in fostering an educational dialogue in which both perspectives coexist and inform one another. In Mongolia, this tension is especially visible, as TEK has been increasingly marginalised within formal education since the post socialist transition (Yembuu 2021). The expansion of standardised curricula alongside rapid urbanisation has further widened this gap, reflecting broader concerns in climate change education about practices that prioritise abstract scientific knowledge over knowledge grounded in specific places and lived experience (Tugjamba, Walkerden, and Miller 2021).

Nevertheless, Stevenson (2007) and Nation and Feldman (2021) argue that when TEK and scientific perspectives are deliberately brought into relationship, CCE can be both intellectually demanding and firmly rooted in local lifeworlds. From this standpoint, climate change education is understood not simply as the transmission of climate-related information but as a relational practice that connects global scientific understanding with locally embedded memory and culturally informed ecological observation (Fortner 2001; Yemini, Engel, and Ben Simon 2025). In such moments, a shrinking riverbank or an altered migration route is no longer interpreted only as data but as a disruption in moral and ecological relations that invites learners to develop scientific literacy alongside a sense of care and responsibility grounded in place.

2. Methodology

2.1. Respondents

This study was conducted in both urban and rural regions of Mongolia, capturing perspectives from teachers working in markedly different ecological and sociocultural contexts (Figure 2).

Urban respondents ($n=10$) were based in Ulaanbaatar, the country's political, economic, and educational centre. Six participants worked in central districts, including Bayangol, Bayanzurkh, Chingeltei, and Sukhbaatar, while four were located in peri-urban districts such as Baganuur, Khan-Uul, and Songinokhairkhan. Rural respondents ($n=10$) were drawn from schools located across a range of ecological zones, including the northern mountain taiga and forest steppe in Khuvsgul and Selenge, the eastern steppe grasslands of Dornod, Khentii, and Sukhbaatar, the southern desert steppe of

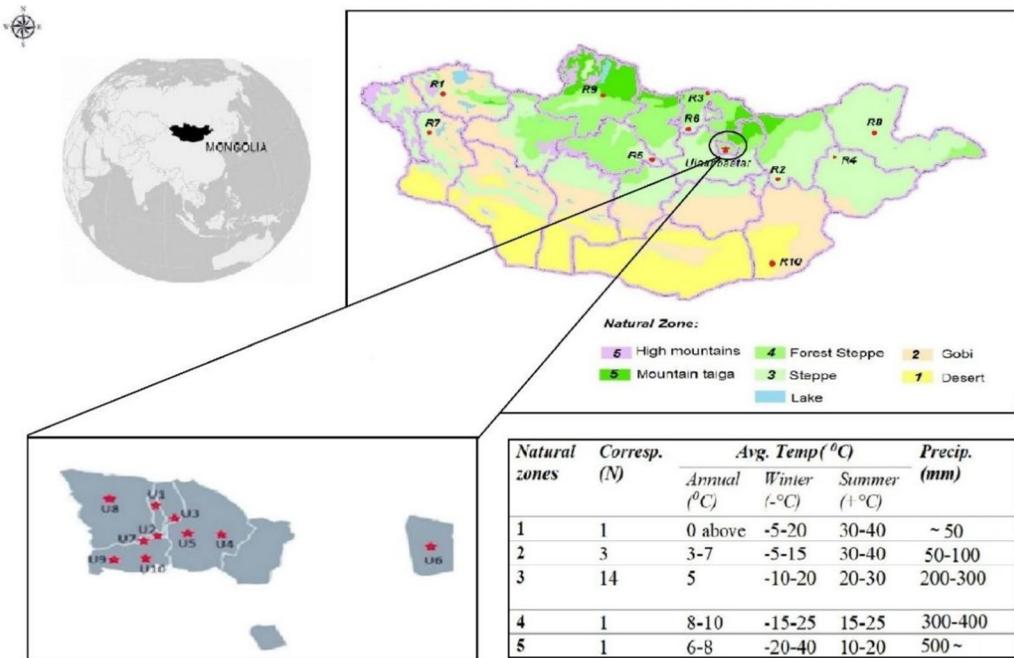


Figure 2. Domicile of participants (map of natural zone in Mongolia adapted from Dash, 2010).

