ECOBRICK LEARNING FOR ECO-LITERACY: A CONCEPTUAL FRAMEWORK FOR GREEN ACTION IN ELEMENTARY SCHOOLS

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Abstract: *Waste management issues in schools are increasingly concerning, underscoring the necessity for eco-literacy among students. As educational institutions face rising waste levels, it is crucial to provide learners with the knowledge and skills to effectively tackle environmental challenges. Education is vital in cultivating sustainable habits and a sense of responsibility towards the environment, promoting proactive waste reduction behaviours. Existing programs often raise awareness about environmental issues but fail to drive significant behavioural changes. Thus, there is a critical need for educational methods that not only inform but also empower students to actively participate in sustainable practices. This study introduces a conceptual model of eco-literacy-based waste management through ecobrick activities, targeting 39 students and teachers at SDN 4 Menteng. By incorporating ecobrick education—converting plastic waste into reusable materials—into the curriculum, the model aims to connect environmental knowledge with actionable practices. This approach focuses on experiential learning and active participation, positioning ecobrick initiatives as effective means to enhance eco-literacy and encourage sustainable behaviours among elementary school students in Kalimantan, while addressing specific waste management challenges faced by schools.*

Keywords*: Eco-Literacy, Ecobrick, Environmental Education, Experiential Learning, Sustainable Behavior*

Introduction

The unsettling reality that virtually every piece of plastic ever created lingers—whether buried, burned, or drifting through vital waterways—magnifies the global waste crisis and underscores an urgent need for environmental responsibility. In ecologically sensitive regions like Kalimantan, where thriving river systems and peatlands are continuously impacted by mismanaged waste, this persistence poses a direct threat to local livelihoods and ecosystems (Oktaliana et al., 2020). Therefore, rethinking how schools cultivate environmental awareness and action from an early age is not merely beneficial but a strategic imperative for nurturing environmentally resilient generations in this critical context.

The global solid waste crisis has reached a critical level, with education systems increasingly recognized as both contributors to and potential solvers of the problem. It was reported that global waste generation has reached 2.24 billion tons annually and is projected to increase by 70% by 2050

if current consumption and disposal patterns persist (Kaza et al., 2018). In Southeast Asia, rapid urbanization and changing lifestyles have made plastic the dominant waste material, while ineffective collection systems exacerbate pollution. Indonesia, ranked second globally after China in mismanaged plastic waste (Jambeck et al., 2015), produces an estimated 12.5 million tons of plastic waste each year, of which only 9% is properly recycled (Suasono et al., 2023). The rest accumulates in landfills, waterways, and public spaces—including schools, which represent everyday microcosms of environmental behavior.

At the micro level, the waste problem is clearly visible in school environments. For example in Buleleng a report by the Dinas Lingkungan Hidup (n.d.) found that each elementary school produces approximately 2–5 kilograms of mixed waste per day, primarily from disposable snack packaging and plastic bottles. In Kalimantan, the challenge is compounded by unique ecological vulnerabilities: schools located near river systems and peatland areas face persistent issues of open dumping and burning due to limited municipal waste services. Field observations from several schools in Palangka Raya and Kapuas (Rahmatullah et al., 2025) indicate that waste segregation is rarely practiced, and environmental programs such as *Adiwiyata* are often implemented only for formal compliance. Such practices reveal that environmental education in many Indonesian schools remains procedural rather than transformative, focusing on short-term cleanliness rather than long-term sustainability.

From a pedagogical perspective, these findings expose a deeper systemic gap—the lack of eco-literacy, defined as the integration of cognitive, affective, and behavioral competencies that enable sustainable living (Capra, 2007). Many school-based programs focus on raising awareness through campaigns or competitions but fail to translate understanding into consistent behavioral change. For instance, a study by Perwitasari et al. (2025) revealed that although students could articulate the importance of waste reduction, their daily practices showed minimal change. This supports a growing critique of conventional environmental education: awareness alone is insufficient. Without opportunities for experiential engagement and emotional connection, educational interventions risk becoming what Sterling (2010) terms *performative sustainability*—activities that appear environmentally conscious yet do not alter the underlying behavior or values of learners.

Eco-literacy provides a more holistic alternative by emphasizing systems thinking, emotional engagement, and action competence (Goleman et al., 2012). At the macro level, integrating eco-literacy aligns with Sustainable Development Goal 4.7, which calls for education that promotes sustainable lifestyles. At the micro level, school-based innovations such as ecobrick learning operationalize this framework by turning waste management into an experiential learning process (Parejo et al., 2021). When students collect, clean, and repurpose plastic waste into ecobricks, they move beyond theoretical understanding toward embodied environmental practice. Such activities enable the translation of *knowing* into *doing*, cultivating habits of care, collaboration, and responsibility. In ecologically sensitive regions like Kalimantan—where the balance between development and conservation is precarious—embedding eco-literacy through ecobrick education is not merely an enrichment activity but a strategic imperative for nurturing environmentally resilient generations.

