



AWE AND WONDER

Science, Mathematics and the Outdoors

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AI Statement

I acknowledge the use of Copilot on 26 September 2026 to support me with my assignment.

I used the prompts:

- “can you help me structure my paragraph, so it flows better”
- “can you look at the image I’ve chosen and make suggestions on risks I may have missed”
- “can you help me find a Welsh source that focuses on outdoor learning”
- “what theorists are best to use here?”
- “do any theorists share the same view in regards to outdoor learning?”
- “can you help me with academic sources or theorists that will help me with a contrasting view”
- “can you read my work and check the structure?”
- “should I move sections to ensure it flows better and include sub headings?”

Part 1



(Pinterest, 2026).

Part 2

<https://canva.link/nhzujym7oa5p801>



ECