

Awe and wonder science, mathematics and the outdoors

Portfolio

I have used generative Artificial Intelligence (AI) in this work, Grammarly (2025) to assist grammatically, and Google Translate (2025) to support this work as an English as a Second Language.

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Part 1. Photograph



Figure 1: Outdoor wooded area behind Brynmill Park, Swansea, Wales (own image, 2025)

Part 2. Learning Story

A morning in the Woodland

It was a dry, partially sunny morning when six Reception children, aged 4–5 years old, set off with their two practitioners to a wooded area just a five-minute walk from the school. The space, safely enclosed by low gates, offered the children freedom to explore within a secure and natural setting. The ground was carpeted with dry leaves in rich shades of yellow, green, and brown, while pinecones and sticks were scattered across the soft earth. As the group entered the clearing, one child's eyes lit up with excitement as he announced, "I am going to find the biggest stick!" The children's laughter and movement filled the space, setting the stage for discovery, imagination, and shared learning.

Almost instinctively, another child bent down, picked up a pinecone, and hurled it across the clearing.

Child A (shouting): "Look! Mine went so far!"

Child B: "I can throw further than that!"

The others joined in, laughing, running, and comparing how far each pinecone travelled. They began to notice differences, such as some landed close by, while others bounced or rolled further. "The big ones do not go as far," one child observed, while another pointed out, "The little ones go further because they are not heavy."

To extend the play, Practitioner 1 placed a plain rope on the ground in a circle and asked: "Can you throw your pinecone inside the rope?" The challenge caught everyone's attention.

Child C: "I did it! Mine is in!"

Child E: "Nearly... I try again!"

Child F clapped: "Yes, I did it!"

Excited by the challenge, the children began aiming carefully. Some crouched low before throwing, others adjusted their distance from the rope, and one child paused to watch her friends before trying herself. These subtle differences in technique revealed not only experimentation with force and direction, but also the emergence of key learning dispositions such as persistence, focused observation, and independent decision-making, all of which underpin enquiry-based learning (Welsh Government, 2022a).

As the children experimented, they noticed how throwing harder or softer, and using different shapes and weights of pinecones, changed whether they landed inside the circle.



(Dyck Arboretum, 2015)

Some rolled in neatly, while others stopped short or bounced away. What started as a simple game evolved into a thoughtful exploration, as children tested their predictions, refined their techniques, and shared their observations.

The practitioners supported by asking: “Why do you think that one went further?” and “What is different about this pinecone?”, encouraging the children to verbalise their reasoning.

Having the time and space to explore freely enabled the children to develop early scientific thinking through lived experience, noticing patterns and beginning to explain why outcomes differed. This aligns with Progression Step 1 in the Science and Technology Area of Learning and Experience (Welsh Government, 2020), where learners observe cause-and-effect and propose explanations for varying results. Their play also engaged the Mathematics and Numeracy Area (Welsh Government, 2019), as they estimated, measured, compared distances, and organised pinecones according to features such as size, weight, and shape. In doing so, the activity fostered a secure sense of self as learners and a disposition towards enquiry, while also developing strategies for evaluation, comparison, and explanation that extend across wider areas of learning.

As the excitement of throwing pinecones settled, Practitioner 2 drew the children’s attention to the carpet of leaves around them. Handing each child a small plastic bucket and magnifying glass, the practitioner invited, “Shall we see what kinds of leaves we can find?”

Child C picked one up and shouted, “Mine is yellow!”

Child E pressed a huge one against her hand: ‘It is bigger than my hand!’

Child F peered through the magnifying glass, laughing: ‘I can see all the lines!’

The children began swapping leaves with each other, comparing shapes and colours. Some lined them up from smallest to largest, while others grouped them by colour, pointing and declaring: “These ones match!” or “This one is different!”

Noticing their enthusiasm, Practitioner 1 asked:

“Why do you think the leaves are different colours?”

The responses were thoughtful and imaginative.

Child A: “Because the trees are painting them!”

Child D: “They get red when they get too hot.”



(Irvine Nature Center, 2018a)

Imaginative responses such as these reveal how children begin to make sense of complex ideas in ways that are meaningful to them. While such explanations may not

yet be scientifically accurate, they are a vital step towards developing a more reasoned understanding.