Dornogobi, the western mountain and semi-desert regions of Uvs and Khovd, and the central forest steppe represented by Arkhangai. Together, these locations reflect substantial variation in climatic conditions, land use practices, and livelihood contexts, within which schools often function as stable institutional sites.

Participants were recruited through school administrators and volunteered without prior screening for interest in climate change education. This recruitment strategy aimed to reduce self-selection bias and to support the collection of context-specific accounts rather than nationally representative data. The total sample size of 20 participants was determined based on the principle of data saturation, here understood as the point of information redundancy where no new codes or thematic insights are identified (Braun and Clarke 2019). Given the specific focus on place-based experiences and the relative homogeneity of the professional background (school teachers), a sample of 20 is consistent with established benchmarks for reaching thematic saturation in qualitative research (Guest et al. 2006). Table 1 summarises the demographic profile of the respondents.

2.2. Data collection

Following ethical approval from the Academic Council of the Mongolian National University of Education (MNUE; Approval Number: 1/104), data were collected through semi-structured interviews examining how Mongolian primary school teachers interpret and teach climate change within their ecological, cultural, and institutional contexts. Interviews were conducted in Mongolian between May and June 2024 and carried out either face-to-face or *via* video conferencing, depending on participants' location

Table 1. Demographic profile of participants.

No	Area	Code	Gender	Years of teaching	School level	Education level
1	Urban	U1	F	30	Primary	Teacher's diploma
2		U2	F	19	Primary	Bachelor's degree
3		U3	M	5	Primary	Bachelor's degree
4		U4	F	15	Primary	Bachelor's degree
5		U5	F	7	Primary/junior high	Bachelor's degree
6		U6	M	17	Primary	Bachelor's degree
7		U7	M	29	Primary	Teacher's diploma
8		U8	F	8	Primary	Bachelor's degree
9		U9	M	7	Primary/high	Bachelor's degree
10		U10	F	5	Primary	Bachelor's degree
1	Rural	R1	M	29	Primary	Bachelor's degree
2		R2	F	5	Primary	Bachelor's degree
3		R3	F	11	Primary/high	Bachelor's degree
4		R4	F	24	Primary	Bachelor's degree
5		R5	F	8	Primary	Bachelor's degree
6		R6	M	17	Primary/high	Bachelor's degree
7		R7	M	26	Primary/junior high	Bachelor's degree
8		R8	F	20	Primary	Master's degree
9		R9	F	32	Primary	Teacher's diploma
10		R10	F	7	Primary	Master's degree

and accessibility. Each interview lasted between 45 and 75 min. The interview protocol focused on teachers' understandings of climate change, observations of local environmental change, curricular and instructional approaches, and perceived challenges and opportunities in climate change education. Participants were informed of the study's aims and procedures, and verbal informed consent was obtained prior to participation.

All interviews were audio recorded and manually transcribed verbatim in Mongolian, then anonymised. To support interpretive accuracy, transcripts underwent a back-translation process, ensuring the conceptual nuances of the Mongolian accounts were preserved for analysis in English. Particular care was taken during translation to account for linguistically and culturally specific terms in Mongolian that are shaped by nomadic lifeways, religious traditions, and historical language development, and that do not always map directly onto English. To support credibility, translated transcripts and preliminary interpretations were shared with a subset of participants for member checking. The English transcripts were subsequently analysed.

2.3. Data analysis

In this study, reflexive thematic analysis (RTA) was employed for its theoretical flexibility and its explicit recognition of the researcher's active role in knowledge production (Braun and Clarke 2019, 2021). In contrast to coding reliability approaches that seek consensus in order to minimise bias, reflexive thematic analysis understands researchers' professional experience and cultural positioning as analytic resources for interpreting participants' accounts. This approach was considered appropriate for examining how Mongolian teachers' values and locally situated experiences intersect with global climate change discourses, enabling interpretation that extends beyond surface description toward a more conceptually grounded and contextually

embedded analysis. Analysis was conducted as an iterative and reflexive process comprising six interrelated phases, consistent with the guidance provided by Braun and Clarke.

