Climate change education and learner competency: Evaluating pedagogical approaches in Kenyan schools

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ABSTRACT

This article evaluates pedagogical approaches for climate change education (CCE) and learner competency in Kenyan schools. It combines narrative synthesis and a purposively delimited corpus of contemporary scholarly literature on the topic of climate pedagogy, learner competency, and African or Global South education contexts. The study was anchored in Epstein's Overlapping Spheres of Influence Theory. A systematic source-identification process screened 72 records and retained six article documents for analysis. Article documents were included when they were peer-reviewed journal articles, accessible in full text, published within the defined search period, and directly focused on family-school-community partnerships, parental engagement, learner retention, academic resources, truancy, community participation, or education for sustainable development in basic education. The synthesis demonstrates the enhancement of learner competency with CCE extending beyond awareness and factual recall to offer a path to climate literacy, inquiry, transdisciplinary problem solving, local-community relevance, climate justice reasoning, action projects, and performing assessment. The evidence from meta-analysis and systematic review suggests climate education interventions have the potential to impact knowledge, attitudes, and behaviour, yet outcomes rely on age-appropriate pedagogy, context, resources, and the design of assessment. African scholarship also stresses local learning, community-based learning, and drawing a connection between ideas and the reality of climate change experiences of learners. The article calls for Kenyan schools to assess CCE through competencies that can be observed in action, like systems thinking, interpreting evidence, adapting plans, collaboration, communicating risk, and taking responsible action. It calls for teacher training, the inclusion of climate projects in schools, partnerships with the community, and competency-based assessment rubrics linked to real learner outcomes.

Keywords: Basic Education; Climate Change Education; Kenya; Learner Competency; Pedagogy; Sustainability

I. INTRODUCTION

Education about climate change is a major issue for school systems since students are raised in communities that suffer from droughts, flooding, heat stress, food insecurity, water scarcity, and environmental degradation. Aeschbach et al. (2025) show that climate education can influence learners' knowledge, attitudes, and behaviour when it is intentionally designed. Both Manteaw et al. (2025) and Tshabalala et al. (2025) emphasise how climate education should be context-specific to African learners and to prepare African youth. Climate-related risks are a reality of life in Kenya, from household livelihoods to school attendance, from crop production to disease trends, from water availability to settlement safety. This transforms CCE into an actionable education mandate, and the instruction question becomes one of how to teach climate issues to enable students to learn useful skills.

The first key variable in this article is climate change education. CCE includes teaching and learning related to climate science, climate variability, causes and impacts of climate change, adaptation and mitigation, climate justice, and responsible action. However, Nepras et al. (2022) report that the level of CCE across the school varies with age group, design, and learning activity, and Obi and Ojo (2026) point out the need for curriculum mainstreaming through the proper pedagogy and policy attention. Aeschbach et al (2025) show that education for climate change can have an impact on knowledge, attitudes, and practices, so in principle, crucial conditions for effective climate education can be fulfilled – allowing the learner to deepen their understanding of the mechanisms and processes involved in climate change and to put their knowledge into practice on concrete issues. A lesson that only identifies greenhouse gases can make a learner aware, but not help them to understand rainfall data, make comparisons between adaptation measures, or describe climate risks to peers in their household or school.

The second key variable is the competency of the learners. Competence is thought to be an observable manifestation of the use of knowledge, skills, values, and attitudes in context. Kubisch et al. (2022) relate climate learning to transdisciplinary engagement; Manteaw et al. (2025) correlate climate learning to local community practice, while Nepras et al. (2022) indicate that the effect of school climate education is dependent on its design. A competent

learner should be able to describe the climatic process accurately, understand simple evidence, distinguish between reliable and misleading claims, link climatic risk with livelihoods and health, collaborate with others, and suggest practicable adaptive and/or mitigation measures with respect to climate change. Competency thus involves the ability to bridge the gap between climate knowledge and inquiry, ethical reasoning, cooperation and collaboration, and real-world problem solving.

