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Effectiveness of Environmental Education for Sustainability in Basic Schools: A Case of Mbeere North Sub-County, Embu County, Kenya

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Abstract

Environmental Education for Sustainability (EES) is a cornerstone of global efforts to achieve Sustainable Development Goals: 4 on quality education & goal 13 on climate action. However, a persistent gap between awareness and action often limits its effectiveness, particularly in resource-constrained contexts. This study evaluated the effectiveness of EES in rural Kenya, drawing on mixed-methods evidence from Mbeere North Sub-County an arid land. Data from 390 learners' questionnaires, interviews with teachers and administrators, and focus group discussions reveal a significant theory-action gap. While awareness and participation in low-complexity activities (e.g., tree planting, litter collection) were high, engagement in sustained, high-complexity practices (e.g., composting, water harvesting) was limited (<15%). Key barriers identified include exam-driven curricula that erode participation in senior grades, infrastructural deficits (65% of schools lacked water harvesting), and socio-economic status, which explained 63% of the variance in outcomes. Interpreted through an integrated framework of Transformative Learning Theory and Ecological Systems Theory, the findings demonstrate that the limitations of EES are not merely pedagogical but systemic. The study concludes that for EES to be transformative in rural Kenyan contexts, policy reforms must move beyond curriculum inclusion to address foundational issues of infrastructure, teacher's capacity, equitable participation, financial resources and the integration of the surrounding community at all levels.

Keywords: *Environmental Education for Sustainability (EES), Basic education, Kenya, Transformative Learning Theory, Ecological Systems Theory, Awareness -Action Gap, Systemic Barriers, and community Participation.*

I. INTRODUCTION

Environmental Education for Sustainability (EES) has become a central pillar in global strategies for addressing climate change, biodiversity loss, and sustainable development (UNESCO, 2020; United Nations, 2015). Anchored in Sustainable Development Goals 4 & 13, EES seeks not only to transmit ecological knowledge but also to transform behaviors and build practical skills. Its transformative promise lies in bridging the persistent gap between environmental awareness and concrete action (Monroe, Plate, Oxarart, Bowers, & Chaves, 2019).

In sub-Saharan Africa, this challenge is particularly acute. Environmental vulnerabilities, deforestation, erratic rainfall, and soil erosion, intersect with socio-economic constraints, undermining food security and livelihoods (Kanyugi, 2024; Ng'ang'a, Njeru, & Gichuki, 2019). While many governments, including Kenya's, have recognized the urgency of EES, translating policy into practice remains uneven. Kenya's new and in transition Competency-Based Education (CBE) incorporates sustainability themes that aligns with climate action frameworks, yet implementation is frequently marginalized within exam-oriented education systems (Otieno, 2020; Kariuki, 2022). As a result, awareness among learners often fails to translate into sustained, pro-environmental behaviors (Mutisya, 2019).

Mbeere North Sub-County in Embu County illustrates these tensions. As an arid area where over 70% of households rely on subsistence farming, it is highly vulnerable to environmental degradation, recurrent droughts, and declining agricultural productivity (Embu County Government, 2023). Schools in this setting are strategically positioned to shape ecological stewardship and resilience for sustainability. However, resource

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shortages, limited teacher training, and weak localization of curriculum undermine the potential of EES (Wanjala, 2018; Kanyugi, 2024). The result is a persistent gap between the aspirations of policy and the realities of school practice.

Scholarship increasingly emphasizes that the effectiveness of EES must be evaluated not just by curricular inclusion but by its ability to instill knowledge, shape behaviors, and foster skills suited to local ecological contexts (Chawla & Cushing, 2007; López-Santiago & Gómez-Villarino, 2024). This orientation resonates with Transformative Learning Theory (Mezirow, 1991), which highlights critical reflection and experiential engagement as catalysts for behavioral change, and with Ecological Systems Theory (Bronfenbrenner, 1979), which situates learning within nested social, cultural, and institutional environments. Together, these perspectives underscore that EES effectiveness depends on both internal processes of learning and the external conditions that enable or constrain action.

This article therefore examines the effectiveness of Environmental Education for Sustainability in rural Kenyan schools in Mbeere North sub-county, focusing on how environmental knowledge and attitudes among learners translate, or fail to translate, into sustainable practices.

