

A Comparative Analysis of Climate Change Education between Developed and Developing Countries: A Comparative Document Analysis

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ABSTRACT: Climate change education (CCE) is widely recognised as central to sustainability, yet its implementation across national school systems remains deeply uneven. This study uses comparative qualitative document analysis to examine how CCE is positioned, integrated and resourced across six countries, Finland, England and Australia as high-income systems, and Pakistan, Bangladesh and Kenya as climate-vulnerable lower-income systems using a most different-systems design. National policies, curriculum frameworks, and peer-reviewed reports from 2010 to 2025 were analysed through directed thematic analysis across six dimensions: policy commitment, curriculum integration, teacher capacity, pedagogy and assessment, resources, and local contextualisation. Findings are summarised through the Climate Education Readiness Index (CERI), a criterion-referenced rubric with reported reliability and robustness checks. The findings contradict a simple dichotomy between developed and developing countries. High-income systems show gaps from exam-driven curricula, uneven teacher confidence, and thin explicit climate content; lower-income systems show capacity gaps, limited assessment alignment, and outright policy reversal. In all six cases, the coherence of policy, curriculum, teacher development, assessment and local context is more closely related to CCE quality than national income. Drawn from a small purposive sample and with coherence not directly measured, these results are read as hypotheses rather than causal claims. CCE is thus not created by copying high-income models but by aligning what policy says, what teachers can do, and what assessment rewards.

KEYWORDS: Climate Change Education, Comparative Education, Document Analysis, Education for Sustainable Development, Teacher Capacity

Introduction

Picture a generation that can explain exactly why the planet is warming but was never taught what to do about it. That is not a hypothetical. It is the reality in most classrooms around the world today. Climate change is no longer just an environmental story: it drives food insecurity, displacement, weaker public health, and widening inequality. Across the scientific, economic and policy communities there is broad consensus that education is one of the most effective tools for responding to it, because people make better decisions as individuals, citizens, and leaders when they understand what is happening and why.

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This is not a new idea. The Paris Agreement 2015 explicitly calls on countries to strengthen climate education, and the UN's Sustainable Development Goals make climate literacy part of the global vision for quality education by 2030 (UNESCO, 2021). In theory, the world has pledged to educate the next generation about the crisis they will face. Paper is one thing; the reality of the classroom is another.

Research consistently shows a stubborn gap between what governments promise in international agreements and what happens when a teacher closes the classroom door (OECD, 2022; UNESCO, 2021). Climate change education is still very unevenly distributed, under-resourced, and inadequate, not only between rich and poor countries, but even within rich and poor countries, often within the same city. That is what this article looks at. How wide is it? What drives it? What would it take to close it?

Background and Rationale

Comparative educational research is an appropriate approach for studying this unevenness, as it highlights how the same global frameworks are interpreted at the national level in terms of policy and practice in the school. It is a well-established assumption that high-income countries are more likely to operationalise sustainability goals comprehensively, whereas lower-income countries grapple with other priorities like foundational literacy, poverty reduction, and infrastructure (OECD, 2022). This study tests that expectation rather than assuming it. By comparing three high-income systems (Finland, England and Australia) with three climate-vulnerable lower-income systems (Pakistan, Bangladesh and Kenya), it asks whether the determinants of CCE quality are in fact a matter of national income, or whether they lie in the coherence with which policy, curriculum, teacher capacity, pedagogy, resourcing and local context are integrated.

Understanding these differences matters for three reasons. First, it clarifies whether and how socioeconomic capacity shapes a system's educational response to climate change. Second, it identifies which features of stronger systems are genuinely transferable and which are not. Third, it evaluates the prevailing assumption that learning flows only from high-income to lower-income systems, given evidence that contextualisation and community-based pedagogy are often strongest in climate-vulnerable settings (Monroe et al., 2019).

Research Objectives and Questions

The primary objective is to compare CCE across the selected developed and developing systems and to explain the patterns observed. Specifically, the study aims to examine how CCE is positioned within national education policies and curricula across the six systems; to identify similarities and differences across six dimensions: policy commitment, curriculum integration, teacher capacity, pedagogy and assessment, resources, and local contextualisation; and to assess the barriers to, and transferable lessons for, strengthening CCE in developing contexts.

These objectives are pursued through three research questions:

1. How is climate change education positioned within the national policies and curricula of the selected systems?
2. What systematic similarities and differences exist across the six dimensions of climate change education?
3. What transferable lessons and context-specific barriers emerge for strengthening climate change education in developing systems?

Scope and Limitations

The study adopts a desktop research design and relies solely on publicly available documents including national education policies, curriculum frameworks, and reports from UNESCO, OECD, UNICEF, and the IPCC as well as peer-reviewed studies. This design enables cross-country comparison without the constraints of fieldwork, but it captures stated and official provision rather than enacted, classroom-level practice. England is examined as one of the four devolved UK education systems, not the UK. The selection of six systems supports analytic depth rather

than statistical generalisation. These boundaries are made explicit so that the findings are interpreted as a structured comparison of policy intent and design, not as a measure of learning outcomes.

Literature Review

Climate change education has become a central element of the global response to the climate crisis, valued both as a means of raising public understanding and as a mechanism for fostering mitigation and adaptation (IPCC, 2023). Over the past decade, international organisations and researchers have converged on the view that CCE must move beyond factual transmission toward competence-based, action-oriented learning that develops systems thinking, civic engagement and adaptive capacity (OECD, 2022; Rousell & Cutter-Mackenzie-Knowles, 2020; UNESCO, 2021). This review synthesises that literature around the six dimensions used in the analysis, drawing its illustrative cases from the six systems the study examines.

Climate Change Education as a Field

CCE is widely understood as part of both environmental education and education for sustainable development (UNESCO, 2021). Systematic and scoping reviews show that the field has grown rapidly since the 2000s, shifting from cognitive, science-based approaches toward participatory, action-oriented learning that gives young people a meaningful role in responding to climate change (Rousell & Cutter-Mackenzie-Knowles, 2021). The Paris Agreement (United Nations, 2015) and SDG 13 embed education within climate-response strategies, while UNESCO's ESD for 2030 roadmap calls for learning systems to promote environmental stewardship, critical thinking, and transformative action.

Policy Commitment and Global Frameworks

International frameworks now firmly position education as a pillar of climate action. UNFCCC Article 6, UNESCO's ESD for 2030 roadmap, and the OECD's work on climate competence all call on national governments to embed CCE within their education systems (OECD, 2022; UNESCO, 2021; UNFCCC, 2021). In practice, however, national translations of these commitments vary widely in specificity and cross-ministerial coordination. Policy commitment has become near universal in name; what differs is whether it carries operational mechanisms capable of reaching the classroom.

