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ARTICLE

Geography education and climate change awareness among secondary school teachers and learners in Tubah Subdivision, Cameroon

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ABSTRACT

By integrating physical and human environmental processes, Geography education is increasingly recognised as an important vehicle for climate literacy. However, evidence on its contribution to climate change awareness and adaptation-oriented learning at school level remains limited. This study examines how Geography teachers and learners in secondary schools in Tubah Subdivision, Cameroon, perceive the contribution of Geography education to climate change awareness. Structured questionnaires were administered to 68 Geography teachers and 150 learners in five secondary schools, supported by semi-structured interviews with five teachers. All teachers (100%, n=68) reported that climate change topics were included in the Geography curriculum, while 81% reported high confidence in teaching them. Teaching experience was significantly associated with teaching confidence. Amongst learners, 92% reported observing local climate-related changes, and 79% identified Geography as their primary source of climate information. These findings indicate that Geography education is an important source of climate change knowledge and adaptation-oriented learning among secondary-school teachers and learners. However, constraints on climate-change education relate to teaching pedagogy, differences in school resources, and limited opportunities for field-based learning.

Keywords: Adaptation-oriented learning, Cameroon, Climate change awareness, Climate literacy, Geography education, Secondary schools

INTRODUCTION

Climate change is one of the defining environmental challenges of the 21st century, with consequences for ecosystems, livelihoods, human health, and socioeconomic development (IPCC, 2021). Rising temperatures, changing precipitation patterns, and the increasing occurrence of climate-related extremes are altering environmental conditions and creating new challenges for communities, particularly those whose livelihoods depend directly on climate-sensitive resources. These impacts are particularly significant in sub-Saharan Africa, where high dependence on rain-fed agriculture, limited adaptive capacity, and existing socioeconomic vulnerabilities increase exposure to climate-related risks (Serdeczny et al., 2017; Leal Filho et al., 2026). Addressing these challenges therefore requires not only technological and policy responses but also a population that understands climate change, its causes, consequences, and possible responses. Education is an important component of this broader response because it can shape how individuals understand environmental change and respond to associated risks. This role is reflected in Sustainable Development Goal Target 13.3, which calls for improving education, awareness-raising, and human and institutional capacity on climate change mitigation, adaptation, impact reduction, and early warning. Schools are particularly important in this regard because they provide structured settings in which young people develop scientific knowledge, environmental attitudes, and an understanding of the relationship between human activities and the physical environment.

Within school-based climate change education, Geography is important as it connects physical processes, such as changes in climate, ecosystems, and natural hazards, with human processes, including livelihoods, resource use, vulnerability, and adaptation (Mbah & Ezegwu, 2024; Naidoo, 2024). Geography teachers also play an important role in translating climate-related knowledge into classroom learning and shaping learners' understanding of environmental issues. As a result, examining climate change awareness among both Geography teachers and learners can provide insight into how climate-related knowledge is communicated and understood within secondary education.

Despite growing attention to climate change and adaptation in Cameroon, research has largely focused on areas such as farmers' perceptions and adaptation practices, climate variability, and broader institutional or educational challenges (e.g. Wuchu, 2024; Chikowore et al., 2026; Leal Filho et al., 2026). Less attention has been given to the role of Geography education in shaping climate change awareness. This is an important gap because Geography teachers are key actors in climate education, while learners can lead on climate knowledge and adaptation in families and communities.

The aim of this study is to examine how Geography education is perceived to contribute to climate change awareness and adaptation-oriented learning among teachers and learners in five secondary schools in Tubah Subdivision, Cameroon. The study evaluates self-reported levels of climate change awareness amongst learners by school, gender, and grade; describes teachers' views on curriculum coverage, teaching confidence, and teaching approaches related to climate change; and identifies perceived barriers to effective climate change education.

METHODOLOGY

Study area

This study was conducted in Tubah Subdivision, Mezam Division, Northwest Region of Cameroon, within the Bamenda Highlands (Figure 1). The area comprises five main communities: Bambili, Bambui, Big Babanki (Kedjom Keku), Small Babanki (Kedjom Kitinguh), and Sabga. The study focuses on five secondary schools in which Geography is offered at the Advanced Level (A-Level): CCAST Bambili, GHS Kedjom Keku, GTHS Ntigi, CHS Bambui, and GHS Mambu. These schools are located across three of Tubah's five main communities.

