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ENVIRONMENTAL EDUCATION AND AWARENESS: A PAN-SOCIETAL FRAMEWORK FOR SUSTAINABILITY AND COMMUNITY EMPOWERMENT

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ABSTRACT

The intensification of global environmental pollution, climate-associated risks, and ecological-knowledge decline highlights the need for inclusive environmental literacy frameworks capable of shaping sustainability behaviour. Although environmental awareness initiatives have expanded internationally, many developing societies, including Nigeria, continue to operate fragmented or symbolic environmental-education models with weak knowledge-to-practice translation. Anchored on behavioural learning and intention-action theory, this review synthesises empirical evidence supporting environmental literacy progression through the K-A-P (Knowledge → Attitude → Practice) continuum and comparative insights from European and Asian environmental-education institutional architectures. Findings affirm that environmental behaviour is adopted more durably when literacy is introduced early in curricula, socially modelled in communal learning spaces, and reinforced cyclically through institutions and community-of-practice clusters rather than linear or sporadic campaigns. The paper further identifies systemic gaps in community feedback, occupational literacy penetration, and enforcement-education coherence while proposing the imperative for cyclical learning frameworks that empower communities in environmental stewardship. The review concludes that environmental sustainability depends on behaviourally engineered, inclusive, feedback-driven systems where schools, occupation clusters, communities, and environmental accountability institutions function as co-actors in reinforcement cycles. The article contributes a holistic pan-societal sustainability-education position relevant to policy and community empowerment research.

Keywords: environmental literacy; sustainability behaviour; community empowerment; environmental education; policy coherence

Introduction

Environmental pollution and climate-induced risks have intensified globally, posing systemic threats to ecosystems, public health, and socioeconomic stability. Institutions such as the United Nations Environment Programme report sustained increases in emissions, biodiversity loss, and solid-waste burdens, warning that human behavior and environmental neglect remain dominant drivers of ecological decline (UNEP, 2021; IPCC, 2023). Despite rising environmental risks, environmental literacy levels in many low- and middle-income societies are stagnating or declining, limiting public capacity to adopt sustainable environmental behaviors (Oyekale, 2022; Ogunbode et al., 2023). In several developing countries, environmental education programmes

remain fragmented, siloed within academic institutions, or reduced to symbolic awareness campaigns with weak longitudinal impacts on behavior (Okoye, 2020; Ezeudu et al., 2022).

The growing discourse in sustainability science emphasizes that environmental education must extend beyond passive knowledge transfer to include behavioral activation, stakeholder ownership, and capacity building through grassroots institutional platforms (Bandura, 1986; Monroe et al., 2019). Theoretical constructs such as the Social Learning framework demonstrate that environmental behavior is shaped most effectively through modeling, reinforcement, and communal learning channels rather than episodic sensitization (Bandura, 1986; Nwankwo & Unachukwu, 2023). Similarly, Planned Behavior empiricism posits that environmental practice outcomes are predicted strongly by structured knowledge, intentional formation, and institutional enabling environments (Ajzen, 1991; Adetunji & Olawuyi, 2024). Consequently, Pan-Societal frameworks that push literacy into occupational clusters, community unions, governance systems, and early-stage learning institutions—while embedding accountability and feedback loops—are now recognized as essential for advancing sustainable behavior at scale (UNESCO, 2021; NBSAP, 2024).

Problem Statement

Although environmental sustainability policies exist at national and institutional levels, environmental literacy remains insufficient across demographic and occupational segments, impeding awareness-to-practice translation. In Nigeria, for example, organizations such as the National Environmental Standards and Regulations Enforcement Agency highlight persistent pollution, unsafe informal-sector operations, and weak compliance culture, problems that are exacerbated by limited environmental education coherence across society (NESREA, 2018; Eneh, 2022).

Empirical studies demonstrate that environmental knowledge gaps exist among children, transition-stage youth, formal workforces, artisans, community decision-makers, and even governance institutions responsible for environmental oversight and public sensitization (Omopariola, 2020; Olatunde & Olalekan, 2023). Public awareness campaigns often fail to produce measurable sustainable environmental behavior due to: (1) poorly structured curricular integration at early learning stages, (2) weak institutional-to-community education alignment, (3) absence of occupational environmental literacy frameworks for informal workers, (4) over-reliance on symbolic rather than experiential awareness systems, and (5) weak community reporting and feedback loops that link environmental issues to behavioral reinforcement systems (Chawla & Derr, 2012; Ogunbode et al., 2023; Nwankwo & Unachukwu, 2023). These structural deficits weaken stewardship behavior, aggravate pollution indices, and limit societal adaptive resilience to environmental risk.