The third key variable is pedagogical approach. Climate learning can either be a collection of facts or a route to achieving practical competence, and it depends on pedagogy. Kubisch et al. (2022) endorse transdisciplinary work across disciplines relating to climate action learning. Climate-enhanced approaches by Manteaw et al. (2025) leverage the role of community-based methodologies where learning is personally relevant, and Obi and Ojo (2026) argue for the need to integrate the learning process and outcomes of climate change in the curriculum and pedagogy of the Global South. These threads explain the use of inquiry-based teaching and learning models, local fieldwork, transdisciplinary projects, community-based learning, and age-appropriate action projects in Kenyan schools.

Research reviews suggest that effective CCE combines sound science with learner-centred and personally meaningful activity. Monroe et al. (2019) identified experiential, relevant, and deliberative approaches as recurring features of effective programmes, while Stevenson et al. (2017) framed CCE as encompassing scientific, social, ethical, and action dimensions. Cantell et al. (2019) similarly presented climate learning as a system in which knowledge, thinking skills, values, identity, motivation, emotions, and action must work together. This literature indicates that learner competency cannot be inferred from content exposure alone.

In Kenya, such pedagogies are necessary as learners face climate issues in varying ways in rural, urban, pastoral, coastal, agricultural, and informal settlement contexts. Manteaw et al. (2025) explain its importance for climate learning in Africa, Obi and Ojo (2026) give the need for a global Southern orbit in curriculum mainstreaming, and Tshabalala et al. (2025) specifically emphasise the need to prepare African youth for climate-related challenges. A learner in a dry land area may link climate stress to pasture, water supply, and a learner in an urban settlement may link it to flood, waste, health risks, and risks relating to heat. Pedagogy should, therefore, leave room for introducing local observations into the classroom space, to compare these with scientific explanations and to experiment with and test out potential responses.

Assessment is equally important. Aeschbach et al. (2025) demonstrate that climate education can have an impact, and Nepras et al. (2022) argue for the prospective effectiveness of designing and setting up a climate education activity within school-based systems. Kubisch et al. (2022) also associate climate action learning with transformative learning and transdisciplinary learning. If learners are only assessed for recall, teachers are likely to cover climate change as content. Assessment through the interpretation of evidence, climate diaries, reports on local inquiry, debates, school environmental audits, adaptation plans, and reflective portfolios enables teachers to assess whether climate knowledge is being translated into competence.

Climate learning also has an affective and participatory dimension. Rousell and Cutter-Mackenzie-Knowles (2020) called for approaches that give children and young people both voice in interpreting climate issues and a practical hand in responding to them, while Trott (2020, 2022) showed that collaborative action can strengthen awareness, agency, and constructive engagement. Ojala (2012) further demonstrated that hope can support environmental engagement when it is grounded in trust and purposeful response rather than denial. Kenyan pedagogy should therefore avoid both alarm without agency and action projects without scientific understanding.

The rationale for this article is that contemporary CCE scholarship offers useful guidance for Kenyan schools, but it needs to be organised around learner competency. Empirical studies suggest that pedagogical design and context are key conditions in determining the impact of climate education on knowledge, attitudes, and behaviours (Aeschbach et al., 2025; Nepras et al., 2022). African scholarship further suggests that climate education must start at the local community level, and youth need to be trained to address current and future challenges (Manteaw et al., 2025; Tshabalala et al., 2025). This article, therefore, attempts to collate contemporary research opinions to assess pedagogical views that could help to improve learner competencies within Kenyan Schools.

Teachers are central to this balance. Drewes et al. (2018) showed that professional development influences how teachers enact climate curricula and what students learn, while Raath and Hay (2016) linked South African teachers' self-efficacy to their willingness to integrate climate resilience into teaching. These findings suggest that curriculum mainstreaming must be accompanied by subject knowledge, pedagogical examples, collaborative planning, and confidence-building. Without this support, cross-curricular CCE may remain dependent on a few motivated teachers.