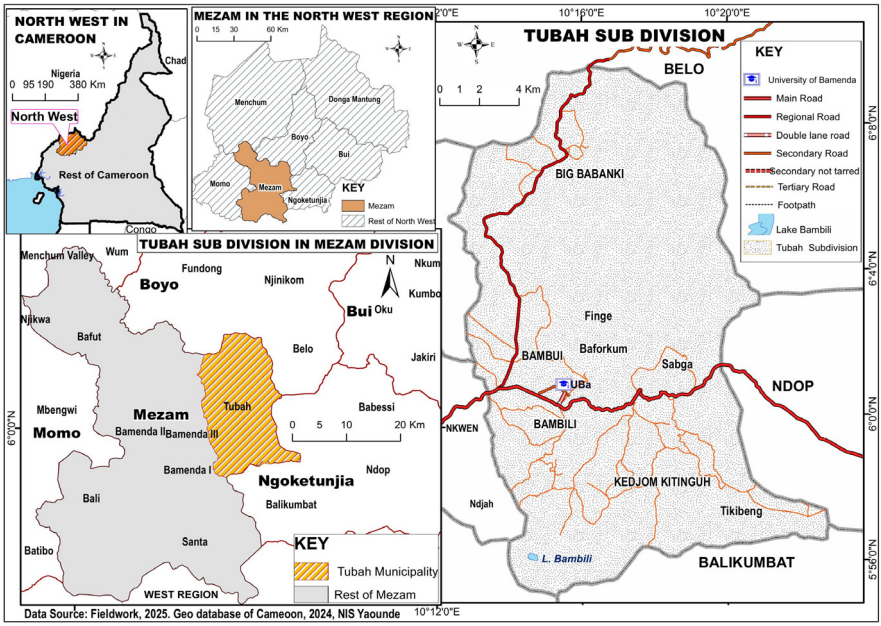


Figure 1. Location map of Tubah Subdivision, Mezam Division, Northwest Region, Cameroon.

Conceptual framework

This study draws on the Knowledge–Attitude–Practice (KAP) model and Climate Literacy Theory (e.g. Maleknia & Zamani, 2025) as applied in this context of secondary-school Geography education. The study focuses on individual-level dimensions of this framework, including curriculum exposure and content, teaching confidence and pedagogical approaches, climate knowledge and awareness, environmental attitudes and concern, and stated willingness to participate in adaptation-oriented activities learners (NOAA, 2009; Anderson, 2012). It does not directly measure actual community adaptation behaviour, community resilience, or changes over time.

Population and sampling

Based on the available school records and enrolment information, the target population was 80 Geography teachers and 200 A-Level Geography learners across the five schools (Table 1). The sample size was assessed using Yamane's (1967) formula: $n = N / [1 + N(e^2)]$, where n = required sample size, N = population size, and e = acceptable margin of error (set at 0.05, i.e. 95% confidence level). Purposive sampling was applied for teacher selection, targeting 68 Geography teachers actively assigned to teach Lower Sixth or Upper Sixth A-Level Geography during the data collection period. Teachers were selected from all five schools to enable school-level comparison. Random sampling was used for the selection of learners within each school, with proportional allocation based on estimated A-Level Geography enrolment.

Table 1. Sample size determination using the Yamane (1967) formula.

Group	Population (N)	Margin of Error (e)	Minimum Required (n)	Achieved Sample	Assessment
Teachers	80	0.05	67	68	Meets minimum
Learners	200	0.05	134	150	Exceeds minimum (+16)
Total	280	0.05	165	218	Exceeds minimum

Data collection and analysis

Separate semi-structured questionnaires were developed for teachers and learners involving closed and open-ended questions. For learners, a composite climate-awareness score was used for 10 binary-scored knowledge/impact items, with the categories of Not Aware 0–3, Slightly Aware 4–5, Moderately Aware 6–7, Highly Aware 8–10). A subset of teachers, drawn across the same five schools, also took part in individual interviews. Quantitative data were analysed using descriptive statistics (frequencies and percentages). Qualitative data were analysed using reflexive thematic analysis following Braun and Clarke (2006).

Ethical considerations

The study received research permission from the Senior Divisional Officer, Tubah Subdivision (Ref. N°087/AR/SDO/TUBAH/2025, dated 17 December 2025). No separate institutional ethics committee approval was obtained but school principals provided access permission. Parents/guardians were informed in advance through school communication channels; participating learners provided assent before completing the anonymous questionnaire.