Aim and Objectives

This article aims to advance a Pan-Societal Environmental Education Framework that bridges knowledge and behavioral sustainability through integrated formal, informal, occupational, and

community-capacity-building pillars. Specifically, the paper seeks to achieve the following objectives:

1. Synthesize key behavioral learning theories that link environment, perception, intention, and action, including the environmental-behavioral modeling and reinforcement principles of Social Learning Theory (Bandura, 1986; Nwankwo & Unachukwu, 2023).
2. Critically evaluate existing environmental awareness and education delivery models across demographic, occupational, community, and governance segments (Monroe et al., 2019; Ezeudu et al., 2022).
3. Identify systemic gaps in community-centered and occupation-driven literacy frameworks, especially among informal sector workers and local community spatial governance institutions (Eneh, 2022; Ogunbode et al., 2023).
4. Propose a cyclical, measurable, and sustainable framework capable of translating environmental knowledge into reinforced stewardship behavior through institutional accountability, occupational integration, and grassroots reporting systems (Ajzen, 1991; Chawla & Derr, 2012; UNESCO, 2021).

Review-Framed Research Questions

1. How does environmental literacy influence sustainable environmental behavior across demographic, occupational, community, and governance cohorts? (Ajzen, 1991; Ogunbode et al., 2023).
2. What institutional and grassroots channels best support scalable environmental awareness and practice reinforcement? (Monroe et al., 2019; UNESCO, 2021).
3. How can environmental education frameworks empower communities while aligning institutional accountability, enforcement coherence, and grassroots reporting to improve stewardship behavior? (Chawla & Derr, 2012; Nwankwo & Unachukwu, 2023; UNESCO, 2021).

Conceptual/Theoretical Framework

Theoretical Foundations

Environmental education that aims to produce durable sustainability behaviour must be grounded in behavioural learning and intention–action theories. The Social Learning paradigm posits that behaviour is acquired through observation, modelling, reinforcement, and social interaction, thereby making environmental cues and communal learning critical to behavioural adoption (Bandura, 1986; Adebayo & Odeyemi, 2020). Environmental action, within this lens, is strongly shaped when individuals observe pro-environmental behaviour enacted by respected actors within shared spaces such as schools, markets, workplaces, and community institutions (Wals, 2017; Nwankwo & Unachukwu, 2023). Complementarily, the Planned Behaviour framework asserts that structured knowledge strengthens behavioural intention, and that intention—when combined with enabling social and institutional conditions—predicts the likelihood of sustainable practice adoption (Ajzen, 1991; Klöckner, 2013). Studies applied in developing economies indicate that environmental-literacy interventions significantly improve sustainability behaviour when

messaging is structured, contextually framed, and reinforced through institutional accountability rather than episodic public campaigns (Monroe et al., 2019; Ezeudu et al., 2022).

Proposed Conceptual Cycle

Building on theoretical synthesis, this paper advances a cyclical literacy-to-action pathway: *Environmental Knowledge → Awareness → Engagement → Empowerment → Stewardship → Feedback → Reinforcement*. This sequence reflects the ecological-behaviour continuum, where environmental literacy stimulates awareness; awareness drives stakeholder engagement; engagement enables capability empowerment; empowerment instils stewardship ownership; and stewardship is reinforced behaviourally through monitoring and community feedback loops (Ardoin et al., 2020; Chawla & Derr, 2012). Environmental-awareness programmes mediated through institutions such as the United Nations Educational, Scientific and Cultural Organization emphasize the importance of participatory environmental learning frameworks that treat communities and institutions as co-actors in environmental governance rather than passive recipients of knowledge (UNESCO, 2021). Feedback loops, a weakly institutionalized component in many environmental-awareness systems in Nigeria, are vital for reinforcing environmental practice and reporting community environmental risks to mediate adaptive resilience behaviour (Olatunde & Olalekan, 2023; Ogunbode et al., 2023).