Engagement with the leaves supported early scientific enquiry as the children began noticing natural patterns and thinking about seasonal change, reflecting Progression Step 1 of the Science and Technology Area of Learning and Experience in the Curriculum for Wales (Welsh Government, 2020), where learners are encouraged to observe, question, and suggest explanations for differences they see in the world around them. At the same time, the act of sorting, sequencing, and comparing leaves by colour and size embedded mathematical development, directly linking to Progression Step 1 in the Mathematics and Numeracy Area (Welsh Government, 2019), which supports learners in arranging objects, ordering by size, and making straightforward comparisons. In this way, the children's playful exploration provided a meaningful bridge between curiosity and creativity, while fostering habits of enquiry and flexible thinking that underpin early scientific and mathematical learning.

After collecting and comparing leaves, Child B suddenly called out: "Let's make a campfire!" The idea quickly caught on, and the other children began gathering sticks and stones from around the clearing.

Recognising the children's enthusiasm, the practitioners intentionally supported the emerging play by placing a rope on the ground in a circle and inviting, "Shall we see what kind of campfire we can build inside it?" The children hurried to place their sticks, experimenting with different shapes and structures. Child D leaned sticks together in a triangle, while Child F laid them flat in a cross. Some designs collapsed quickly, while others held their shape. "Mine keeps falling!" Child A exclaimed in frustration.

The practitioner responded, "What could make it stronger?" encouraging Child A to reflect and adapt his approach by observing the strategies of others.

Nearby, Child E carefully placed stones around the circle, counting aloud: "One, two, three..." until there were ten. Child C compared the circles, announcing: "Mine is bigger!"

The children worked side by side, sometimes swapping ideas, sometimes proudly comparing whose structure was tallest or whose circle had more stones. They observed one another closely, often imitating successful strategies and celebrating when their structures stood firm.

The practitioners extended the play by asking: "What happens if you use the longer sticks? Or the heavier ones?"

These prompts encouraged the children to test materials and observe outcomes, helping them see for themselves how size and weight affected balance and stability. Child B tried balancing a long stick across the circle, but it toppled over: "It's too wobbly!" he laughed. Child F leaned two sticks together, clapping as they stayed upright: "Look, it's strong now!" Child E stretched her arms wide, holding up a thick stick: "This one's really heavy!" while Child A lined his sticks on the ground, saying:

“Mine’s taller than yours!” These interactions showed how the children were exploring, experimenting, and reasoning about the properties of the materials in use.

The campfire activity translated abstract ideas of force, structure, and measurement into concrete experiences. By adapting their strategies, observing one another, and persisting despite initial challenges, they demonstrated resilience and growing confidence as learners. The collaborative enquiry that emerged, supported by practitioner scaffolding, reflects

Progression Step 1 in the Science and Technology Area of Learning and Experience (Welsh Government, 2020),

where learners investigate how varying factors influence stability and strength. It also aligns with the Mathematics and Numeracy Area (Welsh Government, 2019), which emphasises comparing, ordering, and classifying objects by attributes such as size, weight, and shape. Together, these experiences demonstrate how outdoor play can ground early scientific and mathematical concepts in meaningful practice, while also nurturing creative and critical approaches to problem-solving.



(Irvine Nature Center, 2018b)

Before returning to school, the practitioners allowed a short time for free play. Child A knelt beside his campfire, determined to balance one last stick. Child C and D laughed as they rolled pinecones across the ground, cheering when one bounced further than expected. Meanwhile, Child E tipped out her bag of leaves, arranging them in a neat row from smallest to largest, while Child F crouched down to shuffle them into colour groups once again. Returning to earlier explorations allowed each child to refine ideas, strengthen memory, and further develop their ability to think independently while sustaining meaningful enquiry.

As the morning came to an end, Practitioner 1 called, “Time to head back now.”

The children slowly gathered their bags and treasures, some clutching leaves, others holding sticks or pinecones. They gave a final glance at their campfires before turning towards the gate.

Walking towards the gate in pairs, their chatter continued: “Mine was the tallest fire,” “My leaf was yellow and red,” “My pinecone went really far!” Their laughter drifted through the clearing, carrying with it the morning’s discoveries and imaginings, as the children’s own voices wove the learning into stories that followed them beyond the woodland.