Education holds a decisive role in forming sustainable mindsets and habits, especially during the foundational years of childhood. The learning process functions not only as a means of knowledge

transmission but also as a cultural mechanism that shapes how individuals perceive and act upon their relationship with the environment. Scholars such as (Tilbury & Ryan, 2011) and Sterling (2010) argue that transformative education—rooted in experience, reflection, and agency—is essential for preparing learners to navigate ecological challenges. Within this view, schools are not merely academic spaces but living laboratories where values, behaviors, and ecological consciousness are cultivated daily. In contexts like Kalimantan, where communities are directly dependent on natural ecosystems such as peatlands and river networks, education becomes a frontline arena for instilling adaptive and sustainable habits that align with local ecological realities.

However, despite this transformative potential, a persistent gap remains between environmental awareness and environmental action in educational practice. Many school-based programs, while well-intentioned, remain trapped within what Wals et al. (2008) describe as *instrumental environmentalism*—approaches that emphasize knowledge dissemination and moral exhortation without engaging learners in authentic, problem-solving experiences. As a result, students may understand environmental issues cognitively yet remain passive behaviorally. This conflict between *knowing* and *doing* limits the effectiveness of environmental education in achieving sustainable behavioral change. Evidence from national programs such as *Adiwiyata* shows that even schools awarded for environmental compliance often revert to old waste habits once evaluation cycles end (Utami et al., 2025). This pattern indicates that awareness-focused interventions, while necessary, are insufficient to generate enduring transformations in ecological behavior.

The resolution to this conflict lies in reorienting environmental education toward *eco-literacy-based pedagogies* that integrate knowledge, affect, and action. This approach demands learning experiences that are participatory, context-sensitive, and emotionally engaging. Ecobrick education offers one such model. By engaging students directly in the process of collecting, cleaning, and compressing plastic waste into reusable building modules, ecobrick activities transform environmental concepts into lived experiences. Learners move from abstract understanding to tangible action, embodying the principles of care, collaboration, and responsibility (Kroth & Cranton, 2014). Through this hands-on process, they witness the consequences of their consumption and the power of collective solutions, thereby cultivating the behavioral dimension of eco-literacy.

The present paper proposes a conceptual model of eco-literacy-based waste management through ecobrick activities, developed from the intersection of experiential learning, eco-literacy theory, and environmental behavior frameworks. The significance of this work lies in addressing a pressing local and educational challenge: how to transform environmental education from awareness to sustained behavioral change within the socio-ecological realities of Kalimantan. This region, characterized by its unique riverine and peatland ecosystems, faces mounting waste problems due to limited infrastructure and increasing plastic consumption, which is similar to Vietnam case (Nguyen et al., 2023). By situating this conceptual model within the Kalimantan context, the paper contributes a locally responsive theoretical framework that can guide educators and policymakers in designing effective, low-cost sustainability programs.

Accordingly, this paper seeks to address the following guiding questions:

1. How can ecobrick-based learning be conceptualized as an eco-literacy framework that links environmental knowledge, attitude, and behavior?
2. What pedagogical principles underpin ecobrick education as a transformative practice for sustainable behavior in schools?
3. How can this model inform environmental education in ecologically sensitive regions such as Kalimantan?

Through these questions, the paper aims to articulate a theoretical contribution that extends beyond isolated classroom interventions. It positions ecobrick learning as a *scalable and context-sensitive framework* for nurturing eco-literate citizens capable of engaging in meaningful environmental action. This conceptualization provides not only a pedagogical innovation but also a strategic foundation for embedding sustainability into the broader educational and cultural fabric of Kalimantan's communities.

Eco-Literacy and Education for Sustainable Development

Eco-literacy provides the philosophical grounding for environmental education, linking understanding with responsibility—the belief that knowing how living systems work also means caring for their continuity. Capra (2007) frames it as the ability to read the patterns of life and act in harmony with them, while Tilbury (2011) extend this view through Education for Sustainable Development (ESD), emphasizing systems thinking, critical reflection, and collective responsibility as the foundation of sustainable learning. In this sense, eco-literacy is not a single competence but a dynamic integration of knowledge, values, and action.

Its knowledge aspect involves understanding ecological principles such as cycles, limits, and interdependence—the grammar of life itself. The attitudinal aspect grows from empathy and stewardship: the quiet conviction that human well-being depends on the Earth's health. The behavioural aspect makes these commitments visible in daily practice—choosing to reuse, reduce, or pause before consuming. At the centre lies systems thinking, which ties these elements together and helps learners see how social, economic, and ecological forces intersect. Through this lens, eco-literacy moves beyond factual recall toward what Orr (1992) called *an education for living well within limits.*

Still, like any influential idea, eco-literacy invites critique. Sauvé (2005) warn that it can drift toward moral idealism—assuming that once people understand ecology, they will automatically behave ethically. Experience shows otherwise: knowledge alone seldom overrides habit or social constraint. Stevenson (2007) adds that eco-literacy frameworks can overlook how power and inequality shape environmental choices, resulting in education that is ecologically aware but socially naïve. From this perspective, eco-literacy risks prescribing a single, "correct" environmental ethic while neglecting the diversity of local meanings and practices already embedded in communities.