RESULTS

Teacher questionnaire responses

A total of 68 Geography teachers completed the questionnaire with the number of participants varying between schools according to their size (CCAST Bambili 38, GHS Kedjom Kekuh 20, GTHS Ntigi 5, CHS Bambui 4, GHS Mambu 1). Two thirds of teacher participants were female (67.6%) and most teachers (77.9%) have two years of experience or less. All 68 teachers (100%) confirmed that the Geography curriculum includes climate change topics but only 60 participants completed questionnaire items on climate effects, causes, adaptation and mitigation. From these 60 responses, the most commonly covered topics in the curriculum were the effects (91.7%), causes (88.3%), adaptation (73.3%) and mitigation strategies for climate change (68.3%) (Table 2).

Table 2. Teacher perceptions of curriculum coverage, confidence, and pedagogy in climate change topics.

Statement	Number of responses	Percentage (%)	Total number of responses
Curriculum includes climate change topics: Yes	68	100.0	68
Geography helps learners understand climate change: Yes	68	100.0	68
Confidence in teaching climate change			68
Very confident	55	80.9	
Moderately confident	10	14.7	
Not confident	3	4.4	
Primary teaching method used			68
Lecture	47	69.1	
Case studies	12	17.6	
Fieldwork	5	7.4	
Group discussion	3	4.4	
Other methods	1	1.5	

Statement	Number of responses	Percentage (%)	Total number of responses
Curriculum topic focused on			
Effects of climate change	55	91.7	60
Causes of climate change	53	88.3	60
Adaptation strategies	44	73.3	60
Mitigation strategies	41	68.3	60

The dominance of lecture-based approach (69.1%) remains the most significant pedagogical concern emerging from this data. Climate education research consistently shows that passive knowledge transmission through lectures rarely produces the attitudinal change and practical skill needed for adaptive behaviour (Anderson, 2012; Lehtonen et al., 2019). The minimal use of field work (7.4%) is particularly notable, given that the region of the Tubah Subdivision is strongly affected by climate change that could be leveraged for experiential learning.

Teaching experience and confidence

Cross-tabulation of teaching experience by self-reported confidence shows that teachers with 3–4 years of experience (n=15), reported very high confidence in teaching climate change (100%). By contrast, those with less experience reported being less confident in their teaching activities (Table 3). This is a statistically-significant difference ($X^2(2, n=68) = 9.32$, $p=0.0095$, Cramér's $V=0.37$).

Table 3. Teaching experience and teaching confidence regarding climate change amongst teachers (n=68).

Confidence level	1 year (n=24)	2 years (n=29)	3–4 years (n=15)	Total (n=68)
Very confident	15 (62.5%)	25 (86.2%)	15 (100%)	55 (80.9%)
Moderately confident	7 (29.2%)	3 (10.3%)	0 (0%)	10 (14.7%)
Not confident	2 (8.3%)	1 (3.4%)	0 (0%)	3 (4.4%)
Total	24 (100%)	29 (100%)	15 (100%)	68 (100%)

Perceived barriers to effective climate change education

Teachers (n=60) identified a range of barriers limiting climate change education effectiveness, identified through thematic coding (Figure 2). Open-ended written responses on the questionnaire (n=68) can also support these different types of perceived barriers (Table 4).

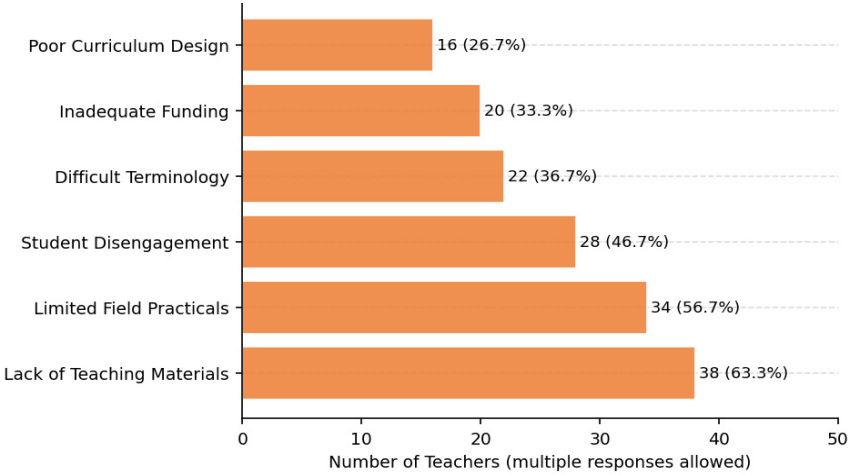


Figure 2. Perceived barriers to effective climate change teaching, identified by the teachers (n=60).