Part 3. RISK-BENEFIT ASSESSMENT

Location / Activity:	Outdoor Woodland	Date:	September 20 th 2025
Assessor:	Cristiane De Freitas	Review date:	February 15 th 2025

General Precautions (apply to all activities):

- A first aid kit will be carried by staff at all times.
- All attending adults are first aid trained.
- One adult carries emergency contact information and a fully charged mobile phone.

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Walking from school to woodland	Supports safe road-crossing skills in real-life contexts, enhancing awareness and confidence. Builds cooperation and responsibility through group movement under adult guidance. Strengthens connection to the local area, enhancing well-being and belonging. Promotes physical health, stamina, coordination, and overall well-being.	Traffic risks when crossing roads if a child steps out unexpectedly or a car does not stop. Slippery pavements in wet weather. Uneven surfaces, loose stones, or kerbs may cause trips or twisted ankles. Sudden weather	Children and adults	High-visibility vests worn by all children and adults to ensure they are easily seen by drivers and other pedestrians. Children walk in pairs, with adults positioned at the front and rear. Clear rules: stay with group, no running, follow adult directions. Buckets/bags used to carry items to prevent tripping. Weather conditions will be checked in advance; trips will be postponed in high winds (above 20 mph) or other adverse conditions.	L

		changes impacting safety and visibility.			
Exploring natural, uneven ground	Enhances balance, coordination, and spatial awareness. Builds physical strength and confidence by exploring various surfaces. Encourages collaboration and problem-solving. Provides rich sensory input (soil, leaves, roots), enhancing language and observation. Fosters respect for living things and understanding of habitats.	Trips, slips, grazes, or twisted ankles on uneven surfaces. Minor injuries such as scratches or stings from insects, nettles, or brambles Damp or leaf-covered areas may increase the chance of slipping.	Children and adults	Safety briefing before visit: stay with group, no running and notify adults when exploring. Adults prepare children with “safe explorer” guidance, including not talking to strangers and always staying with an adult, including for toilet needs. Sturdy footwear and weather-appropriate clothing required, such as warm coats to stay safe and comfortable outdoors. Adults provide clear guidance on safe observation of insects (not to touch or place them in their mouths).	L
Collecting loose parts, such as stones, leaves or sticks	Develops fine and gross motor skills through grasping, lifting, and carrying. Encourages counting, sorting, and comparing (mathematical skills). Promotes scientific enquiry and classification (hard, soft, rough, smooth, heavy, light), noticing natural	Risk of bumps, scratches, or eye pokes when carrying objects. Insects under leaves or stones could lead to bites/stings,	Children and adults	Before the activity, adults explain and model how to carry sticks safely (pointing down) and how to hold stones carefully to avoid accidents. Children are reminded not to swing or run with objects in their hands. Children are warned that some plants may cause skin irritation.	L

	variation, and beginning to classify objects. Supports memory, reasoning, and problem-solving. Strengthens observation and reasoning, with children identifying patterns and similarities across different materials. Encourages play schemas, such as transporting, enclosing, and trajectory, which underpin problem-solving, coordination, and an early understanding of movement and size.	and, in some cases, allergic reactions. Skin irritation from unfamiliar plants. Risk of choking if small items (stones, leaves, rubbish) are mouthed.		Use of buckets/magnifying glasses to explore safely. Adults guide children to turn items over carefully and check underneath before lifting.	
Exploring independent play	Encourages problem-solving as children test their own ideas, learning to judge which strategies are safe and which may carry risks. Develops confidence and risk awareness. Promotes early scientific enquiry as children notice patterns, explore cause and effect, and recognise when outcomes might be unsafe. Fosters imagination and creativity while also requiring children to handle materials safely	Similar to collecting loose parts: Risk of bumps, scratches, or eye pokes when carrying objects. Children may become so absorbed in play that they are less aware of their surroundings,	Children	Adults maintain close supervision while allowing children freedom to explore. Adults remind children to carry sticks pointing down and to handle objects safely, checking before picking them up. Adults support positive engagement and promote respectful interaction.	L

	and show respect for shared spaces. Supports independence, as children select materials, spaces, and actions while considering their own safety and the safety of others.	increasing the risk of slips, trips, or minor injuries. Potential for conflict over shared materials.			
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Part 4. The Importance of Practitioner Support in Developing Mathematical and Scientific Learning through Outdoor Play

Outdoor environments are widely recognised as powerful spaces for learning, offering children opportunities to engage with the natural world in ways that stimulate curiosity, exploration, and enquiry (Ouvry and Furtado, 2020). The curriculum for funded non-maintained nursery settings (Welsh Government, 2022a) reinforces this view, noting that outdoor spaces nurture awe and wonder while providing authentic, multisensory opportunities that enrich children's holistic development. Recent research by Prins *et al.* (2022) further demonstrates that nature-based play, particularly when children interact with loose parts and natural elements, encourages experimentation, collaboration, and the development of resilience and critical thinking.

Within this context, the role of practitioners becomes central to facilitating learning by balancing safety with appropriate risk, closely observing and extending child-led exploration, and designing environments that actively promote mathematical and scientific thinking (Watts, 2020). As demonstrated in Part 2, children's interactions with natural loose parts were transformed into meaningful learning experiences through the support of skilled practitioners. Similarly, Part 3 illustrates how risk–benefit assessment enables practitioners to facilitate active, enquiry-based outdoor learning while maintaining children's safety.

Building on these foundations, the following discussion examines how practitioners support children's engagement with mathematical and scientific concepts through outdoor learning, with a focus on child-led exploration, the affordances of loose parts, and the role of practitioner scaffolding in extending learning. Drawing on theory, policy, and practical examples, the discussion illustrates how skilled practitioners transform natural play into purposeful opportunities for enquiry, discovery, and holistic development.

Child-Led Exploration and Scaffolding in Outdoor Learning

Child-led exploration, defined as learning initiated and directed by the child, is widely recognised in early childhood education as a foundation for deep engagement and sustained cognitive development (Care Learning, 2024). Outdoor environments such as woodlands, fields, and school gardens offer rich, varied, and multisensory contexts that foster autonomy, problem-solving, and independent enquiry (Davy, 2019). As outlined by Tovey (2016), Froebel's philosophy supports the idea that meaningful learning emerges through self-initiated play in natural settings, where curiosity and discovery are nurtured. Similarly, Mauluddia and Solehuddin (2023) explain that Piaget viewed children as active constructors of knowledge, developing understanding through purposeful interaction with their environment, including experimentation, observation, and reflection. These theoretical perspectives are clearly reflected in outdoor learning, where children frequently encounter mathematical and scientific concepts through experiences involving measurement, comparison, pattern recognition, and the observation of cause and effect (Ouvry and Furtado, 2020).

Although child-led play fosters intrinsic motivation and supports children's agency, the role of the practitioner remains central in transforming spontaneous exploration into purposeful learning (White, Cree and Solly, 2020). Watts (2020) notes that the depth of knowledge depends on the practitioner's ability to scaffold enquiry, introduce relevant vocabulary, and draw attention to mathematical or scientific patterns. Speldewinde and Campbell (2022) explain that mathematical concepts are most effectively constructed when grounded in real-world experiences, and outdoor play provides precisely these opportunities. Trina *et al.* (2024) add that early engagement with scientific reasoning in natural environments builds cognitive structures essential for future problem-solving and abstract thinking. This is evident in Part 2 of this work, where children's engagement with pinecones, sticks, and leaves led to a rich exploration of size, weight, balance, and pattern. When practitioners responded with well-timed prompts and modelled precise vocabulary, these interactions evolved into structured learning involving both numeracy and scientific thinking.

Vygotsky's (1978) theory of the Zone of Proximal Development suggests that children progress most effectively when supported by an adult who enables them to achieve more than they could independently. In outdoor learning, this involves sensitive observation, professional judgement, and timely intervention. Rather than directing the activity, skilled practitioners follow children's interests, using open-ended questions and modelling language to deepen understanding while maintaining autonomy (Murphy, Muir and Thomas, 2025). For example, when a child explores how water flows across different surfaces, a practitioner might ask what changes depending on texture or shape, prompting scientific reasoning. Similarly, a child stacking stones can be encouraged to consider height, balance, or number, reinforcing mathematical thinking within meaningful play. Tunnicliffe (2015) argues that such hands-on experiences, when paired with adult-facilitated dialogue, are essential for nurturing scientific thinking. Waite-Stupiansky and Cohen (2020) further reinforce that these strategies are crucial for embedding STEM (Science, Technology, Engineering and Mathematics) learning through outdoor play. Fleer (2019) supports this by suggesting that STEM thinking develops most effectively when it is embedded in playful, practical, and meaningful everyday experiences.