1.1 Statement of the Problem

While climate change is becoming more apparent in African societies, school climate education can be fragmented, theoretical, and exam-based. The reviews reveal that CCE is not merely about content delivery but also involves inquiry, interdisciplinarity, and action while keeping content related to the local community and assessing the competency of learners (Aeschbach et al., 2025; Nepras et al., 2022; Obi & Ojo, 2026). The question in Kenyan schools

is what pedagogical practices should be chosen and evaluated to enable learners to become capable of taking climate-responsible actions, engaging in collaborations, and planning adaptation, rather than just knowing what it is.

A related evidence issue is the use of general statements of policy, advocacy reports, or general statements about the environment in discussions on climate education. This article addresses that limitation by drawing on a transparent source-identification process and including scholarly literature from today with an educational focus. The outcome is a selective evidence base that is traceable, and specifically addresses the educational emphasis of the article.

1.2 Research Objectives

i. To identify pedagogical approaches that will link climate change education to learner competency in Kenyan schools.
ii. To aggregate current empirical research related to effective ways of teaching and learning about climate change.
iii. To recommend competency indicators and practices for assessing climate change education in schools in Kenya.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 Transformative Learning Theory

The underpinning theory for this article is that of Transformative Learning Theory, which sees meaningful learning as a process in which the learner challenges assumptions and reconstructs experience to enable informed action (Mezirow, 1997). The theory is adequate because climate change education is more than the passing of information; it is designed to present an opportunity to question, understand, reflect, and take action responsibly. In the same vein, Kubisch et al. (2022) stress transdisciplinary education and transformative learning in the context of the learning and action nexus, whilst Manteaw et al. (2025) push the transdisciplinary learning and action nexus into communities in climate-constrained African settings. In the context of CCE, transformative learning is when learners take a step from learning climate facts to identify local risks, think about different perspectives, and articulate possible responses.

The theory is also elucidated in this article about the concept of competency. Aeschbach et al. (2025) and Nepras et al. (2022) demonstrate that the quality and design of learning activities play roles in learning outcomes of climate education. Kubisch et al. (2022) relate transformative climate learning with engagement and transdisciplinary reasoning. The learner is competent when the handling of climate change leads to a change in reasoning, communication, collaboration, and participation. For instance, a learner who compares data on rain, explains the life impact of water shortages, weighs in on adaptation options, and proposes an action plan shows a deeper learning level than a learner who only recaps definitions.

2.2 Empirical Review

2.2.1 Pedagogical Approaches that Connect CCE to Learner Competency

Evidence from empirical and review studies indicates that effective CCE is based on active pedagogies. Aeschbach et al. (2025) show that climate education interventions can influence knowledge, attitudes, and behaviour, indicating that pedagogy affects learner outcomes. Nepras et al. (2022) also demonstrated that climate change education in primary to lower secondary education is a varied landscape in terms of design, context, and effects. The results reflect a need for Kenyan schools to focus more on inquiry, dialogue, project, and iterative local problem analysis, and action than on detached teacher-led lecture.

Transdisciplinary pedagogy is especially relevant in view of the interdisciplinary nature of climate change, spanning as it does across science, geography, agriculture, economics, health, ethics, and civic responsibility. Kubisch et al. (2022) urge a reconsideration of science education for climate action with a transdisciplinary approach. This translates to learning about climate change in Kenyan schools by observing weather data, monitoring stress on crops, keeping school gardens, practising water sustainable practices, working on waste management, proper climate even for communication, and using local interviews. These activities enable learners to translate learning into practice in other learning areas, thus gaining competency.

Systematic and conceptual literature clarifies the instructional mechanisms. Monroe et al. (2019) found that effective strategies commonly make climate change personally meaningful, use active learning, and create space for deliberation, whereas Shepardson et al. (2012) argued that learners require a climate-systems framework to connect atmosphere, water, land, ecosystems, and human activity. Bofferding and Kloser (2015) showed that students may confuse mitigation and adaptation, which means inquiry must include explicit conceptual diagnosis and feedback. Kenyan projects should therefore begin with learners' existing explanations, test them against evidence, and revisit them as investigations progress.