Table 4. Representative excerpts from teachers' perceived barriers to effective climate change teaching.

Thematic area	Examples
Poor curriculum design	'The syllabus focuses heavily on global examples like Arctic melting rather than drought cycles here in Mezam.' (CCAST Bambili teacher) 'The curriculum should reward community-based environmental projects rather than solely pen-and-paper exams.' (GHS Kedjom Keku teacher)
Inadequate funding	'We planned a schoolyard compost and tree nursery, but the department had no money for basic supplies.' (CCAST Bambili teacher) 'Schools in rural Kedjom Keku have very tight budgets, limiting instructional purchases for science clubs.' (GHS Kedjom Keku teacher)
Difficult terminology	'Explaining greenhouse gas forcing in plain language takes time that our scheme of work does not permit.' (CCAST Bambili teacher) 'Translating complex climate terms into local examples helps rural students grasp environmental concepts.' (GHS Kedjom Keku teacher)
Lack of learner engagement	'Students prioritize memorization for GCE exam questions rather than discussing practical community action.' (CCAST Bambili teacher) 'Taking students to observe stream bank degradation near village water points improves comprehension immediately. (GHS Kedjom Keku teacher)
Limited field practicals	'We cover the national syllabus, but finding class hours for outdoor environmental exercises is very difficult.' (CCAST Bambili teacher) 'Students see slope failure along the road during rainy season, but we lack formal time to analyze it in class. (GHS Kedjom Keku teacher)

Thematic area	Examples
Lack of teaching materials	'Students understand definitions, but I have no visual charts showing local temperature records.' (CCAST Bambili teacher) 'Our library lacks environmental texts; teachers rely strictly on personal lesson notes from college.' (GHS Kedjom Keku teacher)

Learner questionnaire responses

A total of 150 learners were surveyed (Table 5). All learners (100%) identified Geography as the school subject through which they received information on climate change.

Table 5. Distribution of learner respondents by school, gender, age group, and class level (n=150).

Variable	Category	Frequency	Percentage (%)
School	CCAST Bambili	68	45.3
	GHS Kedjom Kekuh	42	28.0
	GTHS Ntigi	20	13.3
	CHS Bambui	14	9.3
	GHS Mambu	6	4.0
	Total	150	100
Gender	Male	60	40.0
	Female	90	60.0
	Total	150	100
Class level	Lower Sixth	62	41.3
	Upper Sixth	88	58.7
	Total	150	100

Climate change awareness among learners

In total, 138 leaners (92%) reported having observed changes in local weather patterns. The most commonly reported changes were related to temperature and rainfall patterns (Table 6). The identification of school as the primary source of climate information indicates that formal Geography education is the dominant climate knowledge pathway reported in this community.

Table 6. Student climate change awareness and perceptions (n=150).

Statement/response	Frequency	Percentage (%)
Observed local weather changes: Yes	138	92.0
Observed changes in climate		
Rising temperatures	88	58.7
Unpredictable rainfall	35	23.3
Prolonged droughts	14	9.3
Flooding	7	4.7
Climate change is real and serious: Yes	138	92.0
Should learn more about climate change in school: Yes	150	100
Willing to participate in environmental activities: Yes	144	96.0
Primary source of climate information		
School	118	78.7
Television/radio	14	9.3
Community discussions	10	6.7
Family/friends	5	3.3
Other	3	2.0

Descriptive cross-tabulation of climate awareness by gender showed modest differences with female learners more climate-aware than male ones (Figure 3). In investigating climate awareness by level of schooling, Upper Sixth learners had greater awareness than Lower Sixth learners (Figure 4), by virtue of their one additional year of Geography education.