II. THEORETICAL FRAMEWORK

Understanding the effectiveness of Environmental Education for Sustainability (EES) requires a theoretical approach that captures both the internal processes of learning and the external conditions that enable or constrain behavior. This study adopted an integrated framework combining Transformative Learning Theory (TLT) and Ecological Systems Theory (EST). Together, these perspectives explain how learners acquire and reframe ecological worldviews, why transformed perspectives may or may not translate into sustained action, and how systemic conditions in rural Kenyan schools shape the practice of sustainability.

➢ *Transformative Learning Theory (TLT)*

Transformative Learning Theory, propounded by Mezirow (1991, 2000), provides a pedagogical lens for understanding how individuals shift from surface-level awareness of environmental issues to deeper transformations in worldview and identity. Central to Transformative Learning Theory is the role of critical reflection, dialogue, and experiential engagement in fostering perspective transformation (Taylor, 2008; Sterling, 2011). In rural arid parts of Kenya, where environmental degradation is visible through droughts, soil erosion, and deforestation, experiential pedagogies such as tree planting, water harvesting, or waste management connect abstract sustainability concepts with lived realities (Krasny & Roth, 2010; Lange, 2019). By positioning students as active agents rather than passive recipients of knowledge, Transformative Learning Theory highlights how ecological learning can foster long-term commitments to pro-sustainability practices.

➢ *Ecological Systems Theory (EST)*

To move beyond individual-level explanations, the study draws on Ecological Systems Theory (Bronfenbrenner, 1979). Ecological Systems Theory situates environmental learning within nested systems of influence:

- Microsystem: immediate interactions with teachers, peers, and family that shape everyday ecological practices.
- Mesosystem: linkages between schools and communities, which either reinforce or weaken sustainability initiatives.
- Exosystem and Macrosystem: broader structures such as education policies, national climate strategies, cultural norms, and socio-economic inequalities that determine the conditions under which sustainability education unfolds.

Highlighting these nested contexts, Ecological Systems Theory underscores that behavior change is not only cognitive or attitudinal but also embedded in structural and cultural systems. In rural Kenya, this perspective is essential, as exam-driven curricula, infrastructural deficits, and socio-economic disparities often determine whether students can engage in sustainability practices beyond symbolic activities.

➢ *Novel Contribution*

The novelty of this framework lies in its operationalization in a rural African context. Much of the EES literature applies these theories separately, often in resource-rich or urban settings. By integrating Transformative Learning Theory and EST, this study demonstrates how the awareness–action gap in rural Kenya is both behavioral and systemic. It shows that ecological values and intentions are present but often undermined by structural inequities, gendered cultural norms, and exam-oriented education systems.

This integrated lens thus provides analytical rigor for assessing the effectiveness of EES in real-world, resource-constrained environments. It moves beyond evaluating whether learners possess environmental knowledge to examining how they act on it and under what systemic conditions sustainable practices can be nurtured.

III. LITERATURE REVIEW

Environmental Education for Sustainability (EES) has been widely recognized as a pathway for cultivating ecological literacy, values, and behaviors to address challenges such as climate change, biodiversity loss, and unsustainable consumption (UNESCO, 2020; United Nations, 2015). Positioned centrally within SDG, EES aims to ensure that learners acquire the knowledge and skills necessary to advance sustainable development. Yet, while its conceptual promise is well established, the question of effectiveness remains context dependent. This

review situates the study within other scholarly empirical studies in order to anchor the research.

Across different regions, EES has demonstrated positive outcomes where pedagogy transcends rote ecological instruction. In North America, Monroe et al. (2019) show that programs grounded in civic participation and real-world problem-solving foster sustained ecological practices, echoing Transformative Learning Theory's emphasis on experiential learning. In Europe, whole-school approaches such as the Eco-Schools Initiative institutionalize environmental values across pedagogy, infrastructure, and student governance (Rickinson et al., 2019). In Australia, integration of Indigenous ecological knowledge links traditional stewardship practices with contemporary sustainability concerns (Griggs, Wakeling, & Price, 2020).

