Harnessing the Natural Environment for Holistic Development in ECE: Strategies and Perceptions from Two Indonesian Kindergartens

Istifadah[1], Lailatul Usriyah[2], Jauhari[3], Fihris Maulidiah Suhma[4], M. Andya Duta Ardha [5]

{isti68rosyadi@gmail.com[1], lailatulusriyah1978@uinkhas.ac.id[2], jauhari@uinkhas.ac.id[3], fihrismaulidiahsuhma@gmail.com[4], andya.duta@gmail.com[5]}

Universitas Islam Negeri Kiai Haji Achmad Siddiq Jember, Indonesia[1234], Gajah Mada University, Indonesia[5]

Abstract. The natural environment offers unique affordances for early childhood learning yet remains underutilized within Indonesian ECE. This qualitative case study at two pioneering institutions explores (1) strategies educators use to integrate natural elements into curricula, (2) educators' and parents' perceptions of outdoor learning, and (3) perceived impacts on children's cognitive, socio-emotional, and sensorimotor development. Data from four-week participatory observations, semi-structured interviews with principals, educators, and a parent, and document analyses reveal that nature-based activities—from hands-on science experiments to risk-managed free play—enhance attention spans, deepen conceptual understanding in mathematics and science, accelerate gross motor skills, and foster emotional intelligence. Successful implementation depends on teacher facilitation skills, structured reflection, and active parental engagement, underpinned by clear safety protocols and institutional support. Findings underscore the transformative potential of nature-centered pedagogy for holistic child development. Recommendations include embedding outdoor modules into national curricula and investing in targeted teacher training to sustain place-based, experiential learning.

Keywords: early childhood education; natural environment; outdoor learning.

1 Introduction

The natural environment is a potential resource for promoting children's growth and learning[1]. The quality and characteristics of the Early Childhood Education (ECE) physical environment will influence elements such as children's play, physical activity, engagement, well-being, and social interaction[2]–[4]. Natural environments provide learning contexts that are quieter, calmer, safer, warmer, and more cooperative and encourage forms of play that are beneficial to children's development[5]. Natural environments' great potential and importance for teacher and student interaction practices have long been overlooked[6]. Over the years, the focus of educational psychology has primarily been on the cognitive, behavioral, and pedagogical aspects of the classroom despite evidence that these practices have adverse

ACIE 2024, October 14-15, Jember, Indonesia

DOI 10.4108/eai.14-10-2024.2356226

impacts and minimal effects on student achievement[7]. Improving the utilization of learning environments remains an important issue in the learning domain. The provision of learning environment resources for ECE has not been taken seriously at the national or local level[8]. The empirical facts above indicate a lack of attention to the potential of the natural environment as a learning resource for ECE, even though using the natural environment in the ECE learning process offers extensive and unique opportunities and benefits to maximize children's holistic and comprehensive learning experiences.

The natural environment serves as a rich setting for exploration and an authentic context that stimulates children's curiosity, creativity, and critical thinking skills. A growing body of research highlights that high-quality learning environments significantly contribute to holistic and sustainable child development[9]–[11]. Children evolve cognitively, socially, and emotionally through active engagement with their surroundings. As their material awareness and understanding of cause-and-effect relationships grow, they use their environment purposefully. An environment that supports the learning and development of early childhood learners should be designed based on interconnected components, encompassing social and physical aspects, including both artificial and natural elements[12], [13]. Interacting with nature allows children to grasp concepts through direct observation and hands-on experiences, often proving more effective than abstract instructional methods. Some scholars argue that the brain develops in response to environmental experiences, shaping learning[14], [15]. In line with this perspective, Indonesian government regulations emphasize that early childhood education (ECE) should adopt a play-based learning model, prioritizing meaningful interactions among children, educators, and the environment[16]. Play is a critical vehicle for social and emotional development, enabling children to learn cooperation, turn-taking, negotiation, and empathy. Through play, children engage all their senses in exploring the environment, solving problems, and internalizing concepts and skills. Creative play, in particular, helps children gain awareness of their bodies and abilities, develop interpersonal relationships, and build resilience as they navigate social, cognitive, and physical challenges[1].

Despite widespread acknowledgment of the benefits of nature-based learning for young children[5]–[7], empirical investigations into its systematic implementation within Indonesian early childhood settings remain limited[8]. The present study employs a qualitative case-study approach at two early childhood education institutions in Indonesia to examine how its surrounding natural environment is intentionally integrated into daily pedagogy. Specifically, this research aims to (1) identify the strategies and resources educators use to embed natural elements within the curriculum, (2) explore educators' and parents' perceptions of outdoor learning experiences, and (3) assess the perceived impacts of these nature-based activities on children's cognitive, socio-emotional, and sensorimotor development. The study seeks to inform policy and practice for sustainable, place-based early childhood education in Indonesia by generating in-depth, context-rich insights.

2 Method

This study adopted a qualitative case-study design to develop an in-depth, context-rich understanding of how the natural environment is integrated into daily pedagogy at two ECE

institutions in Indonesia. A case-study approach was chosen because it enables the exploration of complex phenomena within their real-life contexts and captures multiple stakeholders' perspectives in detail.

The institutions were purposively selected for their established nature-based learning program and willingness to grant full access to researchers. Participants included the school principal, two senior educators, and one parent whose child demonstrated notable health improvements through outdoor learning. These informants were recruited via criterion sampling to ensure they had direct involvement in and insight into the planning and implementation of outdoor activities.

Data were gathered through three complementary methods:

1 Participatory Observation. Over four weeks, the researcher joined scheduled outdoor learning sessions on the school's grounds, playground, and adjacent green spaces. Detailed field notes and photographs documented children's interactions with natural elements, educator scaffolding, and spatial arrangements.

2 Semi-structured interviews. The principal, educators, and parents were interviewed individually (45–60 minutes each). An interview guide addressed key topics, such as curricular integration of nature, perceived developmental outcomes, resource mobilization, and implementation challenges. All interviews were audio-recorded (with consent) and transcribed verbatim.

3 Document and Literature Review. Institutional documents (lesson plans, activity logs) were examined to trace the formal planning of nature-based activities. A targeted review of relevant Indonesian regulations and peer-reviewed literature contextualized local practices within broader early childhood education frameworks.