1. **Familiarisation:** Analysis began with repeated reading of the Mongolian language interview transcripts, accompanied by the writing of familiarisation notes. Each interview was treated as a holistic account in order to preserve the contextual integrity of teachers' narratives and their relationships to their specific teaching environments.
2. **Coding:** Using a hybrid deductive–inductive approach, transcripts were segmented into discrete meaning units. This was an organic and open process where inductive codes were developed directly from teachers' accounts to capture meanings not anticipated by the initial framework, such as specific local environmental observations or nomadic cultural practices. A heuristic benchmark required a code to appear at least three times across the dataset to be considered a viable pattern.
3. **Theming:** Codes were iteratively compared and clustered into broader candidate themes. This involved visual theme mapping (Figure 3) to organise the building blocks and identify shared concepts that linked different teachers' accounts across urban and rural contexts. Themes were understood not as pre-existing entities but as interpretive constructions organised around central concepts.
4. **Reviewing:** Candidate themes were refined through repeated engagement with the full dataset to assess coherence, distinctiveness, and analytic relevance. This process examined how well the themes addressed teachers' interpretations of climate change in relation to their environments (RQ1), their

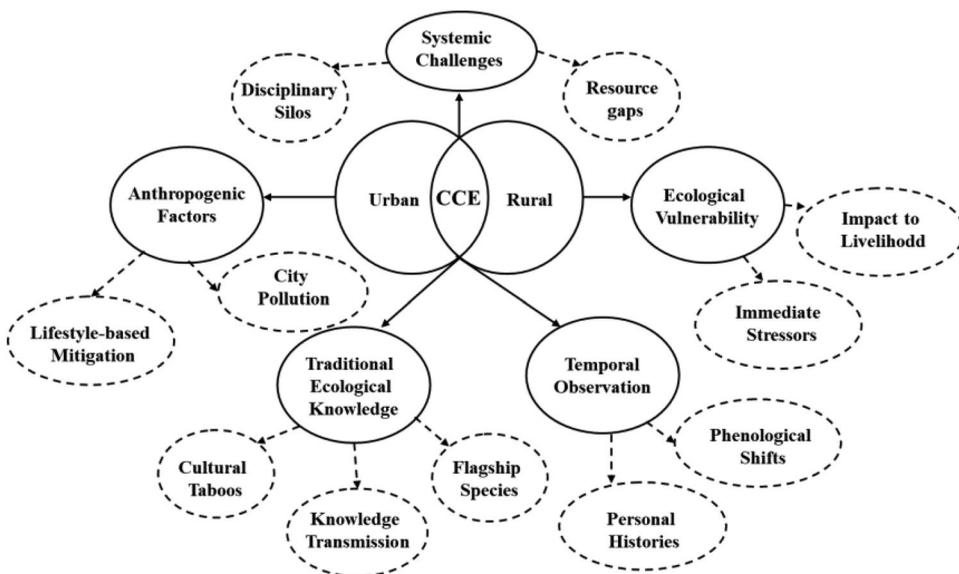


Figure 3. Visual thematic map illustrating the relationship between inductive codes (dashed lines) and their respective themes and subthemes (solid lines).

engagement with traditional ecological knowledge (RQ2), and contextual variation between urban and rural settings (RQ3).

5. **Defining:** The analysis resulted in a final set of five core themes. These themes were refined through reflexive dialogue among the authors to articulate each theme's central organising concept and analytic scope in relation to the dataset. Inter-coder reliability was not sought, as this is incompatible with the epistemological assumptions of RTA.
6. **Reporting:** Final interpretation was guided by the study's theoretical framing of place, including its dimensional and pedagogical aspects, to examine how climate change education was enacted in context.

This process provided the basis for the findings presented in the following section. The resulting five themes illustrate how Mongolian teachers navigate their unique local environments and cultural heritage to enact place-responsive climate change pedagogy.

3. Results and findings

3.1. Theme 1. Ecological vulnerability as the dominant rural entry point to climate change

Rural teachers most often understood climate change through direct ecological disruption that shapes livelihoods and daily routines. Climate education was grounded in locally experienced hazards, including dzud (severe winter disasters in Mongolia that cause mass livestock mortality), drought, flood, and sandstorms. Teachers positioned these as immediate realities that affect pupils and communities. A teacher from Orkhontuul soum, a rural administrative district in Selenge province described how rural life shapes classroom interpretations:

Phenomena such as sandstorms, floods, droughts, and dzuds are directly impacting our lives due to climate change. For example, the prices of food products are increasing. Although our country is rich in livestock, the price of meat rises sharply after dzud because so many animals perish in the cold. Last year, after a flood, even the price of flour increased. These are not distant problems; they affect what our pupils eat every day, and it is impossible to ignore them in the classroom.