In Africa, environmental vulnerabilities and systemic resource gaps intersect. South Africa's WESSA Eco-Schools program has achieved measurable gains in recycling, energy use, and student-led initiatives (Grund & Brock, 2020). Uganda's Roots & Shoots Initiative enhanced students' sense of ecological responsibility, though scalability was limited by funding (Kuhar et al., 2010). In West Africa, culturally embedded pedagogies such as storytelling and community participation strengthened conservation values (Claudia, Korhonen, & Nyman, 2014).

Yet, challenges persist. UNESCO (2020) highlights that EES is often treated as peripheral, confined to clubs rather than embedded in examinable curricula. As a result, many learners achieve only basic awareness without opportunities for transformative practice. This mirrors patterns across the region: successful pilots exist, but systemic integration and sustainability remain weak.

Kenya provides a critical case for evaluating EES effectiveness. Policy frameworks, including the Competency-Based Education (CBE), Vision 2030, the Climate Change Act (2016), and many other legislations, provide a wide range to achieve more on matters environment. However, research consistently points to gaps between policy aspirations and classroom realities.

Grassroots initiatives illustrate both promise and limitations. The Lake Victoria Environmental Management Project (LVEMP) improved ecological knowledge but struggled with long-term sustainability due to weak institutional support (Otieno, 2020). The Eco-Schools Kenya program, led by KOEE and NEMA, has promoted waste management and tree planting, but its reach remains limited and donor-dependent (Kariuki, 2022). The Mau Forest Rehabilitation Initiative mobilized schools and communities in tree planting, linking education with national climate goals (Ng'ang'a, Njeru, & Gichuki, 2019). In semi-arid regions such as Embu, Sustainable Land Management (SLM) projects introduced agroforestry and water harvesting, but many initiatives proved short-lived and insufficiently integrated into formal curricula (Wanjala, 2018).

Overall, Kenyan experiences reveal strong policy frameworks but weak systemic support. Exam-oriented education, inadequate teacher training, and infrastructural deficits constrain students' ability to move from awareness to action. This aligns with Gakuo (2016) and Nzengya & Rutere (2021), who document how underfunded environmental clubs foster basic literacy but depend heavily on external actors.

Table 1 Literature Review Matrix with Strength, Weaknesses and Relevance in Kenya

Context	Representative Initiatives	Strengths / Achievements	Weaknesses / Limitations	Key Lessons for Kenya (Mbeere North)
Global (North America, Europe, Australia)	Eco-Schools (UK & EU) Experiential civic programs (USA) • Indigenous knowledge integration (Australia)	• Institutionalized sustainability in pedagogy and school governance (Rickinson et al., 2019). • Strong experiential learning linking classroom to civic engagement (Monroe et al., 2019). Integration of traditional ecological knowledge into curricula (Griggs et al., 2020).	• Contexts often resource-rich, models less easily transferable to resource-scarce settings. • Risk of over-formalization and loss of local adaptability.	Whole-school approaches can institutionalize sustainability. Experiential and culturally relevant learning build deeper ecological literacy.
Africa (South Africa, Uganda, West Africa)	• WESSA Eco-Schools (South Africa) • Roots & Shoots (Uganda) • Community storytelling (West Africa)	• Demonstrated measurable gains in recycling, conservation, and energy use (Grund & Brock, 2020). Strengthened student–community linkages (Kuhar et al., 2010).	Highly dependent on donor or NGO support, weak sustainability after funding ends. • Limited scaling beyond pilot schools.	Community integration sustains student participation. • Culturally grounded methods (e.g., storytelling) enhance relevance.

		Culturally embedded pedagogies enhance learner engagement (Claudia et al., 2014).	• Infrastructural deficits undermine high-complexity practices.	• Sustainability requires systemic, not project-based, support.
Kenya	Eco-Schools Kenya (KOEE/NEMA) • Lake Victoria Environmental Management Project (LVEMP) • Mau Forest Rehabilitation Initiative Sustainable Land Management (SLM) projects in ASALs	• Policy frameworks (CBC, Vision 2030, NCCAP) formally integrate EES. School clubs promote ecological literacy and conservation (Gakuo, 2016; Nzengya & Rutere, 2021). Localized projects (SLM, Mau Forest) link EES to livelihoods.	• Exam-oriented education sidelines sustainability practices. Teacher training and infrastructure deficits persist. Grassroots programs often donor-driven and short-lived.	Strong policies need deeper classroom integration and localization. Linking EES to livelihoods (e.g., agroforestry, water harvesting) sustains engagement. • Addressing inequities (gender, socio-economic) is critical in rural ASALs.