These critiques strengthen rather than weaken the concept. They remind us that eco-literacy must be situated, dialogic, and culturally responsive. In regions such as Kalimantan, where rivers and peatlands sustain both life and livelihood, environmental understanding cannot be separated from local wisdom or everyday practice. Eco-literacy here should engage in conversation with indigenous

knowledge rather than replace it. For this reason, the framework adopted in this paper treats eco-literacy as a guiding philosophy—adaptive, context-aware, and always in dialogue with the ecological and cultural realities that shape how people live, learn, and sustain.

Experiential Learning and Environmental Pedagogy

If eco-literacy offers the philosophical lens for understanding ecological systems, then experiential learning provides the path for living those understandings in the real world. Kolb (2007) learning cycle—*concrete experience, reflective observation, abstract conceptualization, and active experimentation*—reminds us that learning is not a transfer of facts but a movement between doing, thinking, and redoing. Knowledge grows from experience, not apart from it.

In environmental education, this approach shifts the centre of gravity. Students no longer memorize terms like *reuse* or *stewardship*; they practice them. When they collect, clean, and compress plastic waste into ecobricks, they turn environmental principles into touchable realities. The plastic in their hands stops being theory—it becomes a question, a challenge, a story. Through such tactile encounters, students begin to internalize ecological values as habits of thought and care.

Reflection, however, is where the work deepens. In Kolb's model, reflection is not a quiet pause after activity but the pulse that gives it meaning. When students talk about why they chose certain materials, or write about what they noticed in the trash they brought from home, they begin to connect personal experience to larger systems. Guided discussions or community dialogues can help them see how individual consumption fits within global cycles of waste and production. In these moments, reflection turns activity into understanding; it is where the *eco* meets the *self*.

Ecobrick learning also carries a communal rhythm. Teachers, students, and parents often join hands—literally—to pack bottles and collect materials. The classroom spills into the community, and learning becomes a shared responsibility. This collective participation embodies the spirit of Education for Sustainable Development (Tilbury, 2011), where education is less about instruction and more about co-creation. In places like Kalimantan, where rivers and peatlands shape everyday life, such learning connects deeply with local realities: protecting the environment becomes synonymous with protecting home.

Still, enthusiasm alone can mislead. Critics have long pointed out that experiential projects sometimes stop at the level of *activity*—fun, engaging, but shallow (Wals et al., 2008). Students may build, clean, or plant without ever asking *why* it matters or *what structures sustain the problem.* Without guided reflection and contextual framing, the energy fades as quickly as it rises—what Wals et al., (2008) call the "campfire effect": warm while it lasts, cold by morning. Some programs, eager to "do," forget to pause, analyse, and link experience to broader ecological and social questions.

That is where teachers make the difference. By helping students probe beneath the surface—asking, for instance, how consumer culture fuels plastic dependency, or how local waste economies shape daily choices—they turn a recycling project into an act of critical inquiry. Reflection, in this sense, becomes civic as well as cognitive.

Acknowledging these limits doesn't weaken the case for experiential learning; it strengthens it. When designed with intention—linking reflection, collaboration, and iteration—ecobrick

education can move from activity to transformation. Each bottle packed is a gesture of care, each discussion a bridge between the personal and the planetary. The task is not merely to make an ecobrick but to question what the act itself reveals about human consumption and the possibilities of repair.

In this light, experiential learning—when critically framed—becomes the bridge between the philosophical depth of eco-literacy and the practical realities of environmental pedagogy. It is how students learn *by doing*, *through reflecting*, and, ultimately, *for sustaining.*

Knowledge–Attitude–Behavior (KAB) Model in Environmental Education

Understanding why people act—or fail to act—sustainably remains one of education's most persistent challenges. The Knowledge–Attitude–Behavior (KAB) model (Hungerford & Volk, 1990) offers a useful way to think about this: learning shapes values, and values guide behavior. In theory, the sequence seems clear; in practice, it rarely unfolds so neatly. Students may understand why plastic harms rivers, yet still choose convenience over care. This tension lies at the heart of environmental education—the gap between what we know and what we do.

The KAB framework helps educators trace this pathway. Knowledge equips learners with cognitive understanding of environmental systems. Attitude shapes emotional and ethical orientations—care, empathy, or even discomfort when confronted with waste. Behavior becomes the visible expression of these internal changes. In ecobrick learning, this sequence is not theoretical but tangible: students collect and clean discarded plastics, transforming what was once waste into something purposeful. Through this process, knowledge is reinforced by doing, and attitude is deepened through shared experience. The act of creation becomes a quiet but persistent teacher.