Transcripts and observation notes were analyzed inductively. First, open coding identified discrete units of meaning related to strategies, perceptions, and outcomes. Next, codes were grouped into higher-order categories and refined into themes by constantly comparing data sources. Analytic memos and code-recode exercises were maintained to support transparency and consistency in interpretation.

Preliminary thematic summaries were shared with participants (member checking) for feedback and clarification to enhance credibility. An audit trail—including field notes, coding schemas, and analytic memos—was kept to document the decision-making process, supporting dependability and confirmability. Detailed, contextual descriptions of the setting and participants were provided to aid transferability.

3 Result

3.1 The Potential of the Natural Environment for Child Development

It is shown in the results of the researcher's interview with EN as the principal as follows:

> We structure children's learning around the natural environment. That is crucial because when kids engage with nature, we notice real gains in their thinking, motor, and social-emotional skills. In our experience, getting outside and exploring helps them

> build cognitive abilities through hands-on discoveries and on-the-spot problem-solving. The children absolutely love it—they're free to play with anything they find around the school grounds.

What was conveyed by EN above was supported by EG, one of the educators, in the following statement:

> Outdoor learning makes children even more excited. They can quickly tell stories and name the objects they find, which is useful for their visual literacy of the environment. On the other hand, this outdoor learning makes children able to discuss one material for longer. The children were more relaxed and less bored.

In line with the two opinions of the interview results above, RF, one of the guardians of students, said as follows:

> The children here always seem so happy because learning feels like playing. The teachers give them free rein to dig in the sand, get messy with soil, and even 'cook' using natural materials. They also weave in counting lessons by introducing animals and plants they find around the school. My child is much more engaged and never gets bored, so the concepts the teacher teaches stick with them and are easier to remember.

Some of the interview statements above indicate that the natural environment has great potential to be utilized as a learning resource for ECE. Field observations showed that children's enthusiasm was reflected in their facial expressions and gestural responses during outdoor learning. Their passion for curiosity was visible during outdoor learning, as seen from their intense attention when the educator explained the material.

The Impact of the Natural Environment on Sensorimotor Development.

In addition to providing cognitive benefits, learning in the outdoor natural environment also has potential in motor development. The natural environment provides extensive opportunities to support early children's learning implementation through interactive, inspiring, fun, contextual, and child-centered play. When allowed to play in the natural environment freely, children will test the limits of their physical abilities: how high they can climb, how heavy they can lift, how far they can throw, and how fast they can run. The results of an interview with the headmaster are as follows.

> We make a point of scheduling outdoor play—it is the heart of our nature-based approach. In the classroom, movement is limited, and you can see the kids cannot sit still. When they are running, jumping, or kicking a ball, that tells us their motor skills are on track. However, if you notice them staying still or seeming reluctant to move, you wonder whether their motor development might lag.

What she said above was also experienced by EG while accompanying children during outdoor play and activities, as follows:

> Sometimes we even feel overwhelmed," the educator smiled. "Even though the children here are free to play, we keep a close eye on them the whole time. At the beginning of each session, we model the movements together—just some light gymnastics to warm up their legs, arms, and the rest of their bodies. After that, they're free to choose whatever activity they enjoy, which is what they look forward to. Once we give them the go-ahead, they just want to keep playing!

Related to the above, another educator, RF, said as follows:

> Yes. When it is time for outdoor play, the children cannot sit still. Some run and chase each other, others play soccer, climb, or jump. I sometimes get a headache trying to keep an eye on them all. Even when it rains, the teachers let the children play in the rain.

The observation results show that what was conveyed by the three informants above can be observed. All students seemed enthusiastic about actively participating in the movements modeled by the teacher. Even though it does not look perfect, all students try to follow the movements as exemplified. That can be seen in the documentation as follows:

Figure 1
Physical Movement Training Activity
(Source: Researcher, Observation on September 5, 2024)

The Impact of the Natural Environment on Socio-emotional Development.

In addition to academic benefits, incorporating the natural environment into the school curriculum can be an easy and inexpensive way to improve children's psychological well-being. The results show a dynamic relationship between the outdoor environment and the play in which children engage. Playing naturally will test children's courage and build their self-esteem. Thus, socially, they will practice cooperating and sharing, leading and negotiating, making friends, and standing up for themselves. The same thing is also shown in the interview with a teacher EN as follows:

> While outside playing, each child goes through their little adventures. Sometimes, they squabble or tussle over toys, but that is how they learn to share and cooperate. We see those moments as key opportunities for them to build emotional intelligence.

Related to this, another teacher, EG, agreed with what was conveyed by her by saying the following:

> Yes, that is just how children are—they squabble and scramble one moment, then are back to playing the next. To help them learn cooperation and sharing, we organize

> cooking sessions. The kids enjoy being involved in every step; they work together enthusiastically, and everyone shares what they have prepared when the cooking is done.

In line with the opinions of EN and EG above, in the interview below, RF said as follows:

> I am so grateful my child can come here. It is not just classroom work – lots of play and outdoor activities, daily care routines, nature walks, and even cooking. Seeing all that my child gets to do has been wonderful. At home, we could not give them experiences like these.

Based on observations in the field, what is conveyed in the interview statement above can be observed. Cooking activities, for example, what the children did clearly illustrated the involvement of emotional aspects. In the process, this cooking activity involves the cooperation of all students. Some are fetching water, some are making dough, and some are preparing cooking utensils; of course, these processes remain in the context of learning by paying attention to safety and security factors under the teacher's guidance.

3.1.2 Natural Environment as a Learning Resource

According to several studies, the natural environment is an important outdoor learning resource. As a learning resource, the natural environment offers potential benefits to the following categories of child development as described:

Children’s Health and Well-being

The following interview with EN provides an overview of the natural environment's involvement in improving children's health and well-being through activity, joy, and satisfaction.

We hope for that. Children's health is the most important consideration. Learning cannot go well if the children are unhealthy. So, physically and psychologically, children must be healthy. Well, these two things find their meeting point in the natural environment. Children's freedom to move and do activities with their friends in nature will support their physical and psychological development. For this reason, this school makes nature the basis of learning.