IV. RESEARCH METHODOLOGY

This study employed a convergent mixed-methods design to evaluate the effectiveness of Environmental Education for Sustainability (EES) in Mbeere North Sub-County, Kenya. A mixed-methods approach was selected to allow for a more comprehensive understanding of EES effectiveness by integrating both quantitative and qualitative strands of evidence. Quantitative methods captured measurable outcomes in knowledge, skills, and behaviors, while qualitative methods illuminated the lived experiences of students, teachers, and administrators, as well as the institutional and socio-cultural factors influencing practice. According to Creswell and Plano Clark (2017), the convergence of qualitative and quantitative data enhances validity and provides explanatory depth, a consideration especially important in educational studies situated in resource-constrained and socio-ecologically complex contexts such as rural Kenya.

➢ *Study Site and Population*

Mbeere North Sub-County in Embu County was purposively selected as the study site. The area is climatically arid and experiences prolonged recurrent droughts, deforestation, and high dependence on subsistence agriculture, making it particularly vulnerable to environmental degradation and food insecurity. Schools in this region thus represent critical spaces where sustainability education could foster resilience. Main target were the leaners, teachers, education and environmental leaders in the area who form part of the community.

➢ *Sample and Sampling Procedures*

The study sampled 390 students, a size determined using Yamane's (1967) formula for sample size calculation at a 95% confidence level and a 5% margin of error. Stratified random sampling was employed to ensure balanced representation across gender, age groups, and school levels (junior and senior). This strategy enhanced both reliability and generalizability of the findings. Teachers and administrators were selected purposively, on the basis of their direct involvement in curriculum delivery and management of environmental activities. In addition, education officers were interviewed as expert informants, offering system-level perspectives on policy and institutional support for EES.

➢ *Data Collection Methods*

Three principal tools were employed:

- *Questionnaires:*

Structured questionnaires were administered to students. Items utilized five-point Likert scales measuring the frequency of pro-environmental practices, engagement in conservation activities, and perceptions of enabling or constraining factors. The instrument also captured socio-demographic variables such as age, gender, and household socio-economic status.

- *Semi-structured Interviews:*

Conducted with teachers, administrators, and education officers. These explored curriculum integration, teacher preparedness, and institutional challenges such as resource shortages or competing academic priorities.

- *Focus Group Discussions (FGDs):*

Carried out with student environmental clubs to elicit collective views, peer influences, and experiences of participation in sustainability initiatives. FGDs were particularly valuable for uncovering gendered dynamics and cultural influences on participation.

➢ *Data Analysis*

Quantitative data were analyzed using descriptive statistics to establish overall patterns of student engagement in sustainability activities. To examine relationships among variables, inferential statistics, including correlation and multiple regression analysis, were applied. These methods enabled testing of associations between socio-economic status, environmental knowledge, and sustainability behaviors.

Qualitative data from interviews and focus group discussions were transcribed verbatim and analyzed thematically following Braun and Clarke's (2006) six-phase framework: familiarization, coding, theme development, reviewing, defining, and reporting. This ensured systematic identification of patterns relating to

teacher capacity, institutional conditions, cultural norms, and community linkages.

Findings from both strands were then triangulated within a convergent mixed-methods design to enhance validity and reliability. Quantitative patterns provided measurable indicators, while qualitative insights offered contextual depth, ensuring that the analysis captured both the statistical dimensions and the lived realities of Environmental Education for Sustainability.

➢ *Ethical Considerations*

Ethical approval was secured from the National Commission for Science, Technology and Innovation (NACOSTI) Kenya, and institutional clearance was obtained from Tangaza University. Informed consent was sought from all adult participants, and assent was obtained from students, with parental or guradians consent for those under 18. Participation was voluntary, confidentiality was maintained, and respondents had the right to withdraw at any stage. These measures ensured compliance with international research ethics and Kenya's educational research guidelines.