Curriculum Integration and Pedagogy

Effective Climate Change Education (CCE) depends on integrating climate topics into the curriculum. Although whole-school and interdisciplinary approaches are encouraged, climate education also needs to be explicitly embedded within the formal curriculum rather than treated only as an extracurricular or school-wide initiative (UNESCO, 2021; OECD, 2022). Cross-country curriculum analyses confirm this pattern: climate change tends to appear scattered across science and geography as a context or example rather than as a coherent, progressively sequenced strand, with causal knowledge dominating over action (OECD, 2022). Content matters, but so does the way it is taught. Inquiry-based and action-oriented learning can help students develop the systems thinking and civic skills needed for climate change education, while content-heavy teaching may be less effective (Rieckmann, 2018). Effective teaching and assessment are needed to turn curriculum plans into classroom practice.

Teacher Professional Development and Capacity

Teachers play a vital role in the success of Climate Change Education (CCE) (OECD, 2022; Rieckmann, 2018). Research shows that well-prepared and confident teachers are more likely to implement CCE effectively in classrooms (Ben Zvi Assaraf et al., 2025). Effective CCE requires teachers to guide inquiry-based and interdisciplinary learning, making both pre-service and in-service training essential. Professional development also improves teachers'

confidence and ability to teach climate change (Li et al., 2021). Without proper training, teachers often rely on traditional teaching methods, limiting the effective implementation of CCE. Therefore, teacher development is the process that either brings about the realisation of curricular ambition or loses it.

Assessment and Learning Outcomes

Assessment plays an important role in climate change education. When sustainability competencies are assessed formatively, inquiry-based teaching is more likely to continue, while high-stakes exams that overlook these competencies can reduce the attention given to climate content (OECD, 2022; Rieckmann, 2018). UNESCO (2024) therefore recommends assessing learning across cognitive, socio-emotional and behavioural outcomes. OECD (2024) also highlights approaches such as case-based tasks, reflective writing, concept maps and performance-based assessment to capture broader sustainability competencies. Assessment is thus not a secondary issue but a policy lever; without assessment reform, there is no curriculum reform.

Resources, Infrastructure and Equity

The quality of Climate Change Education (CCE) also depends on access to resources and infrastructure. In high-income settings, schools generally have more stable funding, better digital access, and a wider range of educational materials, although differences may still exist between regions. In lower-income settings, limited electricity, teaching resources, and school facilities can make climate education more difficult and can deepen existing inequalities, especially for poor, rural, and marginalised learners (Mbah et al., 2022). A systematic review of low- and middle-income countries shows that climate change both disrupts schooling directly, through floods and other extreme events, and indirectly, by deepening poverty and displacement, while also positioning education as a key lever for resilience (Ameer & Ghannam, 2025). The literature distinguishes between donor substitution, where external actors fill state gaps with parallel provision, and donor integration, where support flows through national systems, noting that only the latter builds capacity that outlasts the funding cycle.

Local Context, Cultural Relevance, and Indigenous Knowledge

Effective CCE must be grounded in local realities rather than applied as a globally uniform package (Monroe et al., 2019). Integrating local livelihoods, indigenous knowledge and community experience makes climate learning relevant and actionable for students, particularly in climate-vulnerable settings where the consequences of environmental change are already visible (Mbah et al., 2022; OECD, 2024). This points toward a bidirectional model of policy learning: contextualisation is not a compensatory measure for under-resourced systems but a genuine pedagogical strength that better-resourced systems often lack. High-income systems have as much to learn from contextually grounded practice as developing systems must learn from institutional coherence.

Synthesis and Research Gap

Across the reviewed literature, six dimensions recur as the axes along which CCE systems differ, and they structure the present analysis: (1) policy commitment and coherence; (2) curriculum integration; (3) teacher capacity; (4) pedagogy and assessment; (5) resources and infrastructure; and (6) local contextualisation and equity. The literature establishes these dimensions but tends to treat the developed–developing divide as a difference of degree along a single income axis, and to frame policy learning as one-directional. Three gaps follow. First, the relative weight of income versus institutional coherence in determining CCE quality. Second, reform durability, whether CCE survives political and policy transitions is absent from the comparative literature, despite cases of reversal. Third, research rarely explores two-way learning, where high-income countries can learn from climate-vulnerable countries. This study addresses this gap through a six-dimension comparative document analysis.

Theoretical Framework

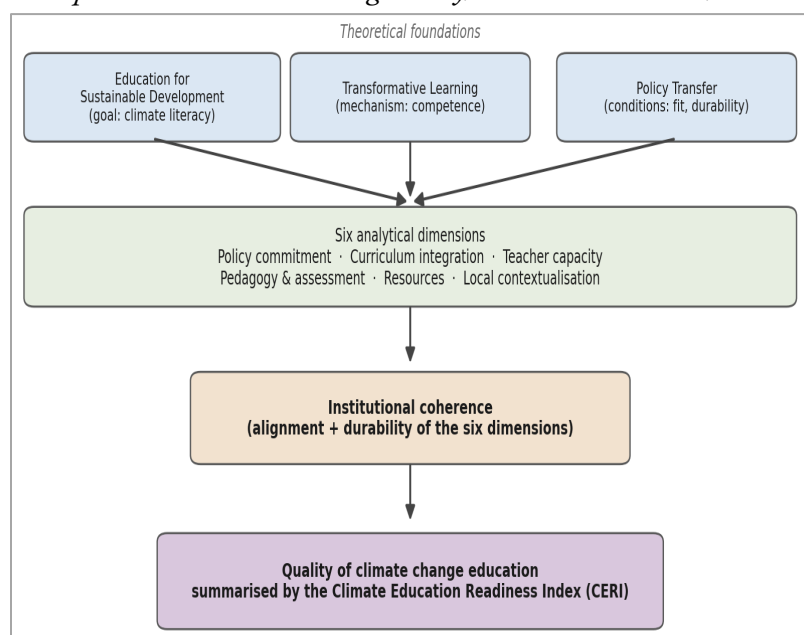
This study is based on three theories that seek to explain the difference between intention and practice and then merges them into one organising lens. Education for sustainable development (ESD) is the starting point. UNESCO's ESD for 2030 roadmap argues that teaching about climate change is not just about introducing another topic into the curriculum. It demands a more fundamental paradigm change in the way that schools view learning. Climate literacy in this context is not a subject of its own, but a cross-cutting orientation that should permeate curriculum, teaching, and school culture. Mezirow (1991) explained that real learning is not about acquiring information; it is about changing one's thinking. When applied to CCE, this translates to effective education developing practical skills such as systems thinking, anticipatory reasoning, collaboration, and the ability to act (Rieckmann, 2018), not just the transfer of facts. This has two direct implications for the study. First, a good curriculum is effective only when teachers can deliver it well. Second, assessment affects classroom learning because the topics that are not assessed and not given importance.