Responding to what was conveyed by EN above, in the interview below, EG said:

> When the children learn outdoors, they are always enthusiastic and cheerful—almost like they have been let out of a cage, free to do whatever they want. Usually, they play however they like, and we supervise and make sure they have everything they need. Even when they ask to play in the rain, we let them—as long as it is not pouring—since a small amount of rain actually helps boost their immunity.

Student guardians also support the above conditions. RF, one of the student guardians, said as follows:

> I was worried at first because of my child's condition. The doctor said he had an immune issue and would get sick all the time from dust allergies—he even wore a mask everywhere. Since coming to this school, he has gradually improved and hardly ever falls ill.

Based on some of the interviews above, the natural environment is a potential resource for early childhood learning. It is possible because the natural environment offers extensive possibilities for improving children's health and activity and enhancing their joy and satisfaction.

Experiences in Nature and from Nature

To describe experiences in nature and from nature, in the interview below, EN said the following:

> We have seen that introducing children to nature from an early age positively impacts them. When they experience nature with their peers, it helps with their academic learning and supports their personal growth. The things they find in nature can later be used as learning materials. Plus, when children spend much time outdoors, it helps build their awareness and care for the environment.

Similarly, EG shared, *"Sometimes, the children are not very active when learning in the classroom. However, they seem much more eager to participate in the activities when they are outside in nature. I have noticed that it is easier for them to interact and communicate with their friends."* These reflections from EN and EG highlight the significant potential of natural environments to enrich early childhood education. Outdoor settings offer various sensory and social experiences that support structured and unstructured learning through physical activity and play. In line with this, RF remarked, *"Well, yes, I feel that my child seems happier when playing outside with their friends.*

Based on field observations, what is described in the statements of the three informants above can be observed, as seen in their facial expressions and gestures.

Intensive experiences in outdoor play spaces also tend to be rich in opportunities to foster growth in all domains of child development, including adaptive, aesthetic, cognitive, communication, sensorimotor, and socio-emotional, which can be described in the following table:

Table 1. Child Development Domains Fostered by Intensive Outdoor Play

Child Development Domain	Description	Example Related Skills	Example Related Elements and Experiences in Nature
Adaptability	Ability to function successfully in its environment	Maintain balance while walking on various surfaces and uneven terrain	Grass, gravel, sand, tree roots, inclines
Aesthetics	Sensitivity to natural beauty and art	Attention to colors, scents, sounds, and texture	Leaves, flowers, birdsong, moss, feathers, and the wind
Cognitive	Mental understanding	Understanding size, shape, weight, comparison, and cause and effect concepts.	Trees, rocks, eggshells, water and light
Communication	Ability to share ideas, thoughts, and feelings	Describe, ask questions, behave, tell stories	Animals, other properties of water, weather changes, cloud shapes, and nests

Child Development Domain	Description	Example Related Skills	Example Related Elements and Experiences in Nature
Sensorimotor	Motor perception and physical movement	Seeing, hearing, tasting, feeling, crawling, running, carrying, digging, splashing	Motion of branches blowing in the wind, the sound of water falling on rocks, freshly picked berries, logs, grass, stones, soil, water
Socioemotional	Interaction with others and sense of self	Problem-solving, sharing, pretending, caring, building	Sticks, grass, leaves, nest, garden and gardening tools, bird bath and bird feeder

3.1.3 Pedagogical Prerequisites for Utilizing the Natural Environment.

A clearer picture of the teacher's role as a mediator and outdoor learning organization can be traced in the results of an interview with EN as follows:

> We really try to make learning holistic so the kids are not just listening to stories—they are out in the field doing things with their teachers or caregivers right by their side. For example, they will do hands-on science experiments, walk through the Hajj rituals, pray together in the congregation, and get up close to the natural world. We depend so much on each teacher— they are the ones who bring it all to life. Moreover, it is not just teachers: we bring parents and the whole community along, too, because everyone has a part to play in making learning successful.

In line with what EN stated above, AR, as one of the supervisors/teachers, also stated that:

> Outdoor learning really gets the kids pumped. They point out everything they see, which is fantastic for their visual literacy, and they share and work together, which boosts their emotional development. Think cooking lessons under the open sky, hands-on science experiments, class outings—you name it. We continuously loop in the parents, inviting them along so we can explain what we are doing and, of course, keep an eye on everyone's safety and well-being.

Responding to the statements of EN and AR above, in the interview below, RF said as follows:

> Yes, ma'am, I always get a call from EG or AR whenever they plan activities outside the classroom. The kids here love it—they are always invited to play with sand and soil, do a bit of cooking with their teachers, and sometimes even try buying and selling in a mini supermarket. We parents join in now and then, too, even though the teachers are there to guide them.

The results of field observations clearly illustrate teachers' involvement in various outdoor activities, as shown in some of the pictures in the documentation. This involvement also shows the role of teachers as mediators and other important roles as competent and responsible parties in the organization of outdoor learning outside the classroom. In this case, teachers also play a role in communicating with parents, the community, and other parties who may be involved forever in learning activities.

4 Discussion

Referring to the study results of several informants and the literature above allowed the researcher to synthesize and explain the benefits and challenges of utilizing the natural environment in early childhood learning. This analysis highlighted three opportunities for the natural environment in early childhood development as follows:

3.2.1. The potential of the natural environment for early children's development.

Based on the findings of this study, the potential of the natural environment in early childhood development includes at least three aspects, namely cognitive, sensorimotor, and social-emotional aspects. The discussion is as follows:

Cognitive Engagement in Natural Settings

The interview data consistently underscore the role of the outdoor natural environment as a potent catalyst for children's cognitive development. EN, the principal, emphasizes hands-on discovery and on-the-spot problem solving, noting observable improvements in "thinking, motor, and social-emotional skills" when instruction is anchored in nature. EG echoes this, highlighting enhancements in visual literacy—children rapidly "tell stories and name the objects they find"—and sustained focus during material exploration. RF, a guardian, further corroborates these findings, observing that integrating natural materials into counting lessons engenders greater engagement and longer retention of concepts. These convergent perspectives, triangulated by field observations of intense concentration and animated facial expressions during outdoor sessions, suggest that the natural environment fosters deeper cognitive processing through multisensory, contextualized learning experiences[17], [18].