Generalized Framework Pillars

To translate environmental knowledge into sustainable, reinforced behaviour at scale, environmental education must move beyond siloed curricular models and symbolic sensitization and evolve into inclusive frameworks that integrate society's formal and informal learning, occupational clusters, community institutions, and governance accountability loops. Based on multi-cohort literature, this paper generalizes four interlinked pillars: (1) *Formal Education Systems*, where curricula at early and advanced learning stages strengthen ecological cognition (UNESCO, 2021; Ezeudu et al., 2022); (2) *Informal Awareness Systems*, where media-driven sensitization supports public behaviour shaping when campaigns are recurrent, community-centred, and occupationally contextualized (Monroe et al., 2019; Ardoin et al., 2020); (3) *Occupational Environmental Literacy*, where the inclusion of informal-sector workers, artisans, and formal workforces in structured environmental practice training reinforces sustainability behaviour (Wals, 2017; Eneh, 2022); and (4) *Community Empowerment and Institutional Partnerships*, which position stakeholder ownership, community reporting loops, town unions, occupational associations, regulatory agencies, and local governance bodies as co-actors interacting with environmental risk models, practice reinforcement, measurable sustainability dashboards, and education-to-enforcement coherence loops (Chawla & Derr, 2012; Nwankwo & Unachukwu, 2023; Olatunde & Olalekan, 2023). Together, these four pillars are crucial for closing environmental-literacy gaps, empowering communities, and achieving a feedback-driven sustainability-behaviour reinforcement cycle across society.

Literature Review

Environmental Literacy and Behaviour Linkage

Environmental literacy has evolved from a purely educational construct into a core behavioural sustainability determinant, shaping ecological decision-making and practice adoption across populations. The K-A-P (Knowledge → Attitude → Practice) pathway remains a foundational model for explaining the cognitive mechanics of environmental behaviour. Empirical studies confirm that environmental knowledge significantly improves ecological attitudes, including risk perception, pollution sensitivity, and resource-responsibility cognition, especially among young learners (Kollmuss & Agyeman, 2002; Chawla & Derr, 2012; Ogunbode et al., 2023). However, knowledge alone does not guarantee practice adoption. Literature indicates that environmental behaviour transition from awareness to practice is mediated by social learning, institutional enabling environments, behavioural reinforcement systems, ecological agency, contextual norms, structural accountability, and feedback loops, which are often weak or absent in developing societies (Ajzen, 1991; Wals, 2017; Ardoin et al., 2020).

The Social Learning mechanism demonstrates that individuals adopt behaviours most durably when environmental practices are consistently modelled by respected actors or peer clusters within shared environments such as schools, marketplaces, and occupational communities (Bandura, 1986; Nwankwo & Unachukwu, 2023). Environmental stewardship research establishes that environmental ownership is significantly stronger when learning frameworks integrate active participation, practice rehearsal, local reinforcement, and community reporting loops that validate environmental cognition and encourage adaptive resilience behaviour (Ardoin et al., 2020; Chawla & Derr, 2012). Consequentially, international environmental education entities such as the United Nations Educational, Scientific and Cultural Organization argue that environmental education effectiveness is amplified when institutions, communities, and knowledge delivery systems act as co-actors rather than symbolic recipients of awareness messaging (UNESCO, 2021).

In Nigeria, environmental awareness translation failures are heavily reported. Studies confirm that environmental knowledge is poorly integrated formally in basic-level institutions, limiting ecological cognition engineering. Environmental hazards arising from informal sector operations account for significant pollution contributions, yet less than 25% of environmental literacy research in Nigeria structurally addresses practice reinforcement or occupational training among artisanal populations (Ezeudu et al., 2022; Eneh, 2022; Nwankwo & Unachukwu, 2023). Governance outlets such as the National Orientation Agency also report that environmental education remains largely symbolic, non-cyclical, non-measurable, and enforcement-disconnected, weakening practice adoption and compliance culture (NOA, 2024).

The broader behavioural literature also intersects the role of cultural memory and socio-environmental psychology. Environmental interpretation is influenced heavily by cultural learning, emotional attachment to space, shared environmental memory, and spatial experience dynamics, especially for early learners, rural clusters, and small-trade communities (Chawla & Derr, 2012; Nwankwo & Unachukwu, 2023). Comparative studies with advanced economies show stronger

practice adoption rates when environmental learning is: (1) curricularized at basic-level institutions, (2) reinforced continuously via local learning clusters, (3) anchored in social learning, (4) occupationally structured, (5) backed by institutional accountability systems, and (6) measured cyclically through stakeholder feedback systems (Liu et al., 2019; Ardoin et al., 2020; UNESCO, 2021). These insights establish that environmental literacy systems must progress from linear models to cyclical behavioural frameworks that embed institutional reinforcement structures, community reporting loops, and societal agency for durable sustainability practice outcomes.

Education Delivery Models Across Societal Cohorts

Environmental education (EE) delivery architectures exhibit substantial variation across demographic, occupational, community, and governance populations, with differential outcomes based on institutionalisation depth, social modelling strength, practical engagement, monitoring structures, and feedback reinforcement. For children and youth, school-based environmental literacy remains the most empirically validated delivery model. Curricularised instruction, environmental-themed simulations, eco-clubs, field-based problem-solving, environmental practical modules, and peer-to-peer social learning substantially enhance ecological cognition, pollution sensitivity, climate-risk perception, and environmental agency among early learners (Monroe et al., 2019; Wals, 2017; Ardoin et al., 2020). Programmes supported by organisations such as the United Nations Children's Fund demonstrate that co-curricular environmental platforms improve youth-led environmental stewardship behaviour when learning is built on practice rehearsal and institutional reinforcement rather than symbolic sensitisation (UNICEF, 2021). However, evidence also indicates that formal school-based delivery must integrate community feedback loops to sustain practice adoption beyond classroom cognition (Chawla & Derr, 2012; Nwankwo & Unachukwu, 2023).

In workforce and artisan clusters, environmental education delivery is markedly under-structured, despite the informal sector contributing a dominant share of societal pollution footprints, resource consumption, environmental-risk encounters, urban waste accumulation, and ecological decision architectures (Eneh, 2022; Ezeudu et al., 2022; Ogunbode et al., 2023). Occupational environmental literacy frameworks embedded into worker training have demonstrated positive environmental practice translation outcomes when combined with enforcement feedback, internal compliance dashboards, sustainability practice triggers, and organisational reinforcement systems (Klöckner, 2013; Monroe et al., 2019). Market cluster models further show that artisanal populations adopt environmental practices more durably when environmental safety training and literacy modules are delivered through trusted occupational unions, cooperative clusters, tool-based environmental workshops, and small-trade learning frameworks that respect communal knowledge architectures (Eneh, 2022; Ardoin et al., 2020).

For community leaders, research confirms that environmental literacy is most effective when framed through grassroots environmental ownership and spatial governance responsibility models. Local leaders act as influential ecological learning actors capable of shaping community environmental norms, enforcing spatial civility, monitoring shared environmental systems, and

embedding stewardship behaviour among residents, traders, land custodians, youth institutions, artisan unions, traditional governance hierarchies, and local councils (Ardoin et al., 2020; Nwankwo & Unachukwu, 2023). However, community literacy fails to achieve practice adoption when dialogue is not formalised through institutional recognition, measurable stewardship reinforcement, or enforcement cohesion.

Governance institutions represent the highest environmental practice failure node when education is symbolic, non-measurable, cadence-poor, enforcement-disconnected, and accountability-loop deficient. Education-to-enforcement coherence is essential for strengthening compliance culture at scale (Ajzen, 1991; UNESCO, 2021). Countries and governance entities that harmonise EE delivery with environmental-risk accountability dashboards, local reporting cohesion, enforcement actors, and cyclical monitoring frameworks demonstrate stronger adaptation behaviour and national compliance culture indices (Liu et al., 2019; UNESCO, 2021). In Nigeria, bodies such as the National Orientation Agency caution that awareness campaigns often remain episodic and symbolic, failing to embed monitoring or measurable accountability, which weakens stewardship adoption (NOA, 2024).

Collectively, the literature demonstrates that environmental education delivery must be pan-societal, cyclical, institutionally anchored, socially modelled, community-capacity-driven, occupationally structured, enforcement-coherent, and measurably reinforced through institutionalised reporting and feedback loops to produce durable sustainability culture across society (Bandura, 1986; Ajzen, 1991; Ardoin et al., 2020; Monroe et al., 2019; Wals, 2017).

Comparative Insights

Comparative analyses of environmental education (EE) frameworks reveal stark asymmetries between advanced and developing economies, particularly in the timing of institutionalisation, depth of behavioural integration, enforcement coherence, grassroots knowledge penetration, and the presence of measurable feedback loops. In Europe, EE systems are structured as long-term societal investments. The European Environment Agency highlights that environmental literacy is introduced early, reinforced through sustained civic-engagement triggers, and tracked through integrated environmental dashboards and digital reporting portals that continuously loop citizen behaviour back to institutions for policy reinforcement (EEA, 2020; Ardoin et al., 2020). This synchronised knowledge-to-practice architecture significantly strengthens pro-environmental behaviours by normalising environmental stewardship within institutional and communal spaces (Wals, 2017; Klöckner, 2013).

In contrast, environmental literacy scaling in Asia demonstrates that successful pan-societal awareness requires harmonisation across media, education, occupation, and enforcement clusters. Studies in China show that EE frameworks attain higher behavioural practice adoption when environmental messaging is embedded into formal curricula, workplace behaviour prompts, and occupational safety modules, supported by local enforcement feedback and recurrent public reporting pipelines (Liu et al., 2019; Ardoin et al., 2020; UNESCO, 2021). Countries applying

circular environmental learning frameworks demonstrate stronger practice adoption rates, as behaviour is reinforced through consistent modelling, public indicators, and institutionalised accountability systems rather than symbolic or one-off campaigns (Bandura, 1986; Monroe et al., 2019).

Pan-societal EE systems further show stronger sustainability outcomes when civic environmental responsibility indicators are measurable and integrated into daily life systems such as waste collection behaviour prompts, energy sustainability feedback loops, pollution reporting cadence dashboards, early learner environmental agency modules, artisan occupational safety audits, local-access compliance adoption, and community-policy reinforcement clusters (Ogunbode et al., 2023; UNESCO, 2021; Nwankwo & Unachukwu, 2023). These frameworks not only improve ecological cognition but also generate measurable environmental compliance behaviour at scale, strengthening community resilience and sustainability culture across economic hierarchies.

However, research confirms that many developing societies, including Nigeria, implement EE largely symbolically, without cyclical behaviour reinforcement structures, occupational literacy clusters, or enforcement–education alignment. Scholars consistently critique the lack of institutionalised feedback loops and accountability dashboards for environmental behaviour assessment in informal sectors, community governance platforms, and early learning institutions (Eneh, 2022; Ezeudu et al., 2022; Nwankwo & Unachukwu, 2023). The National Environmental Standards and Regulations Enforcement Agency also notes that enforcement frameworks are weakened when knowledge delivery is disconnected from regulatory reinforcement and grassroots environmental reporting loops (NESREA, 2018; Eneh, 2022).

Therefore, comparative literature establishes that for EE systems to produce durable sustainability outcomes, environmental literacy must be: (1) introduced early in curricula, (2) socially modelled across communal learning spaces, (3) occupationally structured into workforce and artisan training, (4) cyclically reinforced through community reporting loops, (5) measured via accountability dashboards rather than symbolic campaigns, and (6) aligned coherently with enforcement institutions to strengthen compliance behaviour at scale (Bandura, 1986; Ajzen, 1991; Ardoin et al., 2020; Monroe et al., 2019; UNESCO, 2021; Wals, 2017).

Identified Systemic Gaps

The literature reveals persistent systemic weaknesses in the design, delivery, uptake, and reinforcement of environmental education (EE) across developing societies. First, there is a well-documented disconnect between environmental-literacy building and enforcement accountability, weakening Knowledge-to-Practice transformation (Eneh, 2022; Ezeudu et al., 2022). Behavioural-intention research affirms that environmental awareness does not mature into sustained practice when institutional accountability is absent and regulatory actors are not integrated into learning and reinforcement cycles (Ajzen, 1991; Ardoin et al., 2020). In Nigeria, organisations such as the National Environmental Standards and Regulations Enforcement Agency consistently caution that compliance failures escalate when enforcement systems are not synchronised with structured

environmental-literacy triggers within communities and occupational clusters, thereby limiting behavioural-adoption durability (NESREA, 2018; Eneh, 2022).

Second, community-feedback reinforcement pipelines remain critically weak or missing altogether. Meta-reviews by the United Nations Educational, Scientific and Cultural Organization note that successful EE frameworks institutionalise citizen reporting, community-knowledge co-creation, and behavioural reinforcement through iterative feedback loops that enable institutions and communities to jointly monitor environmental risks and reinforce sustainable behaviour (UNESCO, 2021; Olatunde & Olalekan, 2023; Ogunbode et al., 2023). However, studies indicate that many African and developing-economy EE models lack these cyclical dashboards, monitoring cadence, or practice-reporting architectures, making awareness symbolic rather than behavioural (Ezeudu et al., 2022; Nwankwo & Unachukwu, 2023).

Third, occupational environmental literacy remains disproportionately under-represented in EE research and intervention design despite the informal economy contributing the bulk of environmental-risk encounters, material-disposal behaviours, pollutant-release nodes, and resource-consumption decisions (Eneh, 2022; Ogunbode et al., 2023). Research establishes that artisans and informal-sector workers demonstrate stronger practice adoption when education is embedded into occupational safety modules, local-union training pipelines, tool-audit practice clusters, and compliance reporting triggers anchored within trusted community-of-practice institutions rather than generic media campaigns (Bandura, 1986; Monroe et al., 2019). Yet, fewer than one-third of environmental-literacy studies in Nigerian informal sectors propose structured frameworks for occupational training, environmental-to-enforcement compliance dashboards, or artisan-specific environmental-practice audits (Ezeudu et al., 2022; Eneh, 2022; Nwankwo & Unachukwu, 2023).