However, despite the strengths of outdoor environments, challenges remain. Mart (2023) contends that the presence of natural materials alone does not guarantee cognitive growth. For instance, a child may demonstrate problem-solving by stacking stones, yet without the practitioner's input to introduce terms such as height, weight, or balance, the learning may lack deep conceptual understanding. Additionally, White, Cree and Solly (2020) identify behaviour management as a barrier, with sensory-rich outdoor settings sometimes leading to overstimulation and loss of focus. A child who begins observing insects may quickly lose interest before their scientific enquiry can be extended. These challenges highlight that effective outdoor learning relies not just on setting but on skilled practitioner facilitation. The National Professional Learning Entitlement (Welsh Government, 2021a) advocates for continuous professional development in equipping practitioners with the subject knowledge and pedagogical confidence necessary to scaffold learning. Without such support, opportunities to foster a meaningful understanding of STEM may be missed.

Ultimately, while child-led exploration offers a robust platform for engaging with mathematical and scientific ideas, it is practitioner input that ensures these experiences lead to meaningful learning. As demonstrated in Part 2, practitioners who observed closely, responded with well-judged prompts, and introduced focused vocabulary were able to extend thinking without diminishing autonomy. This balance between encouraging child agency and practitioner support is vital for maximising the educational potential of outdoor experiences (White, Cree and Solly, 2020). This approach also aligns with the Curriculum for Wales (Welsh Government, 2022b), which promotes developmentally appropriate, responsive and play-based pedagogy to support progression across the Areas of Learning and Experience. By doing so, it helps build the foundational skills necessary for children's long-term engagement and achievement in STEM.

Loose Parts in Outdoor Learning

According to Nicholson's (1971, cited in Gull *et al.*, 2019) loose parts theory, environments enriched with flexible and movable materials promote creativity and problem-solving by enabling children to explore, manipulate, and transform resources in open-ended ways. These materials are particularly effective in outdoor contexts, where the physical space and sensory-rich surroundings support sustained engagement with natural elements (White, Cree and Solly, 2020). Mackley *et al.* (2022) emphasise that such environments empower children to lead their own play, engaging in construction, imaginative role-play, and exploratory experimentation. Gascoyne (2018) highlights that the open-ended nature of loose parts fosters scientific thinking by encouraging enquiry, prediction, and testing of ideas. Similarly, McLennan (2020) argues that mathematical understanding is best developed through the manipulation of physical objects to explore concepts such as quantity, pattern, and spatial relationships.

Part 2 of this work demonstrates how children interact with loose parts, such as pinecones, sticks, and leaves, to explore scientific properties and mathematical relationships in an outdoor setting. The educational value of these materials lies not only in their flexibility but also in the ways practitioners actively enhance their

learning potential. By introducing supplementary resources such as magnifying glasses and ropes, practitioners enriched the environment, enabling children to observe fine details, compare attributes, and experiment imaginatively (Community Playthings, 2025). The Reggio Emilia philosophy reinforces this perspective by viewing the environment as a 'third teacher', where materials are intentionally curated to provoke curiosity and support complex thinking (Hargraves, 2020). Within this approach, the practitioner acts as a co-researcher, responding to children's emerging interests and providing timely scaffolding to promote higher-order thinking. Loose parts are central to this process, as their versatility enables children to test predictions, measure variables, and apply reasoning linked to early mathematical and scientific exploration (Kennard, 2022). For example, arranging leaves by size or stacking sticks involves classification, pattern, balance, and measurement. These opportunities are further enhanced when practitioners model appropriate vocabulary, pose open-ended questions, and prompt reflection, thereby deepening children's conceptual understanding (Whalley, 2021).