2.2.2 Recent Evidence on Effective CCE Practices and Learner Outcomes

Design quality is highlighted in the recent evidence base. Aeschbach et al. (2025) offer meta-analytic evidence that school-level CE outcomes impact knowledge, attitudes, and behaviour, whereas Nepras et al. (2022) demonstrate that the structuring of learning activities influences School-level CCE outcomes. These approaches warn against taking the equal influence of all climate lessons for granted. Learner outcomes are enhanced by lessons that are age-appropriate, interactive, evidence-based, and are related to contexts that learners are familiar with.

Global South and African scholarship is used to provide context. Obi and Ojo (2026) emphasise the importance of pedagogy, policy, and Global South perspectives in mainstreaming climate change in school curricula. Manteaw et al. (2025) suggest that climate education in Africa must be community-based, and Tshabalala et al. (2025) emphasise the need for building resilience among the African youth for future challenges. These studies collectively demonstrate that a future educational program for climate learning in Kenya should be scientific and community-oriented, also incorporate justice reasoning, and train communities to be practically adaptive.

Evidence on agency and emotion extends the outcome framework. Rousell and Cutter-Mackenzie-Knowles (2020) and Trott (2020) found that participatory and creative approaches can move learners beyond passive awareness, while Ojala (2012) showed that constructive hope is related to engagement. Trott (2022) further argued that affective and attitudinal learning is part of transformation rather than an optional addition. Consequently, effective CCE should examine whether learners feel capable of acting with others, not merely whether they report concern.

School learning can also extend into families and communities. Lawson et al. (2019) demonstrated that children can influence parental climate concern, which supports the use of carefully designed home-community communication tasks. Mochizuki and Bryan (2015) placed CCE within education for sustainable development, emphasising understanding and readiness for action across mitigation and adaptation. Feinstein and Mach (2020) further identified education as relevant to adaptation through learning, capacity, and social transformation. For Kenyan schools, community links should therefore support reciprocal learning and locally feasible adaptation, not treat community members only as sources of anecdotal data.

2.2.3 Competency Indicators and Assessment Practices for CCE

From the literature studied, there are indications that CCE must be assessed in observable indicators. Aeschbach et al. (2025) agree that outcome indicators should be used as climate education can impact knowledge, attitudes, and behaviour. These indicators are relevant because competitiveness should be affected by the level of school and design of the activity (Nepras et al., 2022) and should include the dimensions of systems thinking, engagement, and action of the local communities (Kubisch et al., 2022; Manteaw et al., 2025). These indicators are accurate, climate explanation, misconception correction, evidence and systems interpretation, ethical judgement, collaboration, communication, adaptation planning, and responsible action. For instance, a learner might explain the difference between weather and climate, and could interpret school water use data, interview community members for their drought impact stories, and present an age-appropriate drought adaptation proposal.

Assessment tasks must, therefore, encompass local inquiry reports, group presentations, climate diaries, evidence interpretation assignments, debate, school environmental audit, and project portfolio. Aeschbach et al. (2025) recommend the need to assess the outcomes beyond simply exposure; Manteaw et al. (2025) endorse tasks that link learning to the realities of the community; and Obi and Ojo (2026) support contextually and pedagogically grounded assessment. These tasks involve applying climate knowledge in action, real-world to school connections, and responsible action. They also assist teachers in offering feedback regarding the quality of evidence, reasoning, collaboration, and viability of proposed action.

Assessment should capture conceptual quality as well as action. Bofferding and Kloser (2015) and Shepardson et al. (2012) showed that students may hold fragmented climate-system and response conceptions, so rubrics should assess causal coherence and the distinction between mitigation and adaptation. Cantell et al. (2019) also indicated that motivation, identity, values, and action interact with knowledge and thinking skills. A balanced assessment should therefore include scientific accuracy, systems reasoning, source use, collaboration, emotional reflection, justice reasoning, and feasibility of response.