Some teachers also linked ecological vulnerability to nearby extractive activity. A teacher in Dornod province explained how field excursions help pupils observe local degradation:

In recent years, mining companies have become increasingly active in our area. After extracting oil, they leave without restoring the land. This leads to the drying up of underground water and rivers, and many animals such as the Mongolian gazelle die in large numbers. I use such concrete examples when discussing these issues with my pupils—we visit these sites together, observe changes, and sometimes conduct field excursions.

Across rural accounts, place-based interpretation emerged as a pragmatic way to interpret environmental instability.

3.2. Theme 2. Anthropogenic pressures as the dominant urban framing

Urban teachers tended to interpret climate change through human-made environmental pressures embedded in dense infrastructure. In these environments, climate change appeared mainly as pollution, waste, and constrained energy use. Pedagogical strategies often emphasised small actions and behaviour change within the limits of urban life. A teacher in Songinokhairkhan district, Ulaanbaatar explained how winter smog influences instruction:

I teach in a place where coal smoke and smog are a normal part of life. In winter, the air becomes almost unbreathable. It is therefore impossible not to think about climate change when it is directly visible in our daily lives. In my lessons, we discuss how to reduce coal use and explore cleaner energy options. I also involve pupils in small actions such as recycling or using less electricity at home...

Another teacher, now working in Bayanzurkh district but originally from western Mongolia's Altai region, reflected on changes observed over two decades:

When I was a child in the Altai Mountain, we could still see eternal snow on the peaks even in summer. Twenty years later that snow has disappeared. Now in Ulaanbaatar my pupils may never see these natural landmarks. I try to remind them that climate change is not only about rising temperatures. It is also about losing parts of our heritage.

Urban teachers thus used place as both a site of degradation and a starting point for feasible climate action.

3.3. Theme 3. Time as a pedagogical resource: before and now narratives of place change

Teachers across contexts mobilised temporal comparisons as a central teaching strategy. They recalled what seasons used to be like and compared them with current patterns. These stories positioned teachers as witnesses to environmental change and helped pupils recognise climate change as gradual and concrete. A teacher from Murun soum, Khuvsgul province described seasonal disruption:

Climate change has dramatically altered the familiar four seasons we once knew. Now we have only three distinct periods, and the transitions between spring and autumn have become unpredictable—sharp changes and shorter durations. Even our once long summers now seem fleeting. This shift brings a new level of uncertainty, making it harder for people to prepare their herds or plan for harvests. I share these observations with my pupils so they can see how these changes are embedded in our daily lives.

Urban teachers also used memories of the Tuul River to prompt pupil curiosity. A teacher from Khan Uul district explained:

When I was a child the Tuul River flowed full and swiftly for summer swimming. Children of my generation would swim there every summer. But now water levels have declined year-round. Pupils ask me in class, 'Why was it like that before and different now?' These questions help them pay attention.

Through such narratives, place functioned not only spatially but also temporally.

3.4. Theme 4. Use of traditional ecological knowledge and local observations in teaching

Teachers described drawing on traditional ecological knowledge and local environmental observations when teaching climate-related topics. Traditional ecological knowledge appeared most often through cultural norms, stories, and ethical practices related to water, land, and wildlife. Local environmental observation was described through attention to nearby rivers, wildlife, seasonal changes, and pollution, which teachers linked to lesson content.

A rural teacher from Umnugobi soum, Uvs province linked water stewardship to traditional practices:

Traditional knowledge strictly prohibits contamination of rivers and lakes. Even placing dairy products in running water is considered disrespectful. When I teach about climate change and conservation, I draw on these familiar practices and ask pupils to talk with their elders at home.