Fourth, curricular penetration at early-learning stages remains symbolic, inconsistent, or inadequately mandatory. The United Nations Children's Fund emphasises that early-stage curricularisation of environmental literacy strengthens climate-risk cognition, pollution-response sensitivity, and practice uptake when supported by co-curricular environmental-practice rehearsal clubs, local audits, behavioural nudges, and sustained reinforcement (UNICEF, 2021; Monroe et al., 2019). However, studies indicate that many developing societies introduce environmental content late, infrequently, symbolically, or non-mandatorily, which weakens self-efficacy and practice uptake among learners (Ezeudu et al., 2022; UNESCO, 2021).

Fifth, institutional–policy coherence gaps persist. Data systems and policy tracking by the European Environment Agency show that EE frameworks that harmonise behavioural-modelling systems, literacy dashboards, occupational-cluster training, and community feedback create long-term environmental agency and stronger sustainability culture (EEA, 2020; Liu et al., 2019). By contrast, gaps in developing economies reveal weak harmonisation between educational institutions, enforcement agencies, and civic-knowledge clusters (Eneh, 2022; Nwankwo & Unachukwu, 2023). Without cyclical reporting cadence, formalised accountability, occupational

learning clusters, and education–enforcement synchronisation, environmental-literacy interventions remain untracked or symbolic, limiting stewardship behaviour penetration across society (Ardoin et al., 2020; Monroe et al., 2019; UNESCO, 2021).

Finally, behavioural-measurement architectures are absent in many intervention designs. Scholars argue that EE adoption must include measurable environmental behaviour indicators within daily-life knowledge-clusters to solidify stewardship behaviour adoption (Kollmuss & Agyeman, 2002; Ardoin et al., 2020). Yet, in Nigeria, environmental awareness is rarely measured through adoption dashboards, feedback portals, or institutionalised reporting systems that enable enforcement reinforcement (Eneh, 2022; UNESCO, 2021).

Collectively, these systemic deficits point to the urgent need for a Pan-Societal EE Framework that is early-curricularised, occupational-cluster-structured, community-feedback-reinforced, enforcement-aligned, accountability-driven, behaviourally-modelled, cadence-rich, outcome-activated, and measurably institutionally enabled across society (Bandura, 1986; Ajzen, 1991; Ardoin et al., 2020; Monroe et al., 2019; UNESCO, 2021; Liu et al., 2019). The identified key gaps could be summarized below:

1. Enforcement actors under-integrated in EE learning cycles.
2. Awareness delivery largely symbolic rather than behaviourally engineered.
3. Weak or missing community-reporting and feedback reinforcement loops.
4. Occupational and informal-sector clusters poorly represented in EE training frameworks.
5. Early-learning curricular penetration late, infrequent, or non-mandatory.
6. Absence of measurable behaviour-adoption dashboards and reporting cadence.
7. Education–enforcement policy coherence weakly harmonised.

Methodology

This article adopts a hybrid qualitative review and framework proposition approach, combining **thematic narrative synthesis** with conceptual framework modelling. The review is anchored on the interpretivist tradition, where environmental knowledge systems, behaviour transition pipelines, and institutional learning architectures are synthesized to propose scalable policy–community practice cycles (Sovacool et al., 2018; Xiao & Watson, 2019). The research design integrates narrative review methods with systems-thinking modelling to advance a literacy-to-action reinforcement framework, positioning institutions and communities as active agents in environmental stewardship development (Ardoin et al., 2020).

Data sources include peer-reviewed journal articles indexed in recognised databases such as Scopus and Web of Science, sustainability and climate synthesis reports by the Intergovernmental Panel on Climate Change (IPCC), global environmental education policy reviews by UNESCO, and national environmental enforcement and orientation reports from Nigeria. Additional sources include institutional environmental reform insights from EU and Asian contexts to support framework transferability (EEA, 2020; Liu et al., 2019; UNESCO, 2021).