The theory of policy transfer is used to describe how countries take on policies of other countries. Phillips and Ochs (2003) specify four phases to policy transfer: attraction, decision, implementation, and realization. However, many policies are not fully implemented. Steiner-Khamsi (2004) argued that policies are tailored to local settings and therefore are likely to evolve in the transfer process. The frameworks serve to support two key findings of the study: local context is not incidental but central; and policy learning is bidirectional.

The three theories all focus on one organizing concept: institutional coherence: The quality of CCE is not dependent on the country's income, but on how far the curriculum, pedagogy, teacher capacity, assessment, institutional support and local fit are aligned and sustained over time. This transition also leaves room for two questions that the comparative literature has neglected: How lasting is reform, and how can learning take place between countries in both directions?

Figure 1

Conceptual Framework Linking Theory, the Six Dimensions, and the Quality of Climate Change Education



Note: The three theoretical foundations inform the six analytical dimensions, whose alignment and durability constitute institutional coherence, which in turn determines the quality of climate change education as summarised by the Climate Education Readiness Index (CERI).

Methodology

Research Design

This study uses qualitative comparative document analysis (Bowen, 2009) to examine how climate change education (CCE) is positioned, integrated and resourced across six countries. Cases were selected using a most-different-systems logic (Higgins, 2024), maximising variation in economic development so that patterns that appear across substantially different national contexts could be identified.

Case Selection

Six countries were purposively selected: Finland, England and Australia as high-income countries, and Pakistan, Bangladesh, and Kenya as low and middle-income countries. Three criteria were used for selection: maximum variation in development level, availability of policy documents in English, and substantive relevance: the three lower-income cases are among the world's most climate-vulnerable countries. The UK is not studied as a whole, but instead England is studied, because education policy is devolved across the four nations of the UK.

Data Sources

Three types of sources were used. First, primary policy and curriculum documents obtained directly from each country's national education authority, including ACARA (Australia), the UK Department for Education, Finland's National Agency for Education, and the equivalent bodies in Pakistan, Bangladesh, and Kenya. Second, supranational reports from UNESCO, the OECD, UNICEF, and the IPCC. Third, supporting peer-reviewed literature identified through a documented Google Scholar search combining "climate change education" with each country name and the terms curriculum and policy, restricted to 2010–2025.

Only national or supranational documents published within the study period, focused on climate or sustainability education in formal schools, and issued by authoritative sources were included. Each retained source was cross-checked against at least one independent source for triangulation. The final corpus comprises twenty-five documents: five intergovernmental reports, seven national policy and curriculum instruments, and thirteen peer-reviewed studies and official communications (see Appendix A).

Analytical Framework

Documents were coded using directed thematic analysis (Braun & Clarke, 2006) against six a priori dimensions drawn from UNESCO's ESD for 2030 roadmap: (1) policy commitment and coherence; (2) curriculum integration; (3) teacher professional development; (4) pedagogy and assessment; (5) resources and infrastructure; and (6) local contextualisation and equity. Coding was conducted manually using a country-by-dimension matrix, with evidence extracts recorded for each cell (Appendix B).

The Climate Education Readiness Index (CERI)

To summarise qualitative judgements in comparable form, each country was rated on each dimension using a criterion-referenced rubric with four anchored bands (Table 1). The CERI is the unweighted mean of a country's six-dimension scores. Equal weighting was chosen for transparency; robustness checks using three alternative weighting schemes, theory-informed, entropy-based and principal-components produced identical country rankings (Spearman $\rho = 1.00$), with no CERI shifting by more than 0.3 points (Appendix C). Composite sensitivity was assessed through a 20,000-iteration Monte Carlo perturbation analysis; results are reported as robustness bands rather than point estimates.

Two raters scored all thirty-six country-by-dimension cells independently before reconciliation. Inter-rater reliability on these independent ratings was exact agreement 63.9%; within-one-point agreement 86.1%; quadratic-weighted Cohen's $\kappa = 0.88$; and ICC (2,1) = 0.88, indicating excellent agreement. Any differences were checked against the original documents, and scores differing by more than two points were reviewed until agreement was reached.

Table 1

Criterion-referenced Rubric for Scoring each Dimension (0–10)

Dimension	Absent / nominal (0–2)	Emerging (3–5)	Established (6–8)	Mature / systemic (9–10)
Policy commitment & coherence	No national climate or sustainability education policy; the area is absent or purely rhetorical.	Policy acknowledges CCE but lacks operational mechanisms or cross-ministerial coordination.	Dedicated national policy or strategy with delivery mechanisms, though coordination gaps remain.	Coherent, mandated, cross-ministerial policy sustained over time and supported by monitoring.
Curriculum integration	CCE absent from the national curriculum.	Confined to one subject or optional / co-curricular, with no progression.	Present across subjects or cross-curricular, but inconsistently enacted.	Mandatory and cross-curricular, with explicit progression across grades.
Teacher capacity	No CCE in teacher education; provision depends on individual initiative.	Only episodic or donor-led training; low reach; absent from initial teacher education.	pre- and in-service provision but reach or teacher confidence remains uneven.	Embedded in initial teacher education and sustained in-service development with broad reach.
Pedagogy & assessment	Rote transmission: sustainability competencies not assessed.	Exam-driven, with little inquiry and competencies unassessed.	inquiry or competency-based pedagogy, with partial or inconsistent assessment.	Inquiry / competency-based pedagogy with aligned formative assessment of competencies.
Resources & infrastructure	Severe deficits; no dedicated funding, materials, or infrastructure.	Limited, unstable, or donor-dependent resourcing, with material and infrastructure gaps.	Adequate resourcing, with sub-national or sustainability-specific gaps.	Stable and adequate funding, materials, and infrastructure for CCE.
Local contextualisation & equity	No attention to local context, indigenous knowledge, or equity.	Limited or tokenistic contextualisation; equity gaps unaddressed.	Meaningful local or indigenous content and equity provision, but not systematic.	Systematic integration of local and indigenous knowledge with explicit equity provision.