V. RESULTS

The mixed-methods findings provide a multidimensional picture of Environmental Education for Sustainability (EES) in rural Kenyan schools. Quantitative data mapped participation trends and behavioral predictors, while qualitative narratives illuminated how socio-economic, cultural, and institutional conditions shape outcomes. Five interlinked patterns emerged.

➢ *Declining Participation with Grade Progression*

Student involvement in sustainability activities dropped steadily with grade level. While 41.4% of junior students reported active participation in environmental clubs or projects, this figure fell to 22% among seniors ($\chi^2 = 12.74$, $p < .01$). Teachers attributed the decline to exam pressure: *"By the time learners get to Class 7 and 8, the exam dictates everything. Environmental clubs become optional luxuries."* Older students themselves viewed EES as a distraction from academic performance. These findings highlight a systemic tension between exam-oriented pedagogy and the experiential learning ethos required for sustainability education.

➢ *Low- vs. High-Complexity Practices*

Engagement clustered around low-complexity, low-resource activities. About 71% of students reported watering trees, litter collection, or switching off lights. Fewer than 15% engaged in advanced practices such as composting, recycling, or water harvesting. Regression analysis confirmed that infrastructure availability strongly predicted participation in complex practices ($\beta = .412$, $p < .05$). Students emphasized material shortages: *"We want to recycle, but there are no bins or tools."* This confirms that willingness alone is insufficient; without institutional enablers, ecological awareness cannot mature into higher-order practice.

➢ *Gendered Dimensions of Engagement*

Participation was gendered in both practice and leadership. Girls reported higher routine engagement (56% vs. 38% of boys), especially in gardening and waste collection. Yet boys held over 60% of leadership positions in environmental clubs. Teachers linked this to entrenched cultural expectations: girls were socialized into caregiving roles, while leadership was coded as masculine. Focus groups revealed resistance among boys to "domestic" activities like gardening, dismissed as *"women's work."* Thus, girls bore greater labor burdens but had weaker decision-making power, an imbalance that both reproduces gender inequality and limits the inclusivity of EES leadership.

➢ *Socio-Economic Disparities in Outcomes*

Socio-economic status (SES) was the strongest predictor of sustainability practices. Regression results showed SES explained 63% of the variance in outcomes ($R^2 = .63$), with higher-income households significantly more likely to support resource-intensive practices ($\beta = .504$, $p = .024$). Wealthier students had greater access to seedlings, tools, and family support. By contrast, students from poorer households often prioritized household labor over school-based initiatives: *"When there is no food at home, how can I spend time planting trees at school?"* These findings illustrate that EES effectiveness is deeply entangled with livelihood realities, reinforcing existing ecological inequalities.

➢ *Teacher and Institutional Gaps*

Capacity and infrastructure constraints limited program effectiveness. Fewer than 30% of teachers reported receiving training in sustainability education, and most described EES as marginal compared to examinable subjects. Only 12% of schools had recycling bins, while 65% lacked water harvesting facilities, restricting experiential opportunities. Teachers often described activities as symbolic rather than sustained: *"We do tree planting ceremonies when visitors come, but ongoing care is hard without water or support."* These institutional deficits mirror the low participation in high-complexity practices and underscore the fragility of EES implementation in semi-arid schools.

➢ *Peer and Cultural Dynamics*

Qualitative findings added nuance. Peer influence was central: *"Most of us join because our friends are in the club."* Yet disengagement was common where EES was framed as labor without academic payoff. Cultural narratives reinforced gendered divides, with gardening labeled feminine and leadership masculine. These dynamics resonate with Ajzen's Theory of Planned Behavior, illustrating how subjective norms and perceived expectations mediate sustainability behaviors.

➢ *Comparative Insights*

The Mbeere case aligns with regional and global findings yet also reveals divergences. Like Rwanda's Green Schools, infrastructure emerged as decisive in enabling advanced practices. However, while Rwanda institutionalized rainwater harvesting and biogas, Mbeere

schools relied on symbolic, low-cost activities. Ghana's community-linked EE demonstrates how embedding education in household livelihoods sustains engagement, in contrast to the Kenyan case where older students disengaged under exam pressure. Uganda's Plastic Brick initiative shows the motivational power of linking EES to tangible benefits, a dimension largely absent in Mbeere programs.