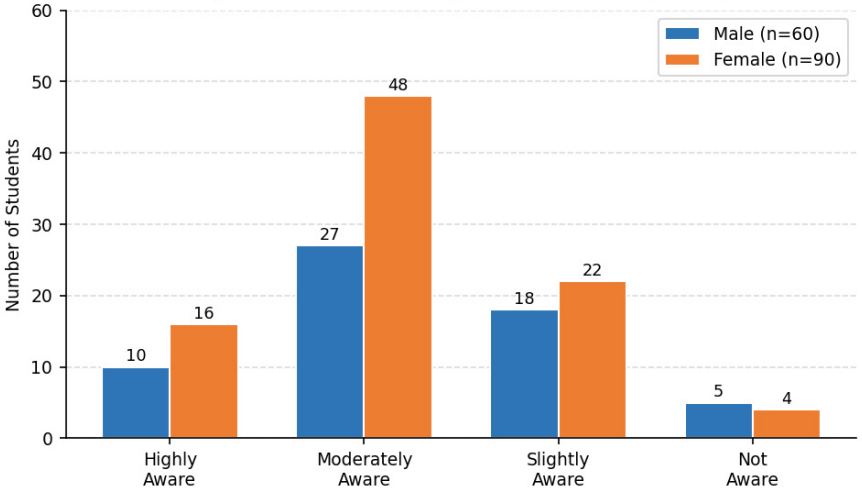


Figure 3. Climate change awareness by gender of learners (n=150).

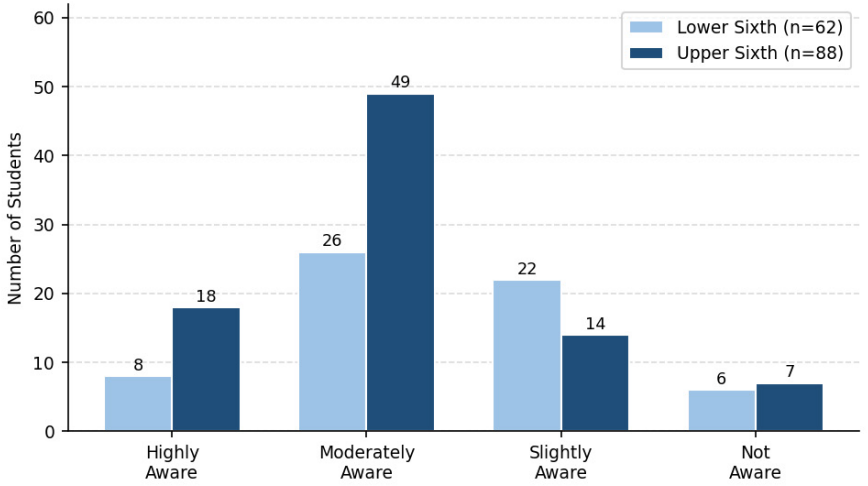


Figure 4. Climate change awareness by level of schooling (n=150).

Climate awareness of learners across the three largest schools was also evaluated (Figure 5). CCAST Bambili learners had the highest proportion of high climate awareness (26.5%), compared to 14.3% at GHS Kedjom Kekuh and 10% at GTHS Ntigi. This may reflect the fact that larger schools may be better resourced and may benefit from more experienced staff and better teaching materials.

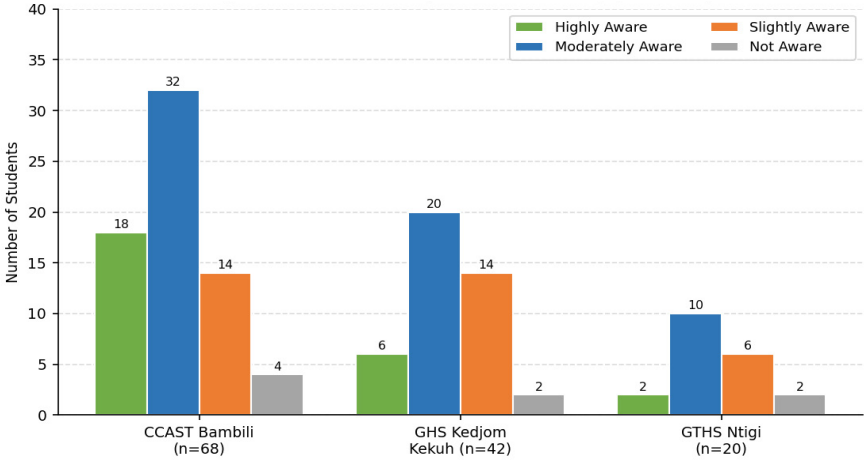


Figure 5. Climate awareness by learners in the three largest schools in this study.