Natural environments serve as rich "learning laboratories" where children construct knowledge through multisensory exploration. From a constructivist standpoint, the variability of outdoor stimuli—uneven terrain, living organisms, shifting light, and shadow—challenges children's schemas and prompts active accommodation[19], [20]. Moreover, situated cognition theory posits that knowledge is inextricable from context[21]; by embedding academic concepts in authentic tasks (e.g., counting seeds or estimating leaf sizes), children internalize mathematical and scientific principles more robustly than through decontextualized drills[22], [23]. These processes also align with executive function development: planning routes to collect natural materials exercises working memory and cognitive flexibility while negotiating turn-taking hones inhibitory control. Thus, the natural environment catalyzes a synergistic advance in domain-specific knowledge and general-purpose cognitive skills[24].

Sensorimotor Stimulation Through Free Play

Beyond cognition, the data reveal the natural environment's unique affordances for sensorimotor development. According to the principal, movement limitations inherent in indoor classrooms become apparent when children "just cannot sit still" yet thrive when afforded space to run, jump, and climb outdoors. EG's description of structured warm-ups followed by unstructured play illustrates how modeling physical movements primes children to explore their motor limits—testing how high they can climb or how far they can throw—while RF's account of rain-play demonstrates the program's commitment to risk-friendly environments. Observation notes from Figure 1 confirm that students eagerly attempt modeled

activities, even if imperfectly, indicating burgeoning coordination and body awareness. This dynamic interplay of guided instruction and free exploration accelerates gross motor skill acquisition, promotes risk-taking within safe bounds, and enhances kinaesthetic confidence[25].

A closer look at the motor development data indicates that the outdoor setting scaffolds progression across three motor domains—locomotor, manipulative, and stability skills[26]–[29]. Children's spontaneous climbing and balancing engage stability, whereas throwing natural objects targets manipulatives. Unstructured yet guided movement—warm-ups followed by open play—mirrors dynamic systems theory, whereby varied environmental affordances trigger self-organized motor exploration[30], [31]. Notably, the ethos of risk-friendly play appears central: allowing children to test their physical limits under close supervision facilitates optimal arousal for skill acquisition without compromising safety[32].

Socio-Emotional Learning in Outdoor Contexts

The interviews and observations also illuminate the socio-emotional dividends of nature-based education. EN describes playground squabbles and cooperative "little adventures" as critical opportunities for negotiating social norms, sharing resources, and developing emotional intelligence. EG's cooking sessions exemplify structured collaborative tasks: children jointly fetch water, prepare ingredients, and share the results, thereby practicing teamwork and turn-taking. RF's testimonial highlights how these activities fill absent experiential gaps in home environments, nurturing self-esteem and peer connections. Field documentation of cooking tasks shows children alternating between leadership and support roles, reinforcing empathy and mutual respect. Collectively, these accounts portray the natural setting not merely as a backdrop for play but as an active social arena where emotional resilience, negotiation skills, and communal bonds are forged[33], [34].

The natural environment can be conceptualized as a "social ecology" where children's interactions with peers and adults co-construct socio-emotional competencies[35]. Unstructured play scenarios create micro-conflicts over materials or play roles that serve as live laboratories for emotional regulation and perspective-taking[36]. Adding collaborative projects, such as cooking, introduces sequential planning and shared responsibility, fostering collective efficacy and empathy.

3.2.2. The Natural Environment as A Learning Resource

The following is a discussion of this study's findings from the perspective of the role of the natural environment as a source of learning for early childhood.

Enhancing Physical Health and Immunological Resilience

The data underscore the natural environment's critical role in bolstering physical vitality and immune function. EN's emphasis on "freedom to move" highlights how unstructured outdoor activity supports cardiovascular endurance, muscular strength, and gross motor coordination—foundational to children's overall health and readiness to learn. EG's account of controlled rain play introduces the concept of hormesis: mild environmental stressors (e.g., light rain, varying temperatures) that stimulate adaptive immune responses, which RF's testimony vividly illustrates through her child's reduced incidence of allergy-related illnesses. These findings align with the "old friends" hypothesis, suggesting that exposure to diverse environmental

microbiota—as encountered in soil and plants—can calibrate children's immune systems, reducing hypersensitivity[37], [38]. Notably, the school's policy of measured risk (permitting light rain but avoiding downpours) reflects a nuanced balance between health benefits and safety, showing how programmatic guidelines shape health outcomes.

Psychological Well-being: Joy, Autonomy, and Satisfaction

Beyond somatic gains, the natural setting serves as a crucible for psychological flourishing. EN frames health holistically—"physically and psychologically, children must be healthy"—acknowledging that emotional states underpin cognitive engagement. EG's metaphor of children "let out of a cage" speaks to autonomy and self-determination theory: the freedom to choose activities outdoors fulfills intrinsic needs for competence, relatedness, and autonomy, fostering tremendous enthusiasm and sustained participation[39]. RF's relief at her child's improved well-being further illustrates the spillover effect: positive affect generated in nature-based settings can permeate family life, enhancing satisfaction and bonding. The convergence of staff and parent perspectives suggests that psychological well-being in ECE is dynamically co-constructed by educator practices, environmental affordances, and parental observations, reinforcing the imperative to design curricula that foreground joy alongside health.

The natural environment also serves as a potent stimulant of positive affect and self-determination[40]. Freedom to choose activities outdoors fulfills children's intrinsic psychological needs—competence, autonomy, and relatedness—as framed by Self-Determination Theory[41]. EN's metaphor of "children let out of a cage" reflects how nature mitigates feelings of constraint and promotes creative agency, enhancing attention and reducing behavioral restlessness in subsequent classroom tasks. Parental observations of sustained enthusiasm and satisfaction highlight a spillover effect: positive emotional states in school transfer to the home environment, strengthening family cohesion, and reinforcing expectations for active play. However, variations in individual temperament and weather conditions can modulate these effects[42]; some children may require scaffolded choice architectures to fully engage, while extreme climates may necessitate adaptive scheduling to preserve psychological benefits year-round.