Still, the journey from awareness to sustained action is not automatic. Studies show that students who perform well in environmental knowledge tests often revert to old habits once class projects end (Kollmuss & Agyeman, 2002). It is one thing to grasp a concept; it is another to live it. The missing link often lies in context—whether the environment, peer culture, and school practices make green behavior possible or even rewarding. The KAB model, then, should not be read as a fixed formula but as a behavioral landscape: a way to understand how knowledge and attitude interact with real social and material conditions.

Critics have long challenged the linearity implied by KAB. Stern (2000) argue that environmental actions emerge not from cognition alone but from a mix of social influence, infrastructure, habit, and emotional attachment. In Indonesia's collectivist settings, behavior often mirrors shared identity more than personal intention. A student may join an ecobrick project not out of private conviction but because her peers, teachers, and community model it as a valued norm. This perspective reminds us that environmental behavior is as much socially produced as it is individually chosen.

When viewed through this lens, ecobrick learning operates less as a behavior-changing tool and more as a social practice that reinforces belonging and care. The process of sorting, cleaning, and compressing waste invites repetition, teamwork, and conversation—conditions under which knowledge becomes embodied and values are lived rather than stated. Over time, students begin to see themselves not just as participants in a classroom project, but as contributors to a collective effort

toward sustainability. The KAB model provides the structural logic of this change, but it is the reflective and communal experience that makes the behavior endure.

Ecobrick as a Pedagogical Innovation

When integrated into classroom learning, the making of an ecobrick (Antico et al., 2017) creates a *small laboratory of experience*. Students collect, clean, and compress plastic waste—simple acts that invite them to observe, question, and reflect. In this process, waste becomes both material and metaphor: a record of everyday consumption, and a reminder of its ecological cost. The work nurtures cognitive understanding (distinguishing types of waste), affective awareness (discomfort at the volume of plastic handled), and behavioral attentiveness (the slow, deliberate act of reducing and reusing). These dimensions correspond closely with Kolb's (2007) experiential learning cycle, where knowledge grows through doing and reflecting, and with the affective depth that eco-literacy seeks to cultivate.

Still, the educational potential of ecobricks depends on *how* they are framed. Without guided discussion, critical questioning, or curricular connection, the activity risks becoming another recycling project—briefly engaging but conceptually thin. Critics of experiential pedagogy have long warned that action-based learning can devolve into rituals of activity that emphasize motion over meaning (Kayes, 2002). In such cases, students may remember how to make ecobricks but fail to connect the act to broader questions about consumption, inequality, or environmental justice.

Viewed through this lens, ecobricks are best understood not as solutions but as pedagogical tools for inquiry. They create moments where environmental awareness becomes tactile—where students feel the weight of their own waste—but it is the teacher's mediation that transforms experience into understanding. In Kalimantan, where environmental education intersects with local culture and community life, this reflective framing becomes essential. When teachers invite students to discuss where the plastics come from, or how local practices manage waste differently, the lesson shifts from cleanliness to consciousness.

In this way, ecobricks serve less as ends than as means of thinking—objects that anchor discussion, provoke reflection, and situate sustainability within the texture of everyday life. Their promise lies in their simplicity: they make it possible to begin complex conversations using what is already at hand. Yet their limitation is equally clear: without continuity, critical reflection, and institutional support, the practice remains symbolic. Recognizing this tension is what keeps the innovation pedagogically honest—and what allows it to evolve from activity toward deeper ecological learning.

Method

This study employed a qualitative approach that combined conceptual reflection with field-based exploration. The research was conducted at SDN 4 Menteng, Palangka Raya, Central Kalimantan, in August 2025, through a three-day environmental education program focusing on waste management and eco-literacy development. The activity served as both a pedagogical intervention and an empirical context for conceptual inquiry.

The research subjects were 39 participants, consisting of elementary school students and their teachers. The program aimed to explore how hands-on activities, such as ecobrick-making, could

serve as learning media to promote understanding, awareness, and behavioral orientation toward sustainable practices in a low-resource school environment.

The procedure consisted of five interconnected stages: (1) needs analysis, (2) program design and planning, (3) eco-literacy training, (4) ecobrick activity, and (5) evaluation and reflection. In the needs analysis stage, preliminary discussions with teachers identified current waste management challenges in the school, existing environmental learning practices, and gaps in student participation. The design and planning stage involved developing lesson outlines, activity guides, and simple reflective instruments to be used during the program.

During the eco-literacy training phase, teachers and students were introduced to key environmental concepts—waste categorization, ecological impacts of plastic pollution, and the principle of transforming waste into useful materials. This was followed by the ecobrick activity, during which participants collected, cleaned, and compressed plastic waste into reusable bottles. Throughout this stage, teachers facilitated reflection sessions where students discussed the meaning of their actions and connected classroom activities to everyday ecological responsibility.

The final stage was evaluation and reflection, conducted after the program. Data were gathered through questionnaires and semi-structured interviews to document participants' reflections, perceived learning, and attitudes toward waste management. At the same time, non-participant observation was carried out across the three-day period to record behavioral engagement, collaboration, and teacher facilitation patterns.

Data sources included observation notes, interview transcripts, and questionnaire responses. The instruments used consisted of structured observation sheets to record participation levels, short questionnaires to measure post-program understanding and attitudes, and interview guides to elicit teacher insights about the pedagogical process. To ensure data richness, triangulation among these three sources was applied, capturing both student and teacher perspectives.

Data analysis followed an inductive and interpretive approach. The collected information was read repeatedly and coded for recurring ideas related to eco-literacy dimensions (knowledge, attitude, and behavior), experiential learning processes, and contextual factors influencing environmental engagement. The emerging themes were then interpreted in relation to theoretical perspectives drawn from Capra's eco-literacy framework (2007), Kolb's experiential learning model (2007), and the Knowledge–Attitude–Behavior (KAB) model (Hungerford & Volk, 1990). The goal was not hypothesis testing, but conceptual synthesis—linking theory and local experience to refine the Ecobrick-Based Eco-Literacy Model.

The analysis emphasized meaning-making rather than measurement, focusing on how participants interpreted and enacted ecological values within their immediate school environment. While the brief three-day engagement limited the scope for long-term behavioral observation, it provided valuable insight into how environmental awareness may take shape through participatory and reflective activity. The resulting framework thus bridges theoretical insight and lived experience, proposing an interpretive model of how eco-literacy can be cultivated through culturally grounded, low-cost educational innovations.

Ethical considerations and trustworthiness were central to the study design. All activities were conducted with approval from the school principal and in collaboration with participating teachers. Students were informed of the educational purpose of the program, and all participation was voluntary, supervised, and non-evaluative. No personal identifiers were recorded, and all reflections were treated as part of learning rather than as assessment. To ensure trustworthiness, triangulation of data sources (observation, interview, questionnaire) was combined with researcher reflexivity, documented through field notes capturing both participant responses and the researchers' interpretive stance. Although the engagement lasted only three days, contextual validity was strengthened by aligning the program with the school's ongoing environmental initiatives and by situating interpretations within the local ecological and cultural realities of Kalimantan.

In this sense, ethical rigor in the study extended beyond procedural compliance to include relational ethics—respecting participants' agency, cultural values, and learning environment. The credibility of the findings lies not in statistical generalization but in the authenticity of the voices, reflections, and experiences that informed the development of the Ecobrick-Based Eco-Literacy Model.

Result and Discussion

The conceptual framework proposed in this paper weaves together three interrelated strands—eco-literacy, experiential learning, and the knowledge–attitude–behavior (KAB) model—to illustrate how sustainability learning might unfold through ecobrick-based activities in schools. The model does not present a fixed pathway but a dynamic interplay among understanding, valuing, and acting, shaped by both individual reflection and social context.

At its foundation lies eco-literacy, which provides the moral and intellectual compass for sustainable education. It encourages learners to read ecological patterns and to recognize waste as more than a technical byproduct—it is a symptom of how societies relate to nature. This orientation ensures that environmental learning begins with meaning and moral inquiry, not simply with instruction. Eco-literacy frames *why* students should care.

Experiential learning forms the pedagogical core of the framework. It translates awareness into lived experience. In ecobrick projects, students move through Kolb's learning cycle: *concrete experience* (handling plastic waste), *reflective observation* (discussing where it comes from), *abstract conceptualization* (understanding reduction and reuse), and *active experimentation* (creating useful materials). Each phase connects thinking to doing. In Kalimantan classrooms, these activities often take on a communal dimension—students collect plastics from home, teachers facilitate reflection circles, and parents observe or participate. When designed intentionally, such experiences can turn environmental problems into learning moments that link personal agency with collective responsibility.