Note: Each dimension is scored as an integer on a 0–10 scale against the band descriptor that best fits the documentary evidence.

Trustworthiness and Limitations

Triangulating policy documents, curriculum frameworks and independent studies reinforced credibility; the search protocol appears in Appendix A, dual-rater scoring improved reliability, and supporting evidence for confirmability is in Appendix B.

This study has three limitations. First, as a document analysis, it examines policy intentions rather than actual classroom practice, and the CERI is an evidence-based framework rather than a validated measurement tool. Second, the analysis was based on documents from one database, so it may not include all relevant sources. Third, both raters were members of the research team, which may introduce confirmation bias. To improve transparency, the scoring rubric and evidence extracts are provided in Appendix B for future replication.

Findings

Overview: Complicating the Developed–Developing Binary

Across all six cases, the quality of CCE appears to depend more on institutional coherence than on national wealth. Stronger systems are those where policy goals are supported by clear curriculum guidance, teacher capacity, aligned assessment, and stable resources. This is consistent with evidence that effective sustainability education depends on a coordinated whole-institution approach, not on resources alone (Holst, 2023). Every developed system has strengths as well as distinct implementation gaps, and every developing system has real momentum in its policies, but also real constraints. The most analytically interesting difference is among the developing countries: Kenya's reform was consolidating while Bangladesh's was reversed, indicating that political continuity, rather than income, is the restraining force on CCE in the developing world. These patterns are offered as interpretive hypotheses the cases illustrate, not causal claims the design can establish.

The CERI shows a three-tier structure that does not correlate with income levels: Finland (8.0) near the mature band, England (6.5) and Australia (6.7) in the established band, Kenya (5.5) in a distinct middle band above its lower-income peers, and Bangladesh (3.7) and Pakistan (3.5) in the emerging band. This structure is also found to be robust across 20,000 Monte Carlo runs, with 99.9% of runs showing Finland at the top and Pakistan and Bangladesh at the bottom, while England and Australia are not distinguishable statistically. That England is at the bottom of the established band is due to exam culture and curriculum barriers, which highlights the point: the index is a measure of coherence, not income.

Climate Education in Developed Countries

Finland: The strength of Finland is in the real system alignment. The National Core Curriculum (Finnish National Agency for Education, 2016) has sustainability as one of seven transversal competences, which is complemented by pre-service teacher preparation, national ESD networks and formative, inquiry-oriented assessment working in the same direction. However, this coherence does not guarantee climate-specific depth. Analyses consistently find explicit climate content sparse within the cross-curricular model (Cantell et al., 2019), and Finnish student-teachers themselves have called for stronger, mandatory CCE in initial teacher education where pre-service teachers' climate knowledge is often low (Mykrä, 2023). Finland is systemically mature but thematically under-specified on climate.

England: England's central tension is between strategic ambition and structural reality. The 2022 Sustainability and Climate Change Strategy set a credible reform agenda (school sustainability leads, climate action plans, a Climate Ambassadors scheme), and the 2025 Curriculum Review recognised CCE as a priority, yet teachers experience the statutory curriculum itself as a barrier to delivering it (Greer et al., 2023). High-stakes examinations provide no signal that climate competencies matter, so they rarely get taught in depth. A two-year study of four English secondary schools similarly found progress on climate and sustainability education to be uneven and heavily dependent on committed individuals rather than systemic provision (Howard-Jones & Hennessy, 2025). England's CCE is strategically rich but structurally constrained and, in practice, voluntary.

Australia: Australia's limitation is structural rather than motivational. Embedding sustainability as a cross-curriculum priority means it has no curricular home of its own and is realised only when individual learning areas choose to incorporate it, a design that produces inconsistent enactment (ACARA, 2022; Dymment et al., 2015). Teacher confidence compounds the problem: only a minority of surveyed teachers feel equipped to teach the cognitive dimensions of climate change, and fewer still feel confident teaching how to act on it (Albion et al., 2025). Australia has a strong, equity-aware framework whose impact is throttled at the point of delivery.

Climate Education in Developing Countries

Pakistan: The most prominent feature of Pakistan is the disconnect between the intent and capacity to deliver. Although the National Climate Change Policy (Government of Pakistan, 2021) formally acknowledges CCE, there is a lack of operational mechanisms and environmental content in the Single National Curriculum. Most significantly, the first dedicated school climate curriculum for grades 1–10 was implemented not by the state but by a donor-funded initiative, supported by the U.S. Embassy Islamabad, in 2024 (U.S. Embassy Islamabad, 2024). Teacher preparation is still limited and is still dependent on NGOs; pedagogy is still largely rote and exam-based, and textbook analysis of Sindh's primary social-studies curriculum finds climate content dominated by factual knowledge, with limited attention to action competence or local contextualisation (Shaikh & Saya, 2026). Pakistan has the political will but lacks the institutional framework.

Bangladesh: The study's most instructive case is Bangladesh, where it has been shown that the quality of the reform is not sufficient; the continuity is equally important. The 2021 National Curriculum was a real improvement and made climate and environment a key learning area, leading to the training of 300,000 to 420,000 teachers in primary and secondary schools. However, the interim government, after the 2024 political change, reverted to the 2012 curriculum for Classes 6–12, meaning that this investment was lost (United Nations Population Fund, 2025). Bangladesh demonstrates that policy instability can be an obstacle to CCE, regardless of the quality of any specific curriculum. Underlying this volatility is a workforce whose readiness varies sharply: comparative survey evidence shows that Bangladeshi teachers' climate change perceptions differ by disciplinary background, prior training, and direct experience of extreme weather, underscoring how dependent durable reform is on sustained teacher development (Ahmed et al., 2022). Its most valuable legacy is the contextualisation of flood-adaptation and mangrove-conservation material tied to students' lived climate experience.

Kenya: The relevance of Kenya to this comparison is that it shows that much of the gap between high- and low-income systems is achievable through ongoing, coherent reform. The Competency Based Curriculum (KICD, 2017) incorporates sustainability through inquiry-based experiential learning linked to ESD and SDG 13, with significant state investment in teacher deployment: 229,000 teachers retooled and 76,000 recruited since 2022. Donor partnerships are now more interwoven and not working in parallel, e.g. the 2023 KICD–UNICEF digital climate course on the Kenya Education Cloud (United Nations Children's Fund [UNICEF], 2024). Climate education is often co-curricular rather than subject-integrated, and teacher shortages in remote areas make access to the curriculum elusive, but these are addressable challenges. Empirical work on Kenya's competency-based system confirms both the promise and the constraint: teachers' perceptions and school-level socioeconomic factors, together with uneven training and digital infrastructure, shape how far climate-responsive activities are implemented (Ndambuki et al., 2026).

Comparative Summary

Table 2

Comparative Summary of CCE Across Six Countries and Six Dimensions

Dimension	Finland	England	Australia	Pakistan	Bangladesh	Kenya
Policy commitment	Strong, ESD-integrated	Strong national strategy (2022) + 2025 review	Sustainability a cross-curriculum priority, SDG-linked	Recognised; weak operational mechanisms	Recognised but volatile (2021→2012 reversal)	Action plan + CBC/CBE; PWPER reforms
Curriculum integration	Cross-curricular but climate thinly specified	Cross-curricular, yet curriculum seen as a barrier	Priority 'not curriculum on its own'; uneven	Thin; 2024 grades 1–10 curriculum emerging	'Climate & Environment' core area then withdrawn for 6–12	Embedded, experiential; co-curricular in practice
Teacher capacity	Pre-service ESD; networks; gaps	Climate Ambassadors (voluntary, uneven)	Low confidence reported	Minimal; NGO-reliant	~300k trained then disrupted by reversal	~76k deployed; remote shortages
Pedagogy & assessment	Formative, inquiry-based	High-stakes exams limit CCE	State variation; inquiry	Rote, exam-driven	Formative (2021) reverted to exams (2025)	Competency/formativ e shift
Resources & infrastructure	Strong; EU-funded	Strong; green-skills investment	Strong but state-variable	Donor/NGO -dependent; deficits	Limited; donor-supported	Limited domestic; donor partnerships
Local contextualisation & equity	Eco-social; limited indigenous emphasis	Moderate	Aboriginal & Torres Strait Islander perspectives	Flood/glacier relevance; gender gaps	Flood adaptation; mangrove conservation	Community service learning; tree planting

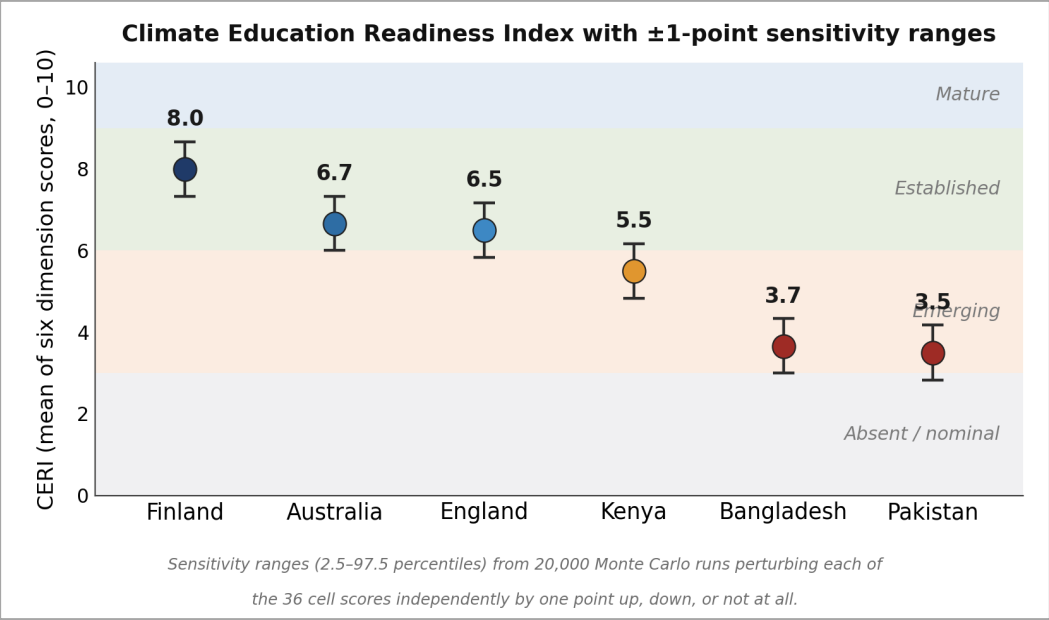
Table 3

Climate Education Readiness Index (rubric-based ratings, 0–10)

Country	Policy	Curric.	Teacher	Pedagogy/Assess.	Resources	Context	CERI
Finland	9	7	8	9	9	6	8.0
Australia	8	6	5	6	8	7	6.7
England	8	6	6	5	8	6	6.5
Kenya	6	6	5	6	4	6	5.5
Bangladesh	4	4	3	3	3	5	3.7
Pakistan	4	4	3	3	3	4	3.5

Note: CERI is the unweighted mean of the six-dimension scores and is interpreted by band: Finland approaches the mature band; Australia, England and Kenya fall in or near the established band; and Bangladesh and Pakistan fall in the emerging band. Differences smaller than about one point (for example, England versus Australia) are not interpreted as meaningful. The ranking is invariant to theory-informed, entropy and principal-components weightings (Appendix C, Table C1). Scores were assigned by two independent raters and reconciled against the source documents.

Figure 2
Climate Education Readiness Index by Country, with 95% Robustness Intervals



Note: Points are reconciled CER scores (Table 3); whiskers are the 2.5–97.5 percentiles from 20,000 Monte Carlo runs that perturb each of the thirty-six cell scores independently by one point up, down, or not at all. Band shading follows the rubric (Table 1). The whiskers are sensitivity ranges expressing the composite's response to one-point rating error rather than inferential confidence intervals and show that the three-tier structure, not any adjacent pair, carries the interpretation.

Cross-Cutting Observations

Six observations cut across the cases. First, the policy–practice gap is universal, not developing-specific: England's curriculum-as-barrier and Australia's official-versus-enacted gap are the high-income analogues of Kenya's co-curricular drift, with the gap's size scaling with resources but its existence not. Second, teacher capacity is the common limiting factor across the income spectrum. Third, assessment alignment predicts depth: systems that assess competencies formatively sustain inquiry-based CCE, while exam-dominated systems compress it. Fourth, stability is a precondition, vividly shown by Bangladesh, where a high-quality curriculum delivered no durable benefit once reversed. Fifth, contextualisation is a developing-country strength rather than a deficit. Sixth, the mode of external involvement matters more than its presence, with Pakistan's substitution model contrasting with Kenya's increasingly state-integrated partnerships.