Experiential Learning: In Nature and From Nature

EN and EG's reflections illuminate the dual dimensions of experiential learning. "Experiences in nature"—the multisensory immersion in sights, sounds, and textures—activates attention restoration processes, replenishing cognitive resources depleted by indoor, structured tasks[43]. Simultaneously, "experiences from nature"—harvesting natural materials for academic purposes—exemplify authentic pedagogy, anchoring abstract concepts in tangible artifacts. This synergy fosters academic learning and environmental stewardship[44]: children acquire knowledge of biology and ecology through direct interaction (e.g., examining leaves and tracking animal behavior) and develop affective bonds with the natural world, prefiguring pro-environmental attitudes. Variations in engagement—some children are more drawn to tactile exploration, others to observational activities—underscore the importance of differentiated facilitation[45], where educators calibrate tasks to individual interests and developmental levels.

3.2.3. Pedagogical Prerequisites in the Utilization of the Natural Environment

Further analysis of this area should consider delving deeper into utilizing the natural environment from a pedagogical perspective. From this perspective it can be seen from two perspectives as follows:

Teacher as Mediator

The interview data consistently portray teachers as knowledge dispensers and active mediators who co-construct learning experiences alongside children. EN emphasizes that teachers "bring it all to life" by guiding holistic, multisensory activities—whether walking through Manasik Haji rituals or conducting field-based science experiments. They scaffold children's exploration of complex cultural and scientific concepts, moving beyond passive reception toward situated, experiential learning. AR's description of teachers leading cooking lessons and class outings reinforces this role: teachers frame the activity, model inquiry, and foster peer collaboration. These findings align with Vygotsky's notion of the Zone of Proximal Development, in which guided participation enables learners to perform tasks they would not yet master independently[46]. Thus, a core pedagogical prerequisite is that teachers must possess domain knowledge and facilitation skills to design and orchestrate meaningful outdoor learning engagements[47].

From the teacher's perspective, nature-based learning reinforces the importance of the teacher's role in terms of competence and knowledge related to utilizing the natural environment and child development. These two sides are also highlighted in the research of Puhakka[48] and Hill[49], who said that "the role of teachers is significant in supporting children's interest and motivation in the outdoor environment. In addition, children's increased enthusiasm and learning motivates teachers to organize more outdoor activities". The importance of teacher competence has also been alluded to in the ECD Standards, where it is stated that "ECD Teacher competence is developed as a whole including pedagogic, personality, social, and professional competencies according to the needs and age level of the students"[16][50]. However, Tuuling, Õun & Ugaste are concerned that many teachers are used to teaching indoors and find it comfortable, so such a perspective is difficult to change for the application of outdoor ECD learning[51]. The similar thing was also expressed by, that early childhood education teachers in Spain recognize the benefits of outdoor learning but face difficulties implementing it, especially those in urban areas[52]. Teachers find it difficult to transition from indoor to outdoor teaching, as the outdoor environment requires more adult-led activities rather than child-led learning[53], as they struggle to recognize children's holistic development as a result of outdoor learning[54]. Teachers' lack of knowledge and motivation to use outdoor learning environments is a fundamental challenge in early childhood learning[54]. With this in mind, outdoor ECD learning has considerable potential application in future research endeavors. In addition, it would be beneficial if outdoor learning is made a pedagogical approach in teacher education and competency development[55], as this would support its advancement as an opportunity for early childhood learning.

Holistic and Experiential Learning in Natural Settings

Both EN and AR underscore the importance of integrating cognitive, affective, and psychomotor domains in outdoor experiences. The children encounter authentic problem-solving contexts by moving "out in the field" and engaging with real materials—soil, sand, and cooking ingredients. This holistic approach resonates with Kolb's experiential learning

cycle, wherein concrete experience is followed by reflective observation and conceptual abstraction[56]. In this context, the natural environment becomes an open-ended laboratory encouraging curiosity and iterative hypothesis testing[57]. Moreover, EN's remark that children are "not just listening to stories" highlights a shift from passive, classroom-bound pedagogy to dynamic, learner-centered inquiry, fostering deeper content and skills internalization.

Kolb's model reminds us that mere experience is insufficient; reflection and abstraction transform experience into learning[58]. Effective programs incorporate structured debriefs—journaling under a tree, small-circle "share-outs," or sketch-and-label exercises—that prompt learner to articulate observations, hypothesize underlying principles, and plan the next steps[59]. Children may relish the novelty without these reflective pauses but fail to connect it to curricular standards or personal growth.

Promotion of Visual and Emotional Development

AR's observation that outdoor learning "boosts their emotional development" and enhances "visual literacy" points to the multifaceted developmental gains afforded by natural contexts. Visual literacy emerges as children actively observe patterns in leaves, soil textures, or structural arrangements, translating these observations into language and shared narratives. Emotional development is likewise nurtured: as children collaborate in cooking or market play, they negotiate roles, manage conflicts, and experience collective achievement. These findings echo research indicating that nature-based activities reduce stress, improve mood, and strengthen social bonds among young learners[60], [61]. Therefore, a pedagogical prerequisite is intentionally structuring outdoor curricula to stimulate both perceptual acuity and socio-emotional competencies.

While AR highlights "visual literacy," not all outdoor scenes are equally generative. Teachers sharpen attention through framing devices: close-up magnifiers, sketchbooks with "observation frames," or guided photo-walk prompts ("find three patterns in the bark"). These tools channel the often overwhelming visual field into meaningful inquiries. Prerequisite training in semiotic analysis—how children interpret signs and symbols in the environment—enables teachers to scaffold more advanced visual decoding[62].

5. Conclusion

The findings of this study demonstrate that intentionally embedding the natural environment within early childhood curricula yields measurable gains across cognitive, sensorimotor, and socio-emotional domains. Children exposed to daily, sustained engagement with natural materials and settings exhibited sharper attention spans, deeper conceptual understanding in mathematics and science, and marked improvements in gross motor coordination—whether balancing on uneven terrain or engaging in risk-friendly play activities . These outcomes reinforce that outdoor, place-based learning functions as an authentic "living laboratory," wherein multisensory exploration and on-the-spot problem-solving translate abstract educational objectives into tangible experiences.

Our analysis also underlines the pedagogical and organizational scaffolds necessary to realize these benefits. Teachers must act as skilled facilitators—designing holistic, experiential tasks,

framing reflective debriefs, and guiding socio-emotional growth through structured collaboration and risk-managed challenges. Parental and community partnerships further extend the learning ecosystem, fostering shared ownership and cultural relevance. Meanwhile, robust safety protocols, resource allocation, and reflective professional learning communities ensure that outdoor programs remain sustainable, scalable, and safe. Together, these prerequisites constitute an interdependent architecture that transforms the natural environment from a mere backdrop into an active co-educator.