Urban teachers also used TEK through species narratives. A teacher in Ulaanbaatar explained how stories about the Gobi mazaalai bear support emotional engagement:

I tell pupils about the mazaalai bears, once strong and healthy, now struggling for survival as they roam long distances for water due to desertification. I remind them that these animals are part of our identity. Losing them is an environmental loss, but also a cultural one.

Across these accounts, traditional ecological knowledge and local observation were used as reference points that teachers connected to classroom discussions of climate-related topics.

3.5. Theme 5. Institutional and practical constraints shaping classroom practice

Teachers across both rural and urban contexts described a range of institutional and practical constraints that shaped how climate change education was addressed in classroom practice. Commonly reported challenges included heavy workload, limited confidence in climate-related content, rigid curricular structures, and subject-specific boundaries that positioned climate change education primarily as the responsibility of science teachers. Several teachers expressed reluctance to engage deeply with climate change topics due to perceived limitations in subject expertise. One rural teacher from Dornogobi province explained:

We usually leave science subjects to the specialised teachers because they have more experience in those areas. Since we are not science experts, we focus on core subjects like mathematics and Mongolian language. Honestly, I am not sure how to teach about climate change...

Workload and time constraints were also frequently mentioned, particularly in urban schools. An urban teacher highlighted the difficulty of independent preparation alongside existing responsibilities and emphasised the need for structured professional support:

We always have a heavy workload, so studying something independently is difficult. However, I believe that if a unified programme on CCE is developed and training is provided for teachers, it will enable us all to implement it effectively and learn from one another.

In addition to institutional factors within schools, some teachers pointed to the role of families in supporting climate-related learning. A teacher from Khashaat soum in Arkhangai province noted the importance of early and shared engagement:

We need to start teaching CCE and water conservation in primary school, even in nursery. Families should be part of this process to build understanding from a young age.

Across these accounts, teachers described incorporating climate-related topics opportunistically through brief discussions or illustrative examples, while sustained or systematic implementation was reported as difficult under existing curricular and workload conditions.

4. Discussion

Discussion examines how Mongolian primary school teachers interpret and enact climate change education across diverse environmental and institutional contexts. Rather than treating place as a neutral backdrop, the analysis considers how place shapes meaning, knowledge use, and pedagogical possibility in practice. The findings are interpreted using the analytical framework presented in [Figure 1](#), which conceptualises place as a layered and active participant in climate change education through biophysical, sociocultural, political-economic, and psychological dimensions, alongside different pedagogical orientations for engaging with place. This framework is used to examine how teachers first make sense of climate change in relation to their immediate environments, then mediate between knowledge systems when teaching it, and finally navigate the constraints that shape what forms of instruction are possible. In doing so, the Discussion moves beyond description to consider the conditions under which place-responsive pedagogy in climate change education is enacted, as well as the tensions that emerge when global climate narratives are translated into everyday classroom practice.

4.1. RQ1: How do teachers interpret climate change in relation to the environmental and cultural characteristics of the places they live and work in?

Teachers' interpretations of climate change were anchored in biophysical disruption in rural settings and in anthropogenic pressures associated with urban infrastructure, indicating how different dimensions of place shaped what climate change came to mean in everyday life (Gruenewald 2003; McInerney, Smyth, and Down 2011; Yemini, Engel, and Ben Simon 2025). Across both rural and urban contexts, climate change was rarely approached as an abstract global phenomenon. Instead, teachers interpreted global climate processes through locally observable changes that intersected with daily experience, including shifts in ecological conditions, livelihood stability, infrastructural stress, and community life (Khadka et al. 2021; Walker and Vance 2023).

In rural regions, interpretation was closely tied to environmental hazards and forms of instability that affected household routines and economic security, such as dzud, drought, flooding, and sandstorms. Teachers frequently linked livestock loss following dzud events to rising food prices, framing climate change as an issue with immediate implications for pupils' everyday lives. In urban contexts, by contrast, teachers interpreted climate change primarily through human produced environmental pressures embedded in dense and constrained infrastructures. Winter coal smoke and persistent smog were described as shaping both teachers' understandings and their instructional emphasis on energy reduction and actions considered feasible within household settings. These differing interpretive entry points reflect how material and infrastructural conditions influence what aspects of climate change become salient within particular places (Hügel and Davies 2024; Ben Zvi Assaraf et al. 2025).

Interpretation was not limited to cognitive recognition of environmental change. Teachers' accounts also revealed affective and identity related dimensions, particularly where environmental change was described through memories of loss, such as the disappearance of perennial snow in the Altai region. Such narratives positioned climate change not only as a scientific concern but also as a disruption to cultural continuity and personal history (Ojala 2023; Stevenson 2007). Across both rural and urban contexts, teachers further employed temporal comparison as a pedagogical resource. References to conditions in the past and present were used to make gradual environmental change perceptible to pupils by connecting present observations with remembered experiences. In this way, temporal comparison activated the psychological dimension of place and supported sense making that was grounded in lived experience (Gruenewald 2003; Wilson et al. 2024).

Taken together, these interpretation patterns align with scholarship that conceptualises place as constitutive of meaning making, rather than as a neutral backdrop for content delivery. From this perspective, teachers' interpretations can be understood as situated responses that emerge through ongoing relationships between environmental change, material conditions, and culturally mediated experience (Gruenewald 2003; McInerney, Smyth, and Down 2011; Wilson et al. 2024; Yemini, Engel, and Ben Simon 2025).

4.2. RQ2: In what ways do teachers incorporate TEK and local environmental observations from their teaching places into their climate change pedagogy?

Building on place-based interpretations, teachers incorporated traditional ecological knowledge and local environmental observation in selective and differentiated ways that reflected both epistemic judgement and contextual constraint (Eijck and Roth 2007; Reid, Teamey, and Dillon 2004). Traditional ecological knowledge was most often used as a culturally grounded interpretive resource rather than as formal explanatory content. Teachers drew on familiar ethical norms, such as water stewardship practices that prohibit contamination, to support value-based reasoning and to encourage dialogue between pupils and family members, particularly elders (Kim, Asghar, and Jordan 2017; Yembuu 2021). In this sense, TEK functioned less as an alternative knowledge system and more as a mediating resource that oriented pupils toward care, responsibility, and relational understanding.

In urban classrooms, references to traditional ecological knowledge appeared less frequently and were more commonly mediated through narrative forms rather than through direct engagement with land-based practices. Teachers described using stories, such as accounts of the Gobi mazaalai bear, to frame desertification as both an environmental concern and a form of cultural loss. These narrative uses of TEK enabled affective engagement while avoiding claims to ecological expertise that teachers did not feel positioned to enact within urban and institutionally constrained settings (Nation and Feldman 2021; Stevenson 2007). Across the dataset, TEK was therefore rarely mobilised as structured explanatory knowledge. Instead, it appeared primarily as ethical framing, narrative reference, or a prompt for intergenerational conversation, reflecting cautious pedagogical judgement rather than deficit or absence (Reid, Teamey, and Dillon 2004).

Local environmental observation played a distinct pedagogical role. Teachers described using observation to support pupils in noticing changes in nearby environments, including seasonal variation, river conditions, wildlife presence, and visible forms of pollution. These observations were then connected to climate-related concepts, positioning observation as an empirical entry point grounded in lived experience rather than in cultural tradition (Khadka et al. 2021; Walker and Vance 2023). Viewed through the lens of pedagogical framing, learning in place supported direct engagement with proximate environments, while learning from place enabled movement from situated observation toward more general climate understanding (Granit-Dgani 2021; Wilson et al. 2024).

The incorporation of both traditional ecological knowledge and local observation was neither automatic nor uniform. Teachers' accounts indicated that these practices were shaped by confidence in subject knowledge, curriculum expectations, and judgements about developmental appropriateness for primary-aged pupils. These constraints reflect enduring tensions surrounding epistemic integration in environmental and science education, particularly where local knowledge is positioned alongside formal scientific curricula (Eijck and Roth 2007; Reid, Teamey, and Dillon 2004; Yemini, Engel, and Ben Simon 2025).

4.3. RQ3: How do differences in place, particularly across urban and rural teaching environments, influence the instructional strategies, content, and priorities that teachers enact in their CCE practice?