➢ *Synthesis*

Taken together, the findings show that while awareness and basic sustainability practices are widespread, the transition to transformative, sustaible behaviors is uneven. Five interlinked barriers stand out:

- Grade attrition driven by exam pressure, which sidelines EES in senior years.
- Infrastructural deficits that prevent participation in high-complexity activities.
- Gender inequities, with girls providing labor but excluded from leadership.
- Socio-economic disparities that limit poorer students' ability to participate.
- Teacher and institutional gaps, reflecting low training and weak resource support.

These patterns suggest that EES in rural Kenyan schools' risks remaining at the level of awareness and symbolic activity, unless systemic reforms address infrastructure, teacher capacity, gender equity, and livelihood integration.

VI. DISCUSSION

This study evaluated the effectiveness of Environmental Education for Sustainability (EES) in rural Kenya, focusing on Mbeere North Sub-County. The findings reveal both promise and constraint: while awareness of environmental issues is widespread and participation in symbolic activities such as tree planting and litter collection is common, translation into sustained, complex practices is limited. This outcome is systemic, shaped by socio-economic inequalities, cultural norms, institutional fragility, and exam-driven curricula.

➢ *Awareness without Sustained Practice*

Transformative Learning Theory (TLT) provides insight into how students acquire ecological awareness and begin to shift worldviews. Through experiential practices, gardening, tree planting, and waste collection, students engage critically with their environment, reflecting Mezirow's (1991) argument that perspective transformation emerges through lived experience. The prevalence of such low-complexity practices indicates that entry-level transformative processes are occurring.

Yet the progression to higher-order practices such as composting or recycling were rare.

➢ *Curriculum Structures and Declining Engagement*

The decline in participation among senior students underscores the influence of systemic curricular priorities. Older students disengaged due to exam preparation, reflecting a misalignment between Kenya's exam-oriented pedagogy and the experiential ethos of sustainability education. From a Transformative Learning Theory perspective, this undermines opportunities for critical reflection. It signals that normative and institutional pressures discourage environmental engagement. This dynamic illustrates how the broader system, not individual willingness, shapes behavioral outcomes, a point reinforced by Ecological Systems Theory (EST).

➢ *Gender Norms and EES Participation*

Gender participation patterns further illustrate how cultural narratives intersect with pedagogy. Girls engaged more consistently in daily practices but were underrepresented in leadership roles, while boys resisted activities coded as feminine. Ecological Systems Theory emphasizes that such outcomes cannot be understood apart from the microsystem (peer norms), mesosystem (school culture), and macrosystem (societal gender roles) in which learners are embedded (Bronfenbrenner, 1979). Without deliberate strategies, EES risks reproducing inequalities by normalizing female labor and male leadership, echoing critiques in African education research that sustainability initiatives often ignore gender dynamics (FAWE, 2019).

➢ *Socio-Economic Inequalities as Structural Barriers*

Socio-economic status emerged as the strongest predictor of participation in higher-order practices. Wealthier students had greater access to seedlings, tools, and encouragement, while poorer students often prioritized survival tasks over ecological engagement. This reinforces EST's insistence that macro-level structures, livelihood insecurity, household poverty, shape the capacity of individuals to act. It also illustrates the limitations of behaviorist models when divorced from socio-economic realities: attitudes alone cannot overcome material constraints. Unlike global or donor-supported contexts where infrastructure is supplied externally, rural Kenyan schools must negotiate sustainability education amid pervasive scarcity.

➢ *Teacher Capacity and Institutional Fragility*

The limited training of teachers and lack of infrastructure further constrained outcomes. With EES marginalized as non-examinable, teachers often confined activities to ceremonial events rather than integrating them into pedagogy. This reflects both Theory of Planned Behavior's focus on institutional and normative reinforcement and EST's emphasis on mesosystem conditions, teacher preparedness, school resources, as decisive enablers. Global cases such as Australia's integration of Indigenous ecological knowledge succeeded precisely because of systemic teacher training and curricular embedding (Griggs et al., 2020). The Kenyan case underscores how, in the absence of such investment, policy aspirations remain symbolic.