Climate change adaptation strategies

Table 7 presents the adaptation-oriented strategies identified by both teachers and leaners as associated with Geography education. Overall, responses from both groups were very similar.

Education-related strategies constitute 29.9% of all responses made by teachers and 32.4% of responses by learners. Tree planting and similar strategies related to agriculture make up 47.2% of all responses by teachers and 46.9% of all responses by learners. Differences in technically specific strategies between teachers and learners, such as crop diversification (50% vs 21.3%) and water conservation (46.7% vs 29.3%) may reflect the incomplete knowledge held by learners on these topics.

Table 7. Climate change awareness and adaptation strategies reported by teachers and learners (multiple responses allowed).

Strategy	Teachers (n=60)	Learners (n=150)	Combined total
Teaching causes and effects of climate change	48 (80%)	88 (58.7%)	136
Tree planting and conservation	42 (70%)	98 (65.3%)	140
Community environmental protection	42 (70%)	56 (37.3%)	98
Raising climate risk awareness	38 (63.3%)	75 (50%)	113
Sustainable farming practices	36 (60%)	62 (41.3%)	98
Crop diversification strategies	30 (50%)	32 (21.3%)	62
Water conservation and management	28 (46.7%)	44 (29.3%)	72
Disaster preparedness improvement	24 (40%)	48 (32%)	72
Total number of aggregated responses	288	503	–

Learners were also asked about the environmental activities they are willing to get involved in (Figure 6). Tree planting was the most popular choice identified.

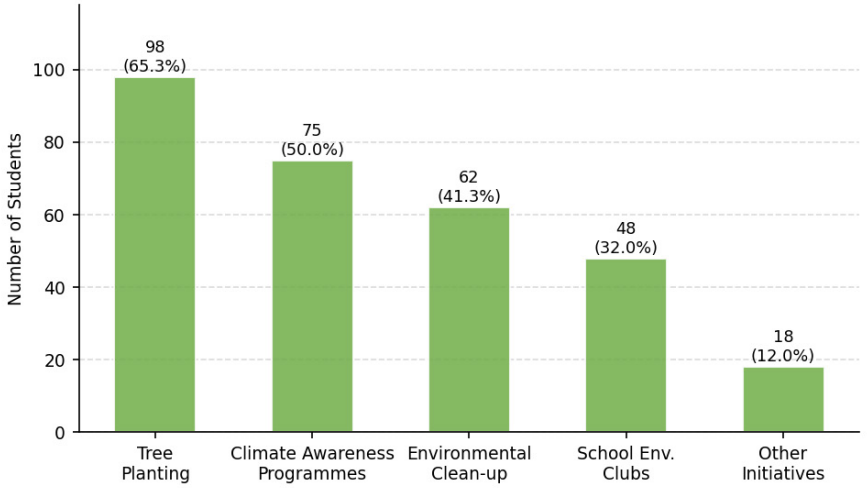


Figure 6. Environmental activities that learners are willing to participate in (n=150, multiple responses allowed).

DISCUSSION

Geography education as a reported climate knowledge pathway

Secondary-school Geography is the major source of climate knowledge in Tubah Subdivision, identified by 78.7% of learners. This is consistent with Leal Filho et al. (2026), who contend that schools constitute a principal formal channel for climate literacy where specialist climate communication services are limited. However, in reality, climate change knowledge takes places in many different contexts, and receiving information about climate change does not mean that this knowledge is understood or linked to real-world experiences or *vice versa*. For example, while 92% of learners reported observing climate changes (Table 6), only 20.5% of Upper Sixth and 12.9% of Lower Sixth learners viewed themselves as highly aware of climate change. The contrast suggests that recognition of climate change is more widespread than deeper, analytically grounded awareness. This implies that exposure to climate-related information through Geography does not necessarily translate into a high level of climate awareness, particularly where learning may focus more on recognising climate change than on understanding its causes, spatial patterns, consequences, and implications for human–environment relationships.