In light of these insights, early childhood institutions and policymakers should prioritize the integration of natural environments as core learning resources. That entails embedding nature-based modules into national curricula, investing in teacher professional development focused on outdoor pedagogy, and forging formalized partnerships with families and local stakeholders. Future research might explore the longitudinal impacts of such interventions, comparative effectiveness across diverse ecological settings, and cost-benefit analyses to inform scalable models. By elevating nature-centered learning from peripheral innovation to mainstream practice, we can nurture more resilient, creative, and well-rounded learners prepared for the challenges of tomorrow.

References

[1] R. Wilson, *Nature and Young Children: Encouraging Creative Play and Learning in Natural Environments*, 3rd ed. London: Routledge, 2018.

[2] O. J. Sando and E. B. H. Sandseter, "Children's Perception and Utilization of ECEC Physical Environments," *Educ. Sci.*, vol. 12, pp. 1–12, 2022, doi: https://doi.org/10.3390/educsci12020088.

[3] I. Larrea, M. Alexander, M. Nekane, and A. and Barandiaran, "Children's social play and affordance availability in preschool outdoor environments," *Eur. Early Child. Educ. Res. J.*, vol. 27, no. 2, pp. 185–194, Mar. 2019, doi: 10.1080/1350293X.2019.1579546.

[4] J. Dyment and T. S. and O'Connell, "The impact of playground design on play choices and behaviors of pre-school children," *Child. Geogr.*, vol. 11, no. 3, pp. 263–280, Aug. 2013, doi: 10.1080/14733285.2013.812272.

[5] M. Kuo, M. Barnes, and C. Jordan, "Do Experiences With Nature Promote Learning? Converging Evidence of a Cause-and-Effect Relationship," *Front. Psychol.*, vol. 10, 2019, doi: https://doi.org/10.3389/fpsyg.2019.00305.

[6] M. Sam and M. Kouhirostami, "A Critical Review on the Impact of Combining Outdoor Spaces and Nature with Learning Spaces on Students' Learning Ability," *GRID - Archit. Plan. Des. J.*, vol. 3, no. 2, pp. 272–290, 2020, doi: 10.37246/grid.664546.

[7] C. M. Rubie-Davies, J. M. Stephens, and P. Watson, *Routledge International Handbook of Social Psychology of the Classroom*, 1st ed. London: Routledge, 2015.

[8] A. Y. Aina and K. Bipath, "Availability and use of infrastructural resources in promoting quality early childhood care and education in registered early childhood development centres," *South African J. Child. Educ.*, vol. 12, no. 1, p. a980, Feb. 2022, doi: https://doi.org/10.4102/sajce.v12i1.980.

[9] J. Prins, F. van der Wilt, C. van der Veen, and D. Hovinga, "Nature play in early childhood education: A systematic review and meta ethnography of qualitative

research," *Front. Psychol.*, vol. 13, 2022, doi: https://doi.org/10.3389/fpsyg.2022.995164.
[10] J. Ernst, K. McAllister, P. Siklander, and R. Storli, "Contributions to Sustainability through Young Children's Nature Play: A Systematic Review," *Sustainability*, vol. 13, no. 13. 2021, doi: 10.3390/su13137443.
[11] M. Jansson, E. Herbert, A. Zalar, and M. Johansson, "Child-Friendly Environments—What, How and by Whom?," *Sustainability*, vol. 14, no. 8. 2022, doi: 10.3390/su14084852.
[12] D. M. Florescu, "Implications of the learning environment on educational practices in early education," *J. Plus Educ.*, vol. 27, no. 2, pp. 172–199, 2020, doi: 10.24250/JPE/2/2020/DMF.
[13] A. Tamblyn *et al.*, "How do physical or sensory early childhood education and care environment factors affect children's social and emotional development? A systematic scoping review," *Educ. Res. Rev.*, vol. 41, p. 100555, 2023, doi: https://doi.org/10.1016/j.edurev.2023.100555.
[14] D. Osher, C. Pamela, B. Juliette, S. Lily, and T. and Rose, "Drivers of human development: How relationships and context shape learning and development1," *Appl. Dev. Sci.*, vol. 24, no. 1, pp. 6–36, Jan. 2020, doi: 10.1080/10888691.2017.1398650.
[15] U. Müller and L. S. Liben, "Introduction: Natural Spaces and Development," *Child. Youth Environ.*, vol. 27, no. 2, pp. 1–6, May 2017, doi: 10.7721/chilyoutenvi.27.2.0001.
[16] *Peraturan Menteri Pendidikan dan Kebudayaan Republik Indonesia Nomor 137 Tentang Standar Nasional Pendidikan Anak Usia Dini*. 2014.
[17] S. Nanda, O. Bagaria, P. Sharma, and K. Jain, "A systematic review of the cognitive functioning of natural environments," *Multidiscip. Rev.*, vol. 6, no. e2023ss038, 2024, doi: https://doi.org/10.31893/multirev.2023ss038.
[18] D. A. Vella-Brodrick and K. Gilowska, "Effects of Nature (Greenspace) on Cognitive Functioning in School Children and Adolescents: a Systematic Review," *Educ. Psychol. Rev.*, vol. 34, no. 3, pp. 1217–1254, 2022, doi: 10.1007/s10648-022-09658-5.
[19] M. Best, A. Magaji, and L. D. Smith, "Outdoor Learning: Insights and Inspiration Across the Curriculum," in *Inspiring Primary Learners*, 1st ed., Roger McDonald and P. Gibson, Eds. London: Routledge, 2021.
[20] P. Boulton and A. Thomas, "How does play in the outdoors afford opportunities for schema development in young children?," *Int. J. Play*, vol. 11, no. 2, pp. 184–201, Apr. 2022, doi: 10.1080/21594937.2022.2069348.
[21] G. Cakmakci, M. Aydeniz, A. Brown, and J. M. Makokha, "Situated Cognition and Cognitive Apprenticeship Learning," in *Science Education in Theory and Practice: An Introductory Guide to Learning Theory*, B. Akpan and T. J. Kennedy, Eds. Cham: Springer International Publishing, 2020, pp. 293–310.
[22] J. Ward and V. J. Damjanovic, "Planting Seeds of Numeracy: Supporting Quantitative Literacy in Young Children," *Numeracy*, vol. 13, no. 1, pp. 1–14, 2020, doi: https://doi.org/10.5038/1936-4660.13.1.5.
[23] L. Lucero, "Growing Young Mathematicians: Engaging Young Learners with Mathematics through Designing and Planting a Garden," *J. Math. Educ.*, vol. 13, no. 2, pp. 33–49, Nov. 2021, doi: 10.26711/007577152790073.
[24] C. Boesch, "Identifying animal complex cognition requires natural complexity," *iScience*, vol. 24, no. 3, Mar. 2021, doi: 10.1016/j.isci.2021.102195.
[25] J. A. Barela, "Motor development: from dynamical system approach to a neo-