Discussion
Coherence, Not Income

The comparison runs against the intuitive framing of comparative work: across these cases, the distance between the strongest and weakest systems is not reducible to wealth. Finland's lead reflects not merely resources but the alignment of policy, curriculum, pedagogy, and assessment into a coherent system, while England and Australia, comparably wealthy, sit in the middle band because one part of their systems works against another. The developing cases appear constrained less by the absence of intent than by the absence of the connective tissue, teacher pipelines, aligned assessment, stable governance that converts intent into practice. This supports the idea that CCE quality depends not on inputs alone but on how well a system's parts work together, from cross-ministerial policy down to

whole-school practice that aligns governance, curriculum, and pedagogy (Holst, 2023). UNESCO (2021) makes a similar point, arguing that cross-ministerial coherence is a precondition for any functioning sustainability-learning ecosystem. The implication is that resource transfers, while necessary, may not be enough on their own without that underlying coherence.

Why the Policy–Practice Gap Is Universal

The policy–practice gap is not a developing-country phenomenon, but a common aspect of curriculum reform everywhere, across the income spectrum. The mechanism is what varies. In developed systems, the gap is created by conflicting curricular logics, a sustainability layer that is layered over an assessment and accountability layer; in developing systems, the gap is created by capacity and continuity gaps. These are not the same problem and the solution is different: England requires curricular integration, Pakistan delivery capacity. What they have in common is that policy or curriculum change is not the end goal of reform, but rather a first step.

Teacher Capacity as the Binding Constraint

Teacher preparation is the recurring constraint in all six systems, consistent with the literature which identifies teacher competence as the main factor that contributes to the success of CCE (Ben Zvi Assaraf et al., 2025; Li et al., 2021; OECD, 2022; Rieckmann, 2018). This holds even at the top: Finnish student-teachers call for more CCE, and only a minority of Australian teachers feel confident teaching it. Mezirow's (1991) transformative-learning framework explains why this matters: CCE requires teachers to be facilitators of inquiry, not content providers, which is not something that can be specified in the curriculum text but must be developed over time through ongoing professional learning. When it is not, even transformative aspirations regress to rote coverage. The other dimensions are thus realised through teacher capacity.

Assessment as the Hidden Lever

The impact of assessment design is underestimated and disproportionate in determining whether CCE is deep. Inquiry-based pedagogy is sustained by systems with formative, competency-oriented assessment, and is systematically compressed by high-stakes examination cultures. This is in keeping with the long-standing theory that assessment has "washback" effects on teaching: what is assessed is what is taught (Alderson & Wall, 1993). The implication is that without assessment reform, there is a structural limit to curriculum reform, as the curriculum without climate competencies in terminal exams signals to teachers that climate competencies are not required, regardless of how strongly the curriculum is promoted.

Institutional Stability and the Bangladesh Lesson

Bangladesh is the study's most theoretically valuable case because it isolates a variable usually held constant: reform durability. The 2021 curriculum was a substantial CCE advance, yet its partial reversal to the 2012 curriculum for Classes 6–12 from January 2025 shows that a curriculum's quality is insufficient if its continuity is not secured. This complicates a reform literature that treats adoption as the critical threshold, suggesting a further one: institutionalisation robust enough to survive political transition. The episode also carries an equity cost, since the wasted training and disruption fall hardest on a system with the least slack to absorb them. Comparative CCE research should therefore treat political-economic stability as an explanatory variable.

Rethinking the Direction of Policy Transfer

The conventional framing of comparative CCE, developing systems learning from developed exemplars is only partially supported here and in one respect inverted. On contextualisation and equity, the developing cases are

frequently stronger: Bangladesh ties learning to flood adaptation and mangrove conservation, and Kenya embeds community service learning, both instances of the place-based, action-oriented learning the literature identifies as most effective (Monroe et al., 2019). Drawing on Phillips and Ochs's (2003) and Steiner-Khamisi's (2004) accounts of policy borrowing, this supports bidirectional learning: developing systems adopt the institutional-coherence lessons of high-income systems while the latter adopt the contextualisation of climate-vulnerable ones. It also cautions that coherence is transferable but content is not: the architecture of Finland's system may travel, but its curriculum cannot simply be transplanted.

Donor Dependence versus Donor Integration

External actors shape CCE across all three developing systems, but how they engage matters more than whether they do. Pakistan's substitution model, in which NGOs and donors fill state gaps, has real but peripheral and often short-lived effects. Kenya routes external support through state institutions, building the institutional coherence this study found to be key (UNICEF, 2024).

Implications for Policy and Practice

The implications follow from the explanatory threads above. Reforms should aim to be coherent, not just to be adopted sequencing curriculum, teacher development, and assessment together. Teacher development needs to be seen as a load-bearing investment, not a series of workshops, but as provision integrated into initial teacher training and continued in-service training. Assessment should reward sustainability competencies through formative, project- and portfolio-based methods aligned to curricular intent, with examination signals reinforcing them. Reforms should be shielded from political turbulence through cross-party and inter-ministerial ownership. Contextualisation should be treated as a strength, grounding CCE in local climate realities and indigenous knowledge. And external support should build durable capacity through national systems, designed as two-way exchange rather than transfer.

Conclusion

The purpose of this study was to empirically assess a common assumption in the field: richer countries are better at educating about climate change. The evidence from six national systems says otherwise. Across Finland, England, Australia, Pakistan, Bangladesh and Kenya, institutional coherence, how a country's policies, curriculum, teacher development, assessment, and local context work together, predicts CCE quality better than national income. This is not a causal claim the design can substantiate, but it is the most consistent interpretation the evidence supports, and it frames the problem in a way that is relevant to practice.

The developed–developing divide is a real phenomenon, but a more complicated one than is commonly portrayed in the literature. Finland leads not because it is rich, but because it is going in the same direction. Both England and Australia have a clear agenda but stall at delivery, one because of exam-driven curriculum culture, the other because climate is a priority without a curricular home. Kenya, however, has narrowed the income gap with high-income systems with sustained and coherent reform. The lesson is not that money does not matter. It is that money without alignment changes little.

Three findings stand out. The policy–practice gap is universal; it exists in both Pakistan and England but takes a different form in each and cannot simply be imported. Reform durability is a distinct, underestimated criterion for success: Bangladesh introduced a climate-rich curriculum, then reversed it, wiping out years of progress. And policy

learning should run both ways, since the contextual grounding of the Bangladesh and Kenya cases is a strength high-income systems seldom seek.