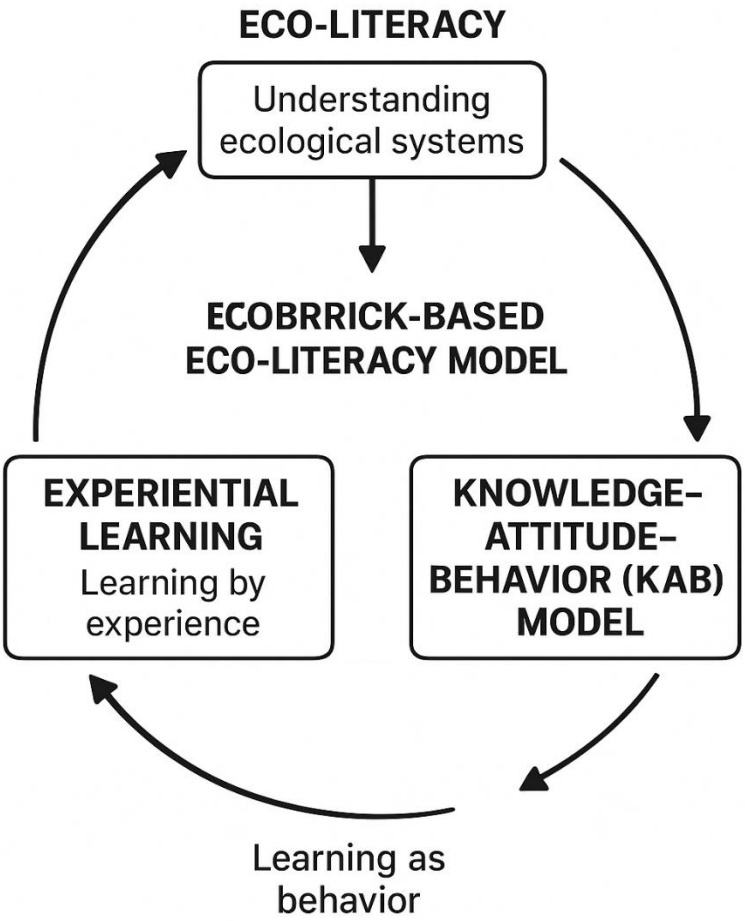

Figure 1. Ecobrick-Based Eco-Literacy Model

The KAB model (Hungerford & Volk, 1990) provides the behavioral logic within this framework. It explains how environmental knowledge, attitudes, and actions influence each other in complex feedback loops. Within ecobrick learning, as students understand waste and value sustainability, they begin to experiment with new habits—sorting, saving, or reusing plastics. When schools display their ecobricks in visible forms, such as garden benches or classroom walls, the action becomes social; students see their contribution embedded in a shared artifact. In this way, behavior becomes situated, not isolated.

Yet it would be overly simplistic to suggest that experiential learning or ecobrick-making alone can produce enduring behavioral change. Experiential learning is catalytic, not causal. It can ignite reflection and emotion—the psychological conditions from which change often begins—but it rarely sustains transformation without broader reinforcement. Behavioral research (Kollmuss & Agyeman, 2002) shows that long-term environmental action depends on supportive systems: institutional structures, peer norms, and cultural validation. Without these, the enthusiasm sparked by an ecobrick project may fade once the activity ends.

Critics of action-based pedagogy (Sterling, 2010) further warn that such approaches can become symbolic rather than transformative—focused on the act rather than its meaning. Students

may diligently pack bottles but never question the social and economic systems that generate so much plastic waste. From this view, ecobricks risk becoming a "comfort practice," offering moral satisfaction without confronting structural change.

Acknowledging these limitations strengthens the framework. It reframes ecobrick learning as a gateway practice—a tangible starting point for developing eco-literacy, not a complete solution. The value of ecobrick education lies not in the object produced but in the reflective and communal processes it enables. When students discuss consumption, trace the journey of waste, or connect school activities with family habits, experiential learning expands into critical ecological inquiry.

The Ecobrick-Based Eco-Literacy Model (see Figure 1) thus represents a cyclical process of *learning about systems*, *learning by experience*, and *learning as behavior*. Reflection weaves through all stages, ensuring that action remains meaningful and contextually grounded. The process is iterative: every act of engagement deepens understanding, and every insight invites renewed action. In Kalimantan—where rivers carry both life and waste—such cycles of awareness and reflection may nurture not only knowledge but a slow cultivation of care.

Ultimately, this framework does not claim that ecobricks change behavior by themselves. Rather, it argues that when embedded within a broader ecology of learning—supported by teachers, communities, and institutional norms—experiential practices like ecobrick-making can *open pathways* toward more enduring environmental responsibility. Transformation, in this sense, is not a single event but an evolving relationship between knowing, doing, and belonging to the living systems that sustain us.

The *Ecobrick-Based Eco-Literacy Model* offers a conceptual way to rethink environmental learning in schools — not as a set of projects or slogans, but as a living practice of awareness, care, and shared responsibility. Its significance lies less in the novelty of ecobricks themselves than in what they represent: a small, material invitation to reconsider the relationship between learning and living sustainably. In the context of Kalimantan, where schools often face resource constraints yet remain deeply rooted in community life, such simple, participatory methods hold pragmatic value. They allow environmental education to begin not with policy or technology, but with something students can touch, question, and transform.

Yet even as the model highlights this potential, it also demands caution. Awareness, no matter how vivid, does not automatically yield transformation. The experience of *SDN 4 Menteng*, where 39 students and teachers participated in a short ecobrick project, demonstrates this clearly. Over three days, the classroom turned into a kind of workshop. Students brought plastics from home—snack wrappers, bottles, sachets—and began the slow, tactile work of cleaning and packing them into bottles. Teachers used the process to discuss the life cycle of materials, the idea of waste reduction, and the notion of shared responsibility. One teacher later described the project as "a mirror," because it showed students, quite literally, the amount of waste they themselves produced. For many, it was a first encounter with their own ecological footprint.