In addition, the moderate or low confidence that teachers have regarding their professional practice (19.1%) is likely to constrain the quality and depth of climate change instruction. Newly appointed teachers, who predominate in this sample, may be more likely to rely on a lecture-based approach rather than field activities or community-

based learning that require greater pedagogical confidence. This interpretation is supported by the qualitative finding that teachers with limited experience expressed greater uncertainty about making climate content locally relevance (Table 2). In Tubah Subdivision, a substantial proportion of climate education is being delivered by teachers with relatively limited experience (77.9% of sampled teachers having two years or less of teaching experience) and, in some cases, lower self-reported confidence. Leal Filho et al. (2026) identified lack of training as the most frequently reported barrier to climate education in African institutions. This highlights the relevance of strengthening pre-service and in-service teacher training, particularly in experiential and field-based approaches that can support teachers in translating climate concepts into locally relevant Geography education.

Role of the school learning environment

The higher proportion of climate-aware learners at CCAST Bambili (26.5%), relative to GHS Kedjom Kekuh (14.3%) and GTHS Ntigi (10%) (Figure 5) is consistent with, but does not fully explain, the role of institutional factors (resource availability, teacher experience profiles, and pedagogical quality) in shaping the climate literacy contribution of Geography education. Larger schools may have more resources (a positive) but also larger classes (a negative) that may affect learners' experiences with Geography education. In addition, the age and infrastructure of the school, organisational structure, leadership, teaching support available, extracurricular activities (such as environmental volunteering) and degree of school community engagement may also influence learners' experience and understanding of climate change. Thus, smaller, less-resourced schools such as GTHS Ntigi, CHS Bambui and GHS Mambu may benefit from targeted support for materials, teacher training, and field-learning opportunities, consistent with Chikowore et al.'s (2026) finding that climate vulnerability in Baham Subdivision, Cameroon, is aggravated by disparities in access across socioeconomic groups.

The observed gap in climate awareness between Lower Sixth (12.9% highly aware) and Upper Sixth learners (20.5% highly aware, Figure 4) is qualitatively consistent with the proposition that sustained curricular exposure deepens climate knowledge over time. This is compatible with Anderson's (2012) view that climate education should be continuous and developmental rather than delivered as a single stand-alone unit.

The adaptation knowledge gap: Bridging classroom and community

Learners' lower endorsement of technical adaptation strategies such as crop diversification and water conservation relative to that of teachers (Table 6) may indicate a gap between classroom exposure and practical adaptation knowledge. This pattern could partly reflect the predominance of lecture-based teaching. Learners' willingness to participate in environmental activities (96%), particularly tree planting (65.3%), indicates considerable readiness for adaptation-oriented engagement. This suggests a potential strategy for engaging learners in practical actions related to climate change and to connect classroom

concepts with the environmental and livelihood realities of their communities through experiential, field-based, and community-centred approaches. This interpretation is consistent with Oino and Musau's (2024) findings in Kenya that locally contextualised and demonstrated climate information can strengthen community engagement with adaptation.

CONCLUSIONS

This study provides a multi-school empirical assessment of Geography education and climate change awareness among secondary-school teachers and learners in Tubah Subdivision, Cameroon. The main conclusions are that (1) school education, particularly Geography, represents an important pathway through which learners obtain climate-related knowledge. However, this did not correspond uniformly to high levels of climate awareness. This suggests that access to climate-related content alone may not be sufficient to develop deeper climate literacy. (2) Differences in climate awareness amongst learners were observed between the level of schooling and between different schools. Upper Sixth learners were more climate-aware than Lower Sixth learners. (3) Learners showed high willingness to participate in environmental activities, suggesting an opportunity to strengthen the connection between classroom climate knowledge and locally relevant environmental engagement. However, teaching experience was significantly associated with self-reported levels of teaching confidence. This points to challenges in delivering experiential and practically-oriented climate education if teachers are inexperienced.

Recommendations from this study are that (1) the Ministry of Secondary Education and other relevant policymakers in Cameroon should strengthen climate-related teaching and learning resources in schools and support practical lessons related to climate and environmental change. Greater logistical support for field work would enable teachers to complement classroom instruction with direct observation of local environmental conditions. (2) Curriculum developers should strengthen the integration of locally relevant climate content into A-Level Geography. Greater emphasis should be placed on experiential learning methods. (3) Schools should strengthen professional development and mentoring for Geography teachers, particularly those with limited teaching experience. Training should emphasise climate change content, practical and participatory teaching methods, field-based learning, and local environmental information. Teachers should be encouraged to connect classroom climate knowledge with adaptation practices and environmental activities.

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