III. METHODOLOGY

3.1 Research Design

The study used narrative synthesis as its primary analytic method. Narrative synthesis was determined to be appropriate because the articles that remained were heterogeneous, comprising meta-analytic, systematic review, conceptual, and contextual scholarship. This approach helped the article present evidence based on pedagogical patterns and implications for the competence of learners in Kenyan schools.

3.2 Data Sources and Search Procedure

No primary data were collected. The secondary evidence base consisted of a delimited, and therefore first, group of contemporary scholarly literature that was found to be specifically relevant to the topic of CCD, learner competency in this context, pedagogy, and curriculum mainstreaming, as well as African education and education in the Global South, and climate literacy. Only used as a basis for interpretation, not as part of the synthesis data set. Literature was searched through educational research databases, including Scopus, Web of Science, ERIC, Google Scholar, ScienceDirect, SpringerLink, Taylor & Francis Online, Wiley Online Library, and DOAJ. Key words were 'climate change education', 'learner competency', 'pedagogy', 'Kenya', 'Africa', 'primary education', 'secondary education', 'climate literacy', 'transformative learning,', and their Boolean combinations.

Records were excluded when they were duplicates, non-journal publications, policy reports, theses, books, newspapers, inaccessible full texts, outside the defined search period, not peer reviewed, unrelated to basic education, or only marginally connected to partnership practices and learner outcomes.

The retained articles shown in Figure 1 and Appendix A constituted the core narrative-synthesis corpus. A wider group of peer-reviewed studies was used as a comparative literature base to deepen interpretation of the core themes, particularly conceptual change, learner agency, emotions, teacher development, intergenerational learning, and adaptation. These additional studies were not recoded as part of the core source-identification flow.