These reflections point to what experiential learning can do well: make the invisible visible. As Kolb (2007) suggests, learning becomes powerful when it moves through the full cycle—experience, reflection, conceptualization, and experimentation. The ecobrick process embodies this

rhythm. Students engage with the physical reality of waste (experience), talk and think about its causes (reflection and conceptualization), and then act by reusing it (experimentation). The process is intuitive and embodied; it translates abstract environmental concepts into sensory understanding. In contexts where textbooks and laboratories are scarce, the waste itself becomes the learning material.

However, the limits of such learning are equally important to acknowledge. As teachers observed, enthusiasm was high during the activity, but there was uncertainty about its longevity. Would students continue separating their waste once the project ended? Would they reflect differently on their consumption habits at home? The answer, as environmental behavior research consistently shows, is complicated.

Behavioral studies (Geng et al., 2016; Kollmuss & Agyeman, 2002) have long argued that environmental knowledge and positive attitudes, while necessary, are insufficient for behavioral change. Habits are embedded in social routines, economic constraints, and cultural norms. A student may feel guilty about waste yet continue using single-use plastics because alternatives are scarce or inconvenient. Similarly, schools may promote eco-friendly messages but still rely on disposable teaching materials. Ecobricks, in this light, are catalytic but not causal—they can spark attention, but they cannot sustain change alone.

Pedagogically, the model highlights a recurring tension in experiential approaches: the risk of activity without reflection. As Wals et al., (2008) warn, environmental projects often fall into a pattern of *doing for doing's sake.* The act of making an ecobrick can feel satisfying and morally affirming, yet remain intellectually shallow if it is not accompanied by critical dialogue. Reflection is what turns activity into understanding; without it, the lesson risks becoming a moral ritual rather than an educational encounter. Teachers play a decisive role here. Their questioning—Why so much plastic? Who produces it? What alternatives exist?—shifts the focus from recycling to reimagining.

This pedagogical nuance is crucial. In Kalimantan, as in many parts of Indonesia, environmental issues are not abstract. They shape daily life: clogged drains, burning waste, floating plastics along riverbanks. When students clean and repurpose plastics, they engage not just with science but with a local reality that touches their families and communities. But to make that engagement meaningful, educators must connect the classroom to the world beyond it. As Sterling (2010) notes, sustainability education fails when it isolates itself from the very systems it hopes to change. The most effective learning occurs when ecological thinking is woven into the social and cultural fabric of the school itself.

Culturally, the model must also confront the question of context and relevance. Sustainability cannot be imported wholesale from global frameworks; it must resonate with local ways of knowing. Kalimantan's indigenous Dayak communities, for instance, have long practiced forms of ecological stewardship rooted in reciprocity and restraint—taking only what is needed and respecting natural cycles. When teachers connect these local values to modern sustainability lessons, eco-literacy becomes culturally grounded rather than imposed. It speaks in a familiar moral language: that of care for the forest, the river, and the community.

At the same time, such cultural grounding is not without tension. Modern schooling often privileges standardized curricula that leave little space for local adaptation. Teachers may feel torn between prescribed content and the urge to contextualize. The *Ecobrick-Based Eco-Literacy Model* thus also serves as a quiet critique of the current educational system: it asks how schools might regain flexibility to make learning responsive to their own ecological surroundings. It suggests that environmental education cannot be something added onto the curriculum; it must become the lens through which all learning is viewed.

This has clear implications for curriculum design. Rather than treating environmental education as a separate subject, schools could integrate it as a cross-disciplinary theme—linking science (material properties, energy use), social studies (community practices), and civic education (responsibility and participation). In this approach, ecobricks become a bridge: an artifact through which students can discuss resource cycles in science, waste economics in social studies, and collective ethics in citizenship lessons. Such integration also mirrors the systems thinking emphasized in eco-literacy—the idea that understanding emerges from seeing connections rather than compartments.

For teachers, the framework underscores a shift in professional identity. In experiential environmental education, the teacher is less a dispenser of knowledge and more a mediator of meaning—someone who helps students interpret, question, and relate their experiences to wider systems. This role requires confidence, reflection, and creative judgment. In SDN 4 Menteng, several teachers noted that they themselves became more conscious of their own habits during the project. One remarked, “I used to think of plastic as just waste; now I think of it as evidence of how we live.” This reciprocal learning—where teachers learn alongside students—is precisely what gives eco-literacy its transformative edge.

At the institutional level, the framework suggests that environmental education should evolve from isolated activities into an ongoing school ethos. Small routines—separating waste, reducing paper use, or reflecting daily on environmental topics—help embed sustainability into everyday practice. When students see their efforts valued and sustained, learning becomes communal rather than episodic. The concept of a *school culture of care* may sound modest, but its cumulative effect can be significant. Research on whole-school sustainability approaches (Stevenson, 2007) shows that consistent, visible practices—rather than occasional campaigns—are what normalize ecological responsibility.