Climate change education is not primarily a resource problem. It is a coherence problem. The gap between the strongest and weakest systems is wide but it is not fixed. Wherever policy, teaching, assessment, and local knowledge are brought into genuine alignment and protected over time, that gap narrows. For countries facing the sharpest climate risks, the path forward is less about importing what Finland does and more about building and defending coherence at home. That is a political choice as much as a technical one and it is one that every system in this study, rich or poor, still must make.

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Appendix A

The Analysed Corpus

Table A1

Intergovernmental and Supranational Framework Documents (Applied Across all Six Cases)

Document	Issuing body / type	Year
Education for sustainable development: A roadmap (ESD for 2030)	UNESCO -- normative framework	2021
Are students ready to take on environmental challenges? (PISA)	OECD -- comparative monitoring	2022
Climate change 2023: Synthesis report	IPCC -- scientific assessment	2023
Action for Climate Empowerment	UNFCCC -- policy framework (Art. 6)	2021
Paris Agreement	United Nations -- treaty instrument	2015

Note: These five documents supply the supranational frame and the a priori dimensions; they are common to every case.

Table A2

Primary National Policy and Curriculum Instruments, by Country

Country	Document	Issuing authority	Year	Type
Finland	National Core Curriculum for Basic Education 2014	Finnish National Agency for Education	2016	Curriculum
England	Sustainability and Climate Change Strategy	Department for Education	2022	Strategy
England	Curriculum and Assessment Review: Final Report	Department for Education	2025	Policy review
Australia	Australian Curriculum v9.0: Sustainability priority	ACARA	2022	Curriculum
Pakistan	National Climate Change Policy	Ministry of Climate Change	2021	Policy
Bangladesh	National Curriculum Framework 2021	NCTB	2021	Curriculum
Kenya	Basic Education Curriculum Framework (CBC/CBE)	KICD	2017	Curriculum

Note: Two further instruments referenced in the text, Pakistan's National Education Policy / Single National Curriculum and Bangladesh's 2012 national curriculum, form part of the analysed basis and require formal citation.

Table A3

Supporting Peer-reviewed Studies, Institutional Reports, and Official Communications, by Country

Country	Source	Type	Year
Finland	Mykrä -- sustainability in the Finnish national core curriculum	Peer-reviewed / analysis	2021

Finland	Cantell et al. -- bicycle model on climate change education	Peer-reviewed	2019
England	Greer et al. -- survey of teachers in England (UCL)	Institutional research report	2023
Australia	Albion et al. -- teachers and sustainability education	Peer-reviewed	2025
Australia	Dyment, Hill & Emery -- sustainability cross-curriculum priority (Tasmania)	Peer-reviewed	2015
Pakistan	U.S. Embassy Islamabad -- TRC/US CANDLE climate curriculum launch	Official communication	2024
Pakistan	Shaikh & Saya -- place-based climate resilience in Sindh primary social-studies textbooks	Peer-reviewed	2026
Pakistan / Bangladesh	Mbah et al. -- CCE policies and practices in South Asia	Peer-reviewed	2022
Bangladesh	UNFPA Bangladesh -- review of the national curriculum in secondary education	Intergovernmental review	2025
Bangladesh	National coverage of the 2025 reversion and 2022–23 training figures	Grey / news (hedged)	2024–25
Kenya	UNICEF -- KICD–UNICEF–Alef digital climate partnership	Official communication	2023
Kenya	Teachers Service Commission statements on recruitment/retooling	Official statement (attributed)	2022–25
Cross-case	Monroe et al. -- effective CCE strategies (systematic review)	Peer-reviewed	2019

Note: Grey-literature and official-statement sources carry the contested quantitative claims (Bangladesh and Kenya teacher numbers, the Pakistan curriculum launch) and are hedged accordingly in the text.

Appendix B

Coding Matrix (Country × Dimension) with Evidence and Scores

Each cell reports the assigned 0–10 score (Table 3), the rubric band (Table 1), and the representative evidence on which the two raters agreed. Evidence statements summarise the cited sources; locators are retained in the scoring records.

Table B1

Coding matrix -- Finland (CERI = 8.0)

Dimension	Score	Band	Evidence and source
Policy commitment & coherence	9	Mature	Sustainability is one of seven transversal competences mandated nationally and sustained across curriculum cycles (FNAE, 2016; Mykrä, 2023).
Curriculum integration	7	Established	Cross-curricular phenomenon-based learning, but explicit climate content in the core curriculum is sparse (FNAE, 2016; Mykrä, 2023).
Teacher capacity	8	Established	Pre-service sustainability modules and ESD networks; student-teachers press for mandatory CCE in initial teacher education (Mykrä, 2023); Finnish holistic CCE models inform teacher practice (Cantell et al., 2019).
Pedagogy assessment	& 9	Mature	Formative, inquiry-oriented assessment aligned with phenomenon-based pedagogy (FNAE, 2016).
Resources infrastructure	& 9	Mature	Stable financing, strong digital infrastructure, EU-supported provision (synthesis; OECD, 2022).
Local contextualisation & equity	6	Established	Eco-social orientation; limited explicit indigenous-knowledge emphasis (FNAE, 2016).

Table B2

Coding matrix -- England (CERI = 6.5)

Dimension	Score	Band	Evidence and source
Policy commitment & coherence	8	Established	DfE strategy (2022) with concrete instruments; 2025 review recognises CCE as a priority (DfE, 2022, 2025).
Curriculum integration	6	Established	Cross-cutting, but teachers experience the statutory curriculum as a barrier (Greer et al., 2023).
Teacher capacity	6	Established	Strategy-led, voluntary provision (Climate Ambassadors) with uneven reach (DfE, 2022; Greer et al., 2023).
Pedagogy assessment	& 5	Emerging	High-stakes exam culture offers little incentive to assess climate competencies (Greer et al., 2023; OECD, 2022).
Resources infrastructure	& 8	Established	Strong financing and green-skills investment; sub-national variation (DfE, 2022).
Local contextualisation & equity	6	Established	Moderate contextualisation; no systematic indigenous anchor (DfE, 2022).