The inclusion criteria prioritize literature that: (1) evaluates environmental knowledge-to-attitude and practice transitions (KAP-driven or behaviour-driven studies), (2) operationalises environmental literacy within formal learning systems, (3) embeds environmental knowledge within occupational or informal-sector clusters, (4) tests community co-ownership models for sustainability behaviour reinforcement, and (5) explores enforcement–education coherence. Studies addressing artisanal environmental literacy, workforce training, school platforms, community institutions, policy-to-practice feedback loops, and frameworks linking learning architectures to enforcement accountability were included in the synthesis (Monroe et al., 2019; Ardoin et al., 2020; Eneh, 2022).

Exclusion criteria filter out anecdotal commentaries, editorials not supported by empirical or institutional policy evidence, strictly linear environmental education models without behavioural reinforcement mechanisms, and non-scholarly opinion pieces that lack systems-design constructs or policy coherence applicability (Xiao & Watson, 2019).

Analysis logic follows a three-layer synthesis pathway: (1) literature coding & theme clustering, (2) sectoral environmental literacy opportunity mapping, and (3) cyclical framework proposition. The synthesis process identifies behavioural empiricism across societal cohorts, evaluates delivery channels, maps stakeholder-learning institutions, overlays enforcement gaps, and models feedback loops that integrate schooling systems, occupational clusters, informal markets, community spatial institutions, and regulatory actors into a systemic reinforcement cycle (Bandura, 1986; Ajzen, 1991; UNESCO, 2021). The final methodological product is a non-statistical, theory-modelled Pan-Societal Framework for environmental literacy uptake, community empowerment, and sustainability behaviour reinforcement, validated through cross-cohort literature alignment.

Analysis & Discussion

Thematic Synthesis (Key Insights)

The synthesis of literature indicates that environmental awareness attains societal impact when delivered through structured, recurrent, and socially embedded channels rather than symbolic or episodic campaigns. Educational systems employing formal curricular integration, community-led sensitisation, and media-supported learning clusters demonstrate higher environmental cognition and stewardship behaviour than fragmented approaches (Monroe et al., 2019; Wals, 2017; Ardoin et al., 2020). The evidence affirms that environmental literacy predicts pro-environmental practice most strongly when learning is cyclical, reinforced by institutional accountability, and socially modelled within trusted communal and occupational clusters (Bandura, 1986; Ajzen, 1991; Ogunbode et al., 2023). Linear awareness systems—although valuable for messaging diffusion—rarely translate to durable practice uptake without behavioural-reinforcement triggers, feedback loops, and local knowledge ownership (Kollmuss & Agyeman, 2002; Nwankwo & Unachukwu, 2023).

Discussion Blocks

Thematic Node	Summary of Analytical Focus
Deficit	Literacy and practical knowledge gaps across learner, workforce, artisan, community, and policy cohorts (Ogunbode et al., 2023; Eneh, 2022).
Channel Failure	Over-reliance on symbolic awareness rather than structured literacy delivery and behavioural practice reinforcement (Ezeudu et al., 2022; Monroe et al., 2019).
Institutional Gaps	Weak coherence between knowledge delivery systems and accountability enforcement institutions, limiting intention-to-practice maturation (Ajzen, 1991; UNESCO, 2021).
Occupational Literacy	Under-structured implementation frameworks for artisans and informal-sector workers who constitute dominant environmental-risk and pollution-encounter nodes (Eneh, 2022; Ardoin et al., 2020).
Community Empowerment	Absence or weakness of community feedback loops, practice rehearsal clusters, stakeholder ownership, and spatial governance agency (Chawla & Derr, 2012; Nwankwo & Unachukwu, 2023).

Framework Implications

Cross-cohort synthesis reveals that environmental literacy frameworks must be tailored to the learning characteristics, social systems, risks, and daily environmental encounters of specific cohorts. School systems require early curricularisation and experiential environmental practice to strengthen K-A-P maturity (UNESCO, 2021; Monroe et al., 2019). Workforce and artisan clusters—estimated to contribute the largest share of unregulated daily environmental risk encounters in Nigeria—adopt pro-environmental practice more durably when education is anchored through trusted occupational unions and reinforced via structured audits and reporting pipelines rather than symbolic media broadcasts (Eneh, 2022; Ogunbode et al., 2023).

Institutions functioning under enforcement mandates—such as the National Environmental Standards and Regulations Enforcement Agency—demonstrate stronger compliance behaviour in communities when education is harmonised with institutional accountability, community reporting cadence, and enforcement feedback loops (Eneh, 2022; UNESCO, 2021). The implication is that EE frameworks must evolve into feedback-driven, socially modelled, and enforcement-coherent systems that transform institutions and communities into co-actors—moving awareness from symbolic messaging to intentional practice adoption (Bandura, 1986; Ajzen, 1991; Ardoin et al., 2020).