➢ *Peer Influence and Cultural Ecosystems*

Qualitative evidence highlighted peer encouragement as a motivator for joining clubs, but also revealed disengagement where EES was perceived as

irrelevant to academic success. Cultural coding of activities, gardening as feminine, leadership as masculine, reinforced these dynamics. These findings illustrate the Theory of Planned Behavior principle of subjective norms shaping behavioral intentions, while Ecological Systems Theory situates them within broader cultural ecosystems. For sustainability education to succeed, it must therefore harness peer dynamics positively and challenge cultural narratives that limit inclusivity.

➢ *Comparative Lessons from Africa*

Placed in regional perspective, the Mbeere case underscores what happens when systemic supports are weak. Rwanda's Green Schools integrated rainwater harvesting and biogas, institutionalizing higher-order practices. Ghana embedded EES into household livelihoods, sustaining engagement across socio-economic divides. Uganda's Plastic Brick initiative linked environmental education to entrepreneurial benefits, motivating participation through tangible outcomes. In contrast, Mbeere North demonstrates the erosion of EES where exam-driven curricula, infrastructural deficits, and poverty dominate.

➢ *Theoretical Integration and Contribution*

The integrated framework clarifies that:

- Transformative Learning Theory explains the presence of ecological awareness and worldview shifts emerging from experiential activities.
- Theory of Planned Behavior and the Hines Model explain why such awareness often fails to translate into behavior under conditions of weak infrastructure, peer disincentives, and exam pressure.
- Ecological Systems Theory explains how systemic inequities, poverty, gender norms, institutional fragility, structure the boundaries of what is possible in practice.

The novelty of this study lies in operationalizing this integration in a rural African context, showing that unlike donor-driven or infrastructure-rich cases, sustainability outcomes in Mbeere North are systematically eroded by exam-oriented curricula and socio-economic inequities, despite policy frameworks that formally support EES. This demonstrates that evaluating effectiveness requires not only pedagogical and behavioral lenses but also systemic analysis attuned to context.

➢ *Policy and Practice Implications*

This study demonstrates that while Environmental Education for Sustainability (EES) in rural Kenyan schools has fostered awareness and low-complexity practices, it has not yet translated into sustained, higher-order engagement. The reasons are systemic: exam-oriented curricula, inadequate infrastructure, limited teacher preparation, and entrenched socio-economic and gender disparities. These findings point to several priority areas for reform.

- *Curriculum and Assessment Reform*

EES will continue to be marginalized as long as it remains outside examinable content. Integrating sustainability competencies into assessment under the Competency-Based Curriculum (CBC) would elevate their importance and sustain engagement across grade levels.

- *Infrastructure for Practice*

Without enabling facilities, water harvesting systems, recycling bins, composting sites, and school gardens, students cannot convert ecological awareness into lived practice. Strategic, low-cost infrastructural investments are critical, especially in semi-arid areas like Mbeere North.

- *Teacher Capacity Development*

With most teachers untrained in sustainability pedagogy, EES risks being reduced to ceremonial activities. Strengthening teacher preparation, through teacher colleges, continuous professional development, and NGO/university partnerships, will enable transformative, practice-oriented pedagogy.

- *Equity and Inclusion*

Findings showed that girls contributed more labor but were underrepresented in leadership, and students from poorer households faced structural barriers to participation. Addressing these inequities requires inclusive leadership structures, mentorship for girls, and material support for disadvantaged learners, ensuring EES advances both ecological resilience and social justice.

- *School–Community Linkages*

Student participation was shaped by household realities and peer norms, underscoring that EES cannot succeed if confined to classrooms. Linking school initiatives to household livelihoods, food security, and cultural traditions, such as farming practices or indigenous storytelling, would deepen relevance and impact. Regional lessons from Rwanda, Ghana, and Uganda show that integration with infrastructure, livelihoods, and entrepreneurship transforms EES from symbolic to systemic.

➢ *Key Policy Messages*

- Integrate EES into assessment: Make sustainability competencies examinable under CBC.
- Invest in enabling infrastructure: Provide water harvesting, recycling, and school gardens.
- Strengthen teacher capacity: Scale up pre-service and in-service training in sustainability pedagogy.
- Promote equity: Ensure girls' leadership and support disadvantaged students with resources.
- Link to livelihoods: Connect EES to farming, food security, and entrepreneurship.
- Embed community engagement: Root EES in local traditions, peer networks, and cultural practices.

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