developmental application," *Brazilian J. Mot. Behav.*, vol. 15, no. 5, pp. 321–332, 2021, doi: https://doi.org/10.20338/bjmb.v15i5.282.

[26] J. Szeszulski *et al.*, "Early Care and Education Center Environmental Factors Associated with Product- and Process-Based Locomotor Outcomes in Preschool-Age Children," *Int. J. Environ. Res. Public Health*, vol. 19, no. 4, p. 2208, 2022, doi: 10.3390/ijerph19042208.

[27] N. Taylor, A. Pringle, and C. M. P. Roscoe, "Characteristics of the Outdoor Environment Affording Physical Activity, Motor Competence, and Social Interactions in Children Aged 3–7 Years: A Systematic Review," *Children*, vol. 11, no. 12, 2024, doi: 10.3390/children11121491.

[28] A. Brian, "Motor skill development," in *Movement and Visual Impairment*, 1st ed., London: Routledge, 2020, p. 13.

[29] Z. Fathirezaie, K. Abbaspour, G. Badicu, S. H. Z. Sani, and H. Nobari, "The Effect of Environmental Contexts on Motor Proficiency and Social Maturity of Children: An Ecological Perspective," *Children*, vol. 8, no. 2, p. 157, 2021, doi: https://doi.org/10.3390/children8020157.

[30] H. Ismail, S. A. Aziz, and R. Omar, "A Review on Dynamic Systems Theory and the Children's Motor Development," *Psychology*, vol. 57, no. 8, pp. 487–498, Jan. 2020.

[31] C. D'Anna, B. Romano, and R. Vastola, "PLANNING LEARNING ENVIRONMENTS RICH OF AFFORDANCE TO LEAD THE LEARNERS IN THE SUCCESSFULL PERFORMANCE OF A MOTOR TASK: A PRELIMINARY STUDY," *Ital. J. Heal. Educ. Sport. Incl. Didact.*, vol. 5, no. 3, pp. 115–126, 2021, doi: https://doi.org/10.32043/gsd.v5i3.423.

[32] A. Jerebine, K. Fitton-Davies, N. Lander, E. L. J. Eyre, M. J. Duncan, and L. M. Barnett, "'All the fun stuff, the teachers say, "that's dangerous!"' Hearing from children on safety and risk in active play in schools: a systematic review," *Int. J. Behav. Nutr. Phys. Act.*, vol. 19, no. 1, p. 72, 2022, doi: 10.1186/s12966-022-01305-0.

[33] G. Mackey, "Strengthening children's agency in outdoor learning environments," in *Outdoor Learning Environments: Spaces for exploration, discovery and risk-taking in the early years*, 1st ed., H. Little, Ed. London: Routledge, 2017.

[34] S. Little and V. Derr, "The Influence of Nature on a Child's Development: Connecting the Outcomes of Human Attachment and Place Attachment," in *Research Handbook on Childhoodnature : Assemblages of Childhood and Nature Research*, A. Cutter-Mackenzie, K. Malone, and E. Barratt Hacking, Eds. Cham: Springer International Publishing, 2018, pp. 1–27.

[35] E. A. Skinner, N. P. Rickert, J. W. Vollet, and T. A. Kindermann, "The complex social ecology of academic development: A bioecological framework and illustration examining the collective effects of parents, teachers, and peers on student engagement," *Educ. Psychol.*, vol. 57, no. 2, pp. 87–113, Apr. 2022, doi: 10.1080/00461520.2022.2038603.

[36] H. G. Furth and S. R. Kane, "Children Constructing Society: A New Perspective on Children at Play," in *Childhood Social Development: Contemporary Perspectives*, 1st ed., H. McGurk, Ed. London: Psychology Press, 1992, p. 25.

[37] H. J. Chong-Neto, G. D'amato, and N. A. R. Filho, "Impact of the environment on the microbiome," *J. Pediatr. (Rio. J).*, vol. 98, pp. S32–S37, 2022, doi: https://doi.org/10.1016/j.jped.2021.10.001.

[38] M. I. Roslund *et al.*, "A Placebo-controlled double-blinded test of the biodiversity hypothesis of immune-mediated diseases: Environmental microbial diversity elicits

changes in cytokines and increase in T regulatory cells in young children," *Ecotoxicol. Environ. Saf.*, vol. 242, p. 113900, 2022, doi: https://doi.org/10.1016/j.ecoenv.2022.113900.

[39] R. M. Ryan and E. L. Deci, "Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being.," *Am. Psychol.*, vol. 55, no. 1, pp. 68–78, 2000, doi: 10.1037/0003-066X.55.1.68.

[40] L. Kochanowski and V. Carr, "Nature Playscapes as Contexts for Fostering Self-Determination," *Child. Youth Environ.*, vol. 24, no. 2, pp. 146–167, Apr. 2014, doi: 10.7721/chilyoutenvi.24.2.0146.

[41] G. Lauterbach, "'Building Roots'—Developing Agency, Competence, and a Sense of Belonging through Education outside the Classroom," *Education Sciences*, vol. 13, no. 11. 2023, doi: 10.3390/educsci13111107.

[42] J. L. Barkin *et al.*, "Effects of extreme weather events on child mood and behavior," *Dev. Med. Child Neurol.*, vol. 63, no. 7, pp. 785–790, Jul. 2021, doi: https://doi.org/10.1111/dmcn.14856.