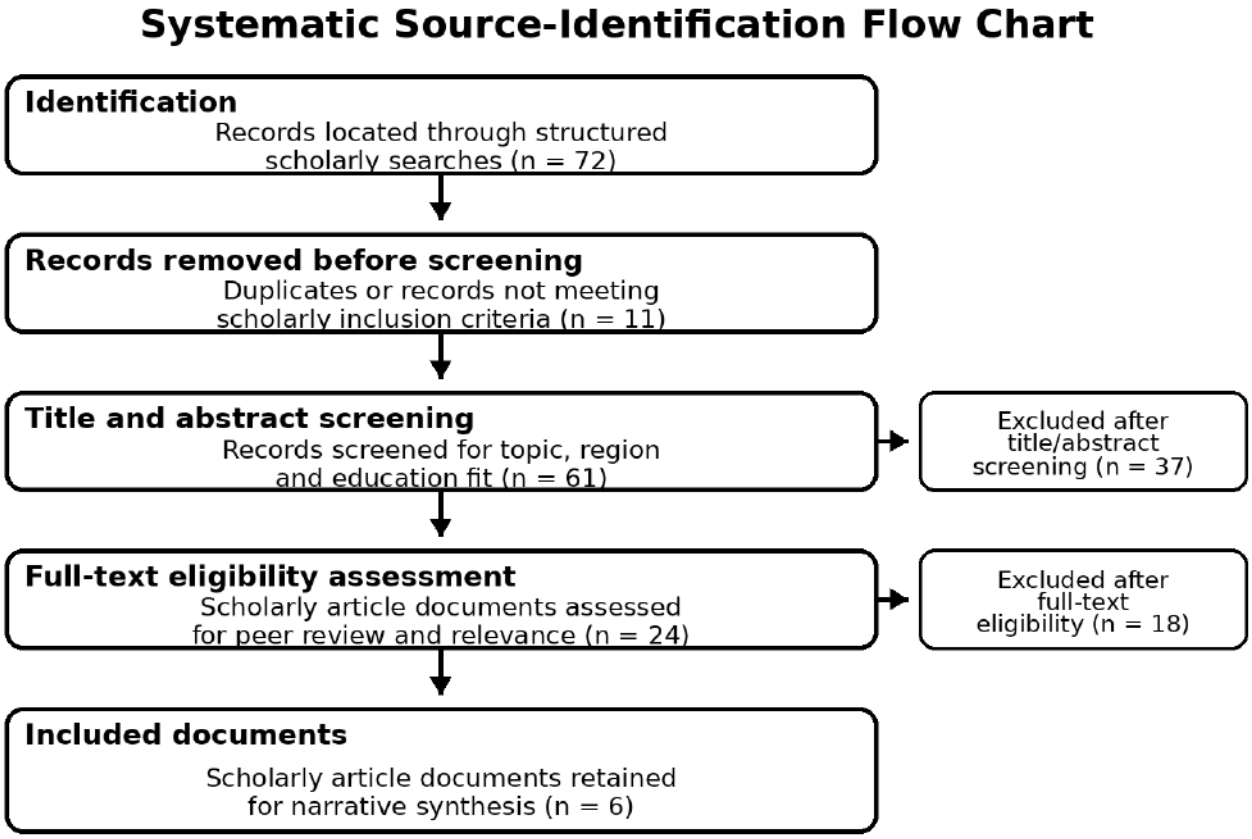

Figure 1
Systematic source identification flow chart.

3.3 Data Collection and Analysis Process

This data collection process included identification of candidate records, deduplication and non-conforming sources, title and abstract screening, detailed eligibility screening, and extraction of pedagogical evidence. The initial search located 72 records. A total of 61 records were screened after removing 11 duplicates or ineligible ones. Twenty-four articles were included after a detailed eligibility assessment following the title and abstract screening. A total of 18 articles were excluded at eligibility, and six peer-reviewed journal articles (PRJA) were retained for narrative synthesis. Because no human participants were recruited, selection referred to article documents rather than individuals, and the final evidence corpus comprised seven eligible journal articles retained after database searching, duplicate removal, title-and-abstract screening, and full-text eligibility assessment. The systematic review process is provided in Figure 1.

Data analysis was divided into four stages. Firstly, each article retained was profiled according to topic, method, education level, and context. Secondly, evidence was drawn on pedagogical approach, on learner outcomes, and implications for schools in Kenya. Third, the recurring patterns identified were organised into story elements of the narrative, that is, climate literacy, transdisciplinary inquiry, local-community relevance, justice and action, and competency-based assessment. Finally, the themes were interpreted in the context of the three goals of the study.

3.4 Ethical Considerations and Conflict of Interest

The research employed secondary literature, which is made public, and no human participants were involved. The author declares no conflict of interest related to this manuscript. All declarations should be changed before submitting if there is any conflict.

IV. FINDINGS & DISCUSSION

4.1 Findings

4.1.1 Pedagogical Approaches that Connect CCE to Learner Competency

The first goal was to develop pedagogical strategies integrating climate change education with learner competency. The synthesis demonstrates that climate literacy is required, but not enough if it is only used as vocabulary. While learners should be provided with an understanding of cause, effect, mitigation, and adaptation, they should also be given a chance to make use of these concepts in familiar instances. This finding is confirmed by Aeschbach et al. (2025) and Nepras et al. (2022), revealing that the design of CE interventions and education contexts influences outcomes in climate education.

Inquiry-based learning plays a crucial role as it involves learners observing, questioning, collecting, comparing, and interpreting information they find. Rainfall narratives, school water-use logs, heat observations, waste audits, soil erosion mapping, community interviews, or school garden records can be created to capture inquiry in Kenyan schools. These activities make climate learning into climate-based reasoning. They also break down the abstraction of climate change by translating the science for a community into something that they see in their surroundings.