Table B3*Coding Matrix -- Australia (CERI = 6.7)*

Dimension	Score	Band	Evidence and source
Policy commitment & coherence	8	Established	Sustainability is a cross-curriculum priority referenced to the SDGs (ACARA, 2022).
Curriculum integration	6	Established	A priority is 'not curriculum on its own'; official-versus-enacted gap, with curriculum leaders reporting limited understanding of the priority (ACARA, 2022; Dymont et al., 2015; Albion et al., 2025).
Teacher capacity	5	Emerging	Only a minority of teachers confident on cognitive dimensions; fewer on action (Albion et al., 2025); ITE students report limited grasp of the priority (Dymont et al., 2015).
Pedagogy assessment	& 6	Established	State-level variation with inquiry-based practice (ACARA, 2022; Albion et al., 2025).
Resources infrastructure	& 8	Established	Strong but state-variable resourcing (ACARA, 2022).
Local contextualisation & equity	7	Established	Aboriginal and Torres Strait Islander perspectives embedded (ACARA, 2022).

Table B4*Coding Matrix -- Kenya (CERI = 5.5)*

Dimension	Score	Band	Evidence and source
Policy commitment & coherence	6	Established	CBC/CBE with action plan and PWPER reforms, aligned with ESD and SDG 13 (KICD, 2017).
Curriculum integration	6	Established	Experiential embedding (community service, tree planting) but often realised as co-curricular (KICD, 2017).
Teacher capacity	5	Emerging	Substantial recruitment/retooling (official statements) but acute remote-region shortages (TSC, attributed).
Pedagogy assessment	& 6	Established	Competency-based, formative shift by design (KICD, 2017).
Resources infrastructure	& 4	Emerging	Limited domestic resourcing offset by integrated donor partnerships (UNICEF, 2024).
Local contextualisation & equity	6	Established	Place-based, action-oriented learning (KICD, 2017; Monroe et al., 2019).

Table B5

Coding Matrix -- Bangladesh (CERI = 3.7)

Dimension	Score	Band	Evidence and source
Policy commitment & coherence	4	Emerging	2021 framework affirmed commitment but Classes 6–12 reverted to 2012 from January 2025 (NCTB, 2021; United Nations Population Fund, 2025).
Curriculum integration	4	Emerging	Climate & Environment a core area in 2021; withdrawn for 6–12 in 2025; 2012 curriculum fragmented (NCTB, 2021; Mbah et al., 2022).
Teacher capacity	3	Emerging	Large-scale 2022–23 training (reported ~300,000–420,000) disrupted by the 2025 reversal (national coverage; hedged).
Pedagogy assessment	& 3	Emerging	Formative model under 2021 reverted to examinations in 2025 (NCTB, 2021; national coverage).
Resources infrastructure	& 3	Emerging	Limited resourcing, donor-supported (Mbah et al., 2022).
Local contextualisation & equity	5	Emerging	Strong contextualisation: flood adaptation and mangrove conservation (Mbah et al., 2022).

Table B6

Coding Matrix -- Pakistan (CERI = 3.5)

Dimension	Score	Band	Evidence and source
Policy commitment & coherence	4	Emerging	Climate/education policies recognise CCE but lack operational mechanisms; thin SNC content (Govt. of Pakistan, 2021; Mbah et al., 2022).
Curriculum integration	4	Emerging	Historically inserted into science/geography without progression; donor-led 2024 grades 1–10 curriculum emerging; primary social-studies textbooks remain knowledge-heavy with weak local contextualisation (U.S. Embassy Islamabad, 2024; Shaikh & Saya, 2026).
Teacher capacity	3	Emerging	Minimal structured preparation; episodic NGO-led workshops (Mbah et al., 2022).
Pedagogy assessment	& 3	Emerging	Rote and exam-driven (Mbah et al., 2022; OECD, 2022).
Resources infrastructure	& 3	Emerging	Donor/NGO-dependent with material and infrastructure deficits (Mbah et al., 2022).
Local contextualisation & equity	4	Emerging	Flood/glacier relevance present but contextualisation limited; gender gaps (Mbah et al., 2022).

Note: Bands follow Table 1 (0–2 absent/nominal; 3–5 emerging; 6–8 established; 9–10 mature). Scores reproduce Table 3 and were assigned by two independent raters and reconciled against the source documents; any discrepancy greater than two points was re-examined.

Appendix C

Weighting Sensitivity and Robustness of the CERI

The CERI is the unweighted mean of the six-dimension scores. To evaluate whether this choice drives the results, the index was recomputed under three alternative weightings (Table C1), and its stability was assessed by perturbing every cell score independently across 20,000 Monte Carlo iterations (Table C2).

Table C1

CERI and Rank Under Alternative Dimension Weightings

Country	Equal	Theory-informed	Entropy	PCA	Rank (all)
Finland	8.00	8.13	8.54	8.04	1
Australia	6.67	6.60	6.79	6.66	2
England	6.50	6.47	6.70	6.52	3
Kenya	5.50	5.53	5.19	5.50	4
Bangladesh	3.67	3.60	3.31	3.64	5
Pakistan	3.50	3.47	3.27	3.50	6

Note: Theory-informed weighting up-weights teacher capacity and pedagogy/assessment; entropy weighting (Shannon) up-weights higher-variation dimensions; PCA weighting uses the first principal component of the standardised matrix (OECD/JRC, 2008). Spearman rank correlation with equal weighting is 1.00 for all three schemes. At $n = 6$ these data-driven weightings are descriptive only: the first principal component explains 87% of the variance with near-uniform loadings, which indicates a single dominant gradient across the cases rather than a validated latent factor, and is consistent with, rather than proof of, the adequacy of equal weighting.

Table C2

Independent-perturbation Robustness of the CERI (20,000 Monte Carlo Runs)

Country / claim	Mean	SD	2.5%	97.5%
Finland	8.00	0.33	7.33	8.67
Australia	6.66	0.33	6.00	7.33
England	6.50	0.33	5.83	7.17
Kenya	5.50	0.33	4.83	6.17
Bangladesh	3.66	0.33	3.00	4.33
Pakistan	3.50	0.33	2.83	4.17
Claim-preservation probability			±1 pt	±2 pt
Finland is the top-ranked system			0.999	0.932
Pakistan and Bangladesh are the two lowest			1.000	0.988
Kenya equals or exceeds a high-income case			0.033	0.188
England exceeds Australia ($\approx 0.5 \Rightarrow$ not separable)			0.301	0.384

Note. Each of the thirty-six cell scores was perturbed independently (one point up, one point down, or unchanged, each with equal probability) and clipped to 0–10; the reported percentiles are sensitivity ranges expressing the composite's response to one-point rating error, not inferential confidence intervals. The three claims the analysis relies on hold at or near certainty; the low probability of Kenya reaching a high-income case is why Kenya is interpreted as a distinct middle tier rather than as overlapping the high-income group.