Affordance theory further extends these insights by emphasising that the educational potential of an environment is shaped not solely by the materials it offers but by the interaction between the child's intentions and the environment's possibilities for action (Walters, 2017). While Nicholson's (1971, cited in Gull *et al.*, 2019) theory highlights the value of open-ended materials, Gibson (1979, cited in Walters, 2017) draws attention to how these materials become meaningful only through dynamic interaction. The affordances of loose parts shift in response to each child's curiosity, intentions, and prior experiences (Kennard, 2022). As Gull *et al.* (2019) assert, it is the practitioner's capacity to observe, respond sensitively, and extend children's ideas that enhances the educational value of loose parts play, creating rich opportunities for developing reasoning, classification, comparison, and problem-solving. This aligns with Vygotsky's (1978) view that conceptual understanding is strengthened when practitioners recognise emerging patterns in children's thinking and offer timely scaffolding to extend cognitive development.

However, despite the educational value of loose parts in supporting early mathematical and scientific thinking, the physical and open-ended nature of such

materials can increase the likelihood of injury, particularly in outdoor environments. Flannigan and Dietze (2018) argue that the very attributes which make loose parts pedagogically powerful, such as variability, versatility, and the promotion of physically active play, can also result in engagement in potentially hazardous behaviours, including lifting, climbing, and balancing. Although these actions contribute to the development of resilience, coordination, and problem-solving abilities, legitimate safety concerns continue to arise. Similarly, Play Wales (2017) acknowledges that outdoor spaces containing natural, unstructured resources demand careful consideration of risk, even when offering rich learning opportunities.

In applied contexts, Spencer *et al.* (2021) found that concerns regarding injury, litigation, and adherence to institutional policies often lead to overly cautious responses from practitioners, ultimately restricting opportunities for engagement with loose parts. According to van Rooijen *et al.* (2023), attitudes toward risk are shaped by practitioner confidence, access to training, and the cultural norms embedded within specific settings. Such factors may limit the facilitation of adventurous and enquiry-based learning experiences.

Rather than eliminating all potential hazards, Cooke, Wong, and Press (2021) advocate for equipping practitioners with the knowledge, skills, and confidence to design environments that balance challenge with safety through creative, developmentally appropriate strategies. As demonstrated in Part 3 of this work, the implementation of a balanced risk–benefit assessment aligns with A Curriculum for Funded Non-Maintained Nursery Settings (Welsh Government, 2022a), which promotes the provision of age-appropriate challenges that nurture resilience, independence, and deeper engagement. This approach also reflects the aims of the Progression Code within the Curriculum for Wales (Welsh Government, 2021b), which supports the scaffolding of children’s developing understanding of quantity, space, and relationships through exploratory play.

In summary, embedding a culture of informed risk awareness within both daily practice and professional development is essential for enabling meaningful

progression in mathematical and scientific learning through loose parts play (Welsh Government, 2023).

Conclusion

To conclude, this discussion has demonstrated how outdoor play offers a highly effective context for fostering early mathematical and scientific understanding, particularly when enriched through informed and responsive practitioner support. This was evident in Parts 2 and 3, where skilled scaffolding and structured risk–benefit assessment transformed spontaneous experiences into meaningful and cognitively rich learning. Drawing on Froebel’s philosophy (Tovey, 2016) and Piaget’s emphasis on experiential education (Mauluddia and Solehuddin, 2023) and underpinned by Vygotsky’s (1978) theory of the Zone of Proximal Development, children’s conceptual development is maximised when practitioners extend emerging ideas through well-timed questioning, enriched vocabulary, and reflective intervention.

Moreover, Nicholson’s loose parts theory (1971, cited in Gull *et al.*, 2019) highlights how open-ended natural materials, when embedded within carefully curated outdoor environments and aligned with the pedagogical principles of the Curriculum for Wales (Welsh Government, 2022b), can support the development of core STEM-related competencies such as classification, comparison, measurement, and problem-solving through playful, multisensory engagement.

Although challenges persist, including behaviour management, variable practitioner confidence, and safety concerns, initiatives such as the National Professional Learning Entitlement (Welsh Government, 2021a) offer essential support by promoting equitable access to ongoing professional development, thereby enhancing practitioner confidence, reflective capacity, and pedagogical effectiveness in outdoor settings.

Ultimately, the balance between promoting child-led inquiry and providing intentional scaffolding lies at the core of effective outdoor pedagogy. When environments are designed to be both stimulating and secure, and when practitioners act as attuned

facilitators, children are empowered to explore, experiment, and construct meaningful knowledge. In doing so, practitioners not only strengthen early mathematical and scientific understanding but also nurture the adaptability, resilience, and independence essential for lifelong learning in an increasingly complex world.

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