Another key competency pathway was transdisciplinary and community-based pedagogies. Kubisch et al. (2022) show that climate action learning requires transdisciplinary engagement, while Manteaw et al. (2025) emphasise community-grounded pedagogy in Africa. This implies that CCE should not be limited to science lessons in Kenyan schools. Learners need to integrate scientific evidence with livelihood knowledge, with ethical judgement, with communicative skills, and with civic responsibility, all to solve climate problems.

The broader literature strengthens this finding by showing that active pedagogy must include conceptual correction, not activity for its own sake. Shepardson et al. (2012) argued for climate-systems reasoning, and Bofferding and Kloser (2015) documented confusion between mitigation and adaptation among secondary learners. Monroe et al. (2019) similarly found that personally meaningful, experiential learning is strongest when it is supported by credible information and deliberation. Kenyan inquiry tasks should therefore require learners to explain causal connections, compare evidence, and revise initial claims before proposing action.

Transdisciplinarity also requires a coherent structure. Cantell et al. (2019) showed that knowledge, thinking skills, identity, values, motivation, emotion, and action operate as connected elements, rather than as separate lesson additions. This supports the synthesis in Kubisch et al. (2022), but it also warns that a school garden or clean-up is not automatically climate education. The activity becomes CCE when learners use climate evidence, connect systems, discuss responsibility, evaluate alternatives, and reflect on outcomes.

4.1.2 Recent Evidence on Effective CCE Practices and Learner Outcomes

The second goal was to compile current research literature on the effectiveness of CCE and the learners' outcomes. A change of knowledge, attitude and behaviour through climate education has been identified as likely in the evidence if the learning experience is not abstract, but context-rich and purposeful (Aeschbach et al., 2025). However, as Nepras et al. (2022) show, not all CCE designs are created equal and successful outcomes cannot be taken for granted simply by being part of the curriculum. Effectiveness is reliant on pedagogy, appropriateness for the age group, assessment design, and relevance for the local context.

African and Global South studies complement this, as they call for a warning on generic climate education. According to Obi and Ojo (2026), the curriculum should be mainstreamed in consideration of pedagogy, policy and realities of the Global South. Additionally, Manteaw et al. (2025) and Tshabalala et al. (2025) indicate that African learners require climate education, which needs to be community-based and equips youth for the future. In the context of Kenyan schools, this means that students should investigate problems they see: water musts and scarcity, seasonal flooding, soil erosion, the heat, stress for crops, disease risks and waste management.

Justice and action are also prominent enduring themes of the evidence. Climate impacts are not distributed evenly – less resourced households may be more vulnerable. Pedagogy should then help learners to speak about responsibility, fairness, adaptation and collective action in an age-appropriate manner. Young and older students can implement water-saving, waste sorting and tree protection measures, as well as compare climate adaptation options and communicate climate messages with peers and family members. This discussion specifically applies to the necessity of making connections to the literature read and to the learning objectives.

The outcome evidence also needs a broader interpretation than knowledge, attitude, and behaviour scores. Rousell and Cutter-Mackenzie-Knowles (2020) and Trott (2020) showed that voice, agency, creativity, and participation are central to how young people engage with climate change. Ojala (2012) and Trott (2022) further demonstrated that emotion and constructive hope shape whether concern supports engagement or withdrawal. Kenyan evaluations should therefore examine whether learners can act with informed hope, communicate uncertainty, and participate without being overwhelmed.

Teacher and community conditions moderate these outcomes. Drewes et al. (2018) found that professional development shapes classroom enactment, while Raath and Hay (2016) linked teacher self-efficacy to commitment to climate-resilience teaching in South Africa. Lawson et al. (2019) also demonstrated that school learning can influence family concern, suggesting that well-designed communication tasks can extend impact beyond the classroom. These findings support community-linked CCE, but only where teachers have time, resources, and safeguards for accurate communication.