In Kalimantan’s schools, this cultural shift is particularly relevant. Environmental challenges here are not distant threats; they are lived realities tied to geography and livelihood. Peatland fires, deforestation, and river pollution are part of the collective memory of many communities. Addressing these issues requires not only scientific understanding but social empathy—a recognition that environmental harm often intersects with poverty, access, and policy. Schools, as social microcosms, are uniquely placed to nurture that empathy. Through modest projects like ecobricks, they can help students see how environmental care begins with attention: noticing what is around them, tracing the consequences of small acts, and discussing how collective choices shape the commons.

Nevertheless, the model also invites self-critique. Ecobricks may symbolize care, but they also reflect a paradox: turning waste into building blocks can risk normalizing plastic use rather than reducing it. Some critics argue that such approaches divert attention from the systemic roots of plastic production—corporate supply chains, consumption patterns, and inadequate waste policy. A mature eco-literacy must therefore teach not only personal responsibility but structural awareness. Students should be encouraged to ask, "Why does so much single-use plastic exist?" as much as "How can we reuse it?" In this way, education becomes not only adaptive but also political: a means of imagining different futures, not just managing existing waste.

From a broader pedagogical perspective, the *Ecobrick-Based Eco-Literacy Model* contributes to ongoing debates about the purpose of environmental education in the Global South. Too often, sustainability discourse assumes Western pedagogical ideals—project-based learning, digital tools, or large-scale recycling systems—that may not fit local realities. Kalimantan's schools offer an alternative vision: one where sustainability begins with what is available, guided by community involvement and cultural meaning. The ecobrick, in this sense, becomes a symbol of pragmatic creativity—transforming scarcity into opportunity, and constraint into pedagogy.

Ultimately, the implications of this model reach beyond the classroom. It gestures toward a broader philosophy of education—one that values slowness, care, and situated understanding over performance and measurement. Change, if it happens, will be uneven and slow, woven through relationships rather than directives. The small, careful work of cleaning and packing plastic bottles may seem trivial, yet it embodies a deeper principle: that sustainability begins in attention. Attention to materials, to consequences, to each other.

In conclusion, the *Ecobrick-Based Eco-Literacy Model* does not promise behavioral transformation. It offers instead a conceptual and pedagogical orientation: a way of seeing education as a practice of ecological awareness. When implemented with reflection, cultural sensitivity, and institutional support, even modest activities can nurture dispositions of care that extend beyond the classroom. For schools in Kalimantan, where ecology and culture are inseparable, this approach reclaims education as a site for both understanding and belonging—to place, to community, and to the living systems that sustain them.

Conclusion

This paper has proposed the *Ecobrick-Based Eco-Literacy Model* as a way of conceptualizing how sustainability learning might take shape within the everyday realities of schools. Drawing on eco-literacy, experiential learning, and the knowledge–attitude–behavior framework, it argues that meaningful environmental education grows where knowledge, reflection, and collective action intersect. Yet, throughout the discussion, it has become clear that the value of such models lies not in their elegance but in their adaptability—how they respond to real classrooms, communities, and constraints.

The illustrative case of SDN 4 Menteng showed that short, low-cost, participatory activities such as ecobrick-making can open new pathways for environmental understanding. They make waste visible and moral reflection tangible, giving students and teachers a shared language for care. But as the

literature and local experience both suggest, these acts are beginnings, not endpoints. Without ongoing reinforcement—curricular continuity, supportive school culture, and alignment with local norms—such enthusiasm fades. The framework therefore offers not a blueprint for behaviour change, but a map of conditions under which eco-literacy might emerge and evolve.

From a pedagogical standpoint, this means treating experiential learning as critical practice—a cycle of doing, reflecting, and questioning, rather than an isolated project. Teachers become the linchpins of this process. Their capacity to connect ecological issues with daily life, to mediate between scientific ideas and cultural values, and to sustain reflection beyond activity determines the depth of learning. Supporting teacher professional growth in this area is therefore essential for schools that aim to cultivate sustainable habits, not just environmental awareness.

Institutionally, the implication is to view sustainability not as an extracurricular theme but as a whole-school orientation. Small routines—reducing waste in class, discussing environmental issues during assemblies, or showcasing student projects—help embed eco-literacy within school identity. Policy support from local education offices could reinforce this by integrating environmental reflection into assessment rubrics or community engagement programs. Such systemic coherence is what allows conceptual models like the one proposed here to take root in practice.

For future research, the framework invites empirical testing and contextual refinement. Longitudinal studies could examine how eco-literacy develops over time and what forms of reinforcement sustain behavioural change. Comparative work might explore how local ecological knowledge, such as Dayak traditions of stewardship, can inform modern sustainability pedagogy. These directions would deepen the theoretical foundation laid here, helping bridge conceptual insight and educational practice.

In the end, the argument of this paper is deliberately modest. Ecobricks alone will not transform environmental behaviour, but they can reframe how schools imagine sustainability—as something teachable through experience, reflection, and care. If education is to nurture lasting ecological awareness, it must begin not with grand programs, but with the small, thoughtful acts that teach students what it means to live responsibly within the systems that sustain them.

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