Contribution to Knowledge

This article contributes to sustainability-behaviour and environmental-education literature by modelling a **Pan-Societal Environmental Education Framework** that integrates four previously siloed but behaviorally linked domains:
(i) early and advanced curricular institutionalization;
(ii) structured informal awareness systems;
(iii) occupational literacy realities for workforce and informal-sector artisans; and
(iv) community empowerment through reporting and behavioural reinforcement loops.
While earlier works validate isolated dimensions of environmental cognition or awareness, none proposition or harmonise a measurable, cyclical, and enforcement-coherent pan-societal

framework linking institutions, occupations, communities, and regulatory accountability systems within one reinforcement pipeline (Ardoin et al., 2020; Monroe et al., 2019; UNESCO, 2021). This framework advances existing discourse by embedding a scalable, community-reinforced, and behaviour-activation model that can support sustainable practice adoption across formal and informal societal nodes.

Summary

The global escalation of environmental pollution, climate-driven vulnerabilities, and unsustainable resource-use behaviours demonstrates that sustainability outcomes are fundamentally constrained by the environmental-knowledge deficit pervasive across societal cohorts. Evidence from environmental education meta-reviews and applied behavioural sustainability studies confirm that environmental literacy must extend beyond passive knowledge transmission to become an inclusive, practice-oriented, and socially reinforced learning construct capable of shaping individual and community stewardship behaviour (Monroe et al., 2019; Ardoin et al., 2020; UNESCO, 2021). Environmental sustainability is unattainable where environmental literacy is uneven, siloed, non-cyclical, or symbolic, particularly in societies characterised by weak policy–education coherence and limited grassroots engagement capacity (Kollmuss & Agyeman, 2002; Eneh, 2022; Ezeudu et al., 2022).

Scholarly consensus emphasises that durable environmental practice emerges when environmental knowledge matures into intention-backed attitudes and is reinforced through social learning, enabling environments, institutional accountability systems, and community knowledge co-ownership mechanisms (Bandura, 1986; Ajzen, 1991; Wals, 2017). Yet, developing societies frequently operationalise environmental awareness symbolically rather than behaviourally, leading to low *Knowledge-to-Practice* translation rates, particularly within informal-sector and artisanal populations that constitute dominant societal pollution-encounter and daily environmental-risk nodes (Eneh, 2022; Ogunbode et al., 2023).

The analysis further establishes that environmental-education effectiveness is highest when learning frameworks integrate early curricularisation in schools, structurally embedded occupational training for workers and artisans, socially respected practice clusters for communities, and formalised reporting and feedback loops that allow institutions and communities to jointly observe, audit, report, reinforce, and co-own environmental responsibility (Monroe et al., 2019; Nwankwo & Unachukwu, 2023; UNESCO, 2021).

Conclusion

Based on the synthesized behavioural and comparative education literature, this article asserts that environmental education must evolve from linear and symbolic sensitisation programmes towards cyclical Pan-Societal Environmental Learning Frameworks that embed literacy practice indicators, socially modelled adoption triggers, community-stakeholder ownership, formal curricular integration, occupational-training clusters, grassroots reporting agility, cadence-rich reinforcement

cycles, and institutional accountability systems for sustainability behaviour tracking (Bandura, 1986; Ajzen, 1991; Monroe et al., 2019; Ardoin et al., 2020; UNESCO, 2021).
A Pan-Societal framework that connects *Education → Awareness → Engagement → Empowerment → Stewardship → Community Feedback → Enforcement Reinforcement* is imperative for sustainable communities where residents, learners, artisans, workers, community leaders, and governance institutions interact as co-actors within measurable and reinforced environmental learning ecosystems rather than symbolic recipients of sensitisation (UNESCO, 2021; Eneh, 2022; Nwankwo & Unachukwu, 2023).

Future environmental literacy interventions, especially in developing economies, must therefore prioritise early curricularisation, occupation-cluster penetration, community-feedback architectures, measurable adoption dashboards, and enforcement-learning coherence to produce durable environmental agency, reduce climate vulnerability, and strengthen national pollution-response and ecological stewardship indices. This article concludes that only education frameworks embedded cyclically across society—where learning units, occupational clusters, traditional governance, community platforms, and enforcement actors function as systemic reinforcement institutions—can deliver the behavioural outcomes required for sustainability and community empowerment at a national scale (Bandura, 1986; Ajzen, 1991; Monroe et al., 2019; Ardoin et al., 2020; UNESCO, 2021).

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