4.1.3 Competency Indicators and Assessment Practices for Evaluating CCE

The third aim was to recommend competency indicators and assessment practices in the evaluation of CCE in Kenyan schools. Performance-based assessment model is in place and supported by synthesis. The assessment of climate literacy should be done through the accurate explanation of the causal relation, impacts, mitigation and adaptation. Secondly, inquiry skills should be evaluated in terms of observations, interpretation of data, evaluation of sources and conclusions based on the evidence. Third, assessment of ethical reasoning needs to be conducted by discussing the concepts of vulnerability, responsibility, justice and fairness. Fourth, there is a need for feasible school or community adaptation and mitigation proposals for assessment of the action competence.

Rubrics are a prerequisite for such evaluation. A rubric may provide a description of the levels of performance for each of the following areas: Evidence Use, Systems Thinking, Collaboration, Communication, Feasibility, and Responsible Action. If no such descriptors exist, project work can become “ornamental” or symbolic. Clear descriptors will enable teachers to judge competence in learners and facilitate feedback to enhance learners' reasoning and participation.

The proposed indicators can be achieved gradually. Lower Primary students may be guided/focused on observation, taking care of the school environment, simple explanations and responsibility. At the upper primary and secondary levels, students can read and compare sources, understand simple data and discuss vulnerabilities, debate on options, and propose adaptation proposals. Progress is essential, as it is important that competence in climate topics be developed over time and not just through one lesson.

The proposed rubric should therefore separate several forms of competence that can develop at different rates. Climate-system understanding and misconception correction can be assessed through explanations and evidence tasks (Bofferding & Kloser, 2015; Shepardson et al., 2012), while agency and constructive participation can be assessed through project decisions, reflection, and collective action (Rousell & Cutter-Mackenzie-Knowles, 2020; Trott, 2020). Justice reasoning can be assessed by examining whose risks, responsibilities, knowledge, and options are represented, consistent with the review by Trott et al. (2023). This multidimensional structure reduces the risk of awarding high competence for enthusiastic action that is scientifically weak, or for accurate recall that produces no considered response.

Adaptation competence also deserves explicit evidence. Mochizuki and Bryan (2015) connected CCE with readiness for mitigation and adaptation, while Feinstein and Mach (2020) described education as contributing to adaptation through individual learning, collective capacity, and social change. Learners can therefore be assessed on whether they identify a local hazard, distinguish vulnerability from exposure, compare options, justify a feasible response, and explain limits or trade-offs. Cordero et al. (2020) further show why sustained, high-quality climate education should be evaluated for long-term behavioural relevance rather than a one-off project display.

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

Assessment of education on climate change in Kenyan schools should focus on the capacities they build, rather than the coverage of climate. The reviewed scholarship demonstrates that effective CCE is local, transdisciplinary, inquiry-based, justice-aware, and action-oriented. Interpretation of evidence, systems thinking, ethical reasoning,

collaboration and feasible action are an integral part of climate literacy, but are not sufficient to achieve climate literacy on their own. Consequently, it is concluded that CCE should be adopted as a pathway to competencies with an emphasis on various interrelated competencies pivotal in science, social learning, and community action in Kenya.

5.2 Recommendations

Teacher preparation should be enhanced to improve teachers' abilities to facilitate climate inquiry, draw on local data, prompt discussion of justice and responsibility, and employ clear rubrics to assess learner competency. Schools should develop sustainable climate initiatives like conserving water, reducing waste, a school garden, caring for trees, local risk mapping, and climate communication activities, thus also make sure each project is connected to explaining, evidencing, reflecting and assessing. Classroom learning should be tied to local experience by using community partnerships to facilitate interviews, observations of adaptation, or problem-solving on adaptations. Climate change education should also be addressed in an interdisciplinary way in the fields of science, social studies, languages, agriculture, creative learning, and values education to give learners a holistic perception of climate change instead of just discrete facts. Comparing the impact on climate literacy, climate change adaptation reasoning, and adaptation action of inquiry, climate clubs, school-garden projects, debate, field observation, and digital climate resources could be suitable for future empirical studies in Kenya.

Declaration of Interest

The authors declare that they do not have any known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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