Differences in place shaped climate change education most clearly at the level of instructional enactment, where teachers translated interpretation and knowledge mediation into concrete strategies under real constraints. In practice, rural instruction aligned with learning in place through field observation and with learning from place through generalising local ecological signals to broader climate concepts, whereas urban instruction aligned with learning of place through analysing built-environment causes and with learning for place through feasible household-level actions (Granit-Dgani 2021). Rural teachers described taking pupils to sites affected by mining activity to observe dried riverbeds and land degradation directly. In these cases, locally visible environmental degradation, including extractive activity, functioned as a concrete entry point for discussing climate risk, even when the causal chain between

local damage and global climate processes was complex or indirect. Urban teachers, by contrast, often began from winter smog and daily infrastructure constraints, and prioritised actions framed as feasible within household routines, including reducing coal use and saving electricity.

Across both settings, however, instructional priorities were constrained by institutional and political conditions, including curriculum absence, rigid subject boundaries, heavy workload, and uneven access to professional support, which shaped what teachers judged pedagogically feasible. Teachers' accounts included explicit reluctance tied to subject boundaries and confidence, such as "we are not science experts," alongside the practical limits created by workload and the need for structured training. These patterns align with wider evidence that climate change education implementation is frequently limited by teacher preparedness and systemic design constraints, not simply by individual motivation (Beach 2023; Ben Zvi Assaraf et al. 2025). Taken together, the findings indicate that place shapes not only instructional strategies and content emphasis, but also what teachers deprioritise or leave unaddressed. In this way, RQ3 completes the analytical progression by showing how place, already central to interpretation and knowledge mediation, also structures the limits and possibilities of climate change education in practice.

4.4. Implications of findings

The findings underscore the need to support teachers as central actors in CCE by strengthening both their pedagogical and emotional capacities. Teachers in this study demonstrated a willingness to employ place-responsive approaches, drawing on local ecological observations and cultural narratives to make climate issues meaningful for pupils. Yet many also felt underprepared, particularly when integrating traditional ecological knowledge or addressing pupils' affective responses to environmental change. This highlights the importance of teacher preparation that extends beyond disciplinary content to include relational, ethical, and emotional dimensions of practice (Ojala 2023). Professional development programmes that combine robust climate science with attention to emotional literacy and context-specific pedagogy could help build confidence and agency among educators (Fuchs 2023). Such preparation would also align with calls for participatory and affective approaches in CCE that empower teachers to foster critical dialogue and ethical reasoning in their classrooms (Roussell and Cutter-Mackenzie-Knowles 2019).

For schools, the findings suggest the potential value of adopting whole-school approaches that integrate CCE across curricula, campus practices, and community relationships. Many teachers noted that fragmented curricula and rigid subject boundaries limited their ability to embed climate issues meaningfully in everyday teaching. While individual teacher adaptations foster relevance and responsiveness to place, the analysis indicates that without an organising framework, such efforts risk remaining uneven and episodic, limiting opportunities for conceptual progression across classrooms. This indicates the need for more cohesive institutional environments that support alignment between locally grounded practices and shared learning goals, ensuring that climate learning is not confined to science lessons or extracurricular activities but becomes part of a collective educational ethos (Rushton 2025).

Strengthening connections between schools and local communities—particularly in rural areas where TEK and intergenerational knowledge remain vibrant—could further enhance the relevance of climate pedagogy and support pupil engagement (Rushton, Walshe, and Johnston 2026).

At the system level, the study points to the need for educational policies and frameworks that acknowledge diverse knowledge systems while enabling coherent and cumulative climate learning across schools. Current approaches remain heavily shaped by Global North paradigms, often marginalising local epistemologies and place-based adaptation strategies (Westphal et al. 2025). Prior research has specifically identified risks of tokenism, defined as the superficial incorporation of indigenous and local knowledge without meaningful pedagogical integration (Tugjamba, Walkerden, and Miller 2021). Although participants in this study did not report explicit instances of tokenism, this literature highlights an important caution for future curriculum development. To address this, curriculum development should foster genuine dialogue between scientific and local knowledge systems, supporting teachers in mediating global climate concepts within local lifeworlds while maintaining curricular coherence (Tugjamba et al. 2018; Yembuu and Uranchimeg 2019). Policies that promote collaborative networks and support teacher led innovation within shared curricular structures (Ben Zvi Assaraf et al. 2025; De Rivas, Vilches, and Mayoral 2025) could provide the structural conditions necessary to sustain place responsive yet coherent climate change education. While systemic reform may be gradual, such measures are essential for ensuring that all pupils benefit from cumulative and equitable climate learning rather than relying solely on individual teacher initiative.