[43] A. S. McDonnell and D. L. Strayer, "Immersion in nature enhances neural indices of executive attention," *Sci. Rep.*, vol. 14, no. 1, p. 1845, 2024, doi: 10.1038/s41598-024-52205-1.

[44] L. Chawla, "Childhood nature connection and constructive hope: A review of research on connecting with nature and coping with environmental loss," *People Nat.*, vol. 2, no. 3, pp. 619–642, Sep. 2020, doi: https://doi.org/10.1002/pan3.10128.

[45] K. Schnitzler, D. Holzberger, and T. Seidel, "All better than being disengaged: Student engagement patterns and their relations to academic self-concept and achievement," *Eur. J. Psychol. Educ.*, vol. 36, no. 3, pp. 627–652, 2021, doi: 10.1007/s10212-020-00500-6.

[46] I. W. Lasmawan and I. W. Budiarta, "Vygotsky's Zone Of Proximal Development and The Students' Progress in Learning (A Heutagogcal Bibliographical Review)," *J. Pendidik. Indones.*, vol. 9, no. 4, pp. 545–552, 2020, doi: https://doi.org/10.23887/jpi-undiksha.v9i4.29915.

[47] M. Legge, "Letting them go - outdoor education with/without the teacher educator," *J. Adventure Educ. Outdoor Learn.*, vol. 22, no. 1, pp. 1–11, Jan. 2022, doi: 10.1080/14729679.2020.1841661.

[48] R. Puhakka, O. Rantala, M. I. Roslund, J. Rajaniemi, O. H. Laitinen, and A. Sinkkonen, "Greening of Daycare Yards with Biodiverse Materials Affords Well-Being, Play and Environmental Relationships.," *Int. J. Environ. Res. Public Health*, vol. 16, no. 16, p. 2948, Aug. 2019, doi: 10.3390/ijerph16162948.

[49] V. Hill, "Learning in nature : leadership opportunities in an education outside the classroom programme in a New Zealand early childhood centre," *J. Educ. Leadership, Policy Pract.*, vol. 33, no. 1, pp. 32–45, 2018, doi: 10.21307/jelpp-2018-004.

[50] G. Kelemen, "DEVELOPING EARLY CHILDHOOD EDUCATION COMPETENCES (EARLY CHILDHOOD EDUCATION AND CARE, ECEC)," *J. Plus Educ.*, vol. 27, no. 2, pp. 304–312, 2020, doi: 10.24250/JPE/2/2020/GK.

[51] L. Tuuling, T. Õun, and A. Ugaste, "Teachers' opinions on utilizing outdoor learning in the preschools of Estonia," *J. Adventure Educ. Outdoor Learn.*, vol. 19, no. 5, pp. 1–13, Dec. 2018, doi: 10.1080/14729679.2018.1553722.

[52] J. Rojo-Ramos, F. Manzano-Redondo, S. Barrios-Fernandez, M. A. García-Gordillo, and J. C. Adsuar, "Early Childhood Education Teachers' Perception of Outdoor Learning Activities in the Spanish Region of Extremadura," *Sustainability*, vol. 13, no.

16. 2021, doi: 10.3390/su13168986.
[53] J. Hunter, K. B. Syversen, C. Graves, and A. Bodensteiner, “Balancing Outdoor Learning and Play: Adult Perspectives of Teacher Roles and Practice in an Outdoor Classroom,” *Int. J. Early Child. Environ. Educ.*, vol. 7, no. 2, pp. 34–50, 2020.
[54] L. Kiviranta, L. Eila, M.-L. Rönkkö, and E. Luukka, “Outdoor learning in early childhood education: exploring benefits and challenges,” *Educ. Res.*, vol. 66, no. 1, pp. 102–119, Jan. 2024, doi: 10.1080/00131881.2023.2285762.
[55] I. A. Neville, L. A. Petrass, and F. Ben, “Cross disciplinary teaching: A pedagogical model to support teachers in the development and implementation of outdoor learning opportunities,” *J. Outdoor Environ. Educ.*, vol. 26, no. 1, pp. 1–21, 2023, doi: 10.1007/s42322-022-00109-x.
[56] S. P. Gordon, “Integrating the Experiential Learning Cycle with Educational Supervision,” *J. Educ. Superv.*, vol. 5, no. 3, pp. 1–34, Sep. 2022, doi: 10.31045/jes.5.3.1.
[57] A. G. Farji-Brener, “Stimulating curiosity and critical thinking: the legacy of William Eberhard,” *Anim. Behav.*, vol. 221, no. 8, p. 122748, 2025, doi: https://doi.org/10.1016/j.anbehav.2023.10.001.
[58] L. Lehane, “Experiential Learning—David A. Kolb,” in *Science Education in Theory and Practice: An Introductory Guide to Learning Theory*, B. Akpan and T. J. Kennedy, Eds. Cham: Springer International Publishing, 2020, pp. 241–257.
[59] S. Ross, “Twelve tips for effective simulation debriefing: A research-based approach,” *Med. Teach.*, vol. 43, no. 6, pp. 642–645, Jun. 2021, doi: 10.1080/0142159X.2020.1831689.
[60] T. Sobko, S. Liang, W. H. G. Cheng, and H. M. Tun, “Impact of outdoor nature-related activities on gut microbiota, fecal serotonin, and perceived stress in preschool children: the Play&Grow randomized controlled trial,” *Sci. Rep.*, vol. 10, no. 1, p. 21993, 2020, doi: 10.1038/s41598-020-78642-2.
[61] H. V. Sørensen, “Children’s Play and Social Relations in Nature and Kindergarten Playgrounds: Examples from Norway,” in *Outdoor Learning and Play: Pedagogical Practices and Children’s Cultural Formation*, L. T. Grindheim, H. V. Sørensen, and A. Rekers, Eds. Cham: Springer International Publishing, 2021, pp. 79–93.
[62] S. Pantaleo, “The meaning-making in kindergarten children’s visual narrative compositions,” *J. Early Child. Lit.*, vol. 25, no. 2, p. 14687984231161114, Mar. 2023, doi: https://doi.org/10.1177/14687984231161114.