4.5. Limitations and recommendations

This study offers insight into how Mongolian primary school teachers draw on local environments and cultural traditions in climate change instruction. It provides a focused account of teacher perspectives across diverse ecological and institutional contexts, rather than a comprehensive view of all actors involved in shaping climate education. Future research would benefit from including school administrators and curriculum developers, as well as community elders, whose roles in shaping and legitimising climate knowledge remain influential but fall outside the scope of the present analysis (Reid, Teamey, and Dillon 2004; Ben Zvi Assaraf et al. 2025). Incorporating these perspectives could clarify how institutional priorities and community relationships shape teachers' efforts to adopt place-based and culturally responsive approaches, as well as how school-level coordination across curriculum, campus practices, and local partnerships influences the coherence of climate pedagogy (Gleeson and Morrissey 2024; Rushton, Walshe, and Johnston 2026).

This study also centred on teachers' pedagogical approaches and did not examine how young learners engage with or respond to place-based and tradition-informed content. Research that foregrounds pupil perspectives could offer further insight into how children interpret ecological change, the knowledge and values they bring from home, and the extent to which classroom practices resonate with these lived experiences (Hestness et al. 2017; Yembuu 2021). Such work would deepen understanding of intergenerational knowledge transmission and the role of cultural identity in

environmental literacy. It may also help to clarify how younger and more urbanised teacher cohorts, many of whom have limited experience of rural or nomadic lifeways, adapt place-responsive pedagogical practices under conditions of ongoing climate disruption (Beach 2023; Sattler, Bishkhorloo, and Graham 2021). Rather than assuming stable or transferable models of practice, future research should examine how climate change education in primary schools is continually re-worked in response to shifting environmental, cultural, and institutional conditions (Bleazby et al. 2023; Roussel and Cutter-Mackenzie-Knowles 2019).

5. Conclusion

This study examined how Mongolian primary school teachers interpret and enact climate change education across contrasting rural and urban contexts by foregrounding place as a condition shaping pedagogical feasibility. Rather than treating place solely as a source of local relevance, the findings demonstrate that place structures what teachers judge teachable in practice, shaping processes of prioritisation and pedagogical omission. These place-based conditions enabled climate change to become meaningful within classroom settings, while simultaneously delimiting instruction to phenomena considered observable, discussable, and appropriate for primary-aged learners.

Teachers drew on personal histories, community knowledge, and locally available resources, with these practices shaped by schooling norms, curriculum authority, and institutional constraints. Traditional ecological knowledge featured selectively within pedagogy, operating primarily as ethical framing, narrative reference, or a prompt for family dialogue rather than as structured explanatory content. Importantly, the findings show that institutional and place-based conditions did not merely constrain climate change education but actively shaped teachers' pedagogical judgement. Decisions to simplify content or prioritise feasible household actions reflected situated responses to perceived pedagogical risk and uneven professional support. By foregrounding teachers' place-responsive pedagogical judgement, this study clarifies how the aspirations of SDG 4 (Quality Education) and SDG 13 (Climate Action) are interpreted, adapted, and, in some contexts, constrained within everyday primary school practice, rather than uniformly enacted through policy or curriculum alone.

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Shinetsseg GerelkhUU conceived and designed the study, collected the data, conducted the formal analysis, and led the writing of the original draft and subsequent revisions. Hiroki Fujii provided overall academic supervision, guided the research methodology, contributed to the theoretical framing, and reviewed and edited the manuscript. Khalifatulloh Fiel'ardh contributed to the theoretical analysis, refined the conceptual framework, and provided substantive feedback across manuscript drafts. Batchuluun Yembuu contributed to the conceptualization and theoretical framing, advised on the interpretation of the findings, and provided critical feedback on the manuscript. Dembereldorj Uuriintuya coordinated the project, supported study implementation, and contributed to manuscript revision. All authors discussed the results, revised the manuscript, and approved the final version.

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Data availability statement

The data is available by contacting the third author of the study, Hiroki Fujii, who is principle investigator of the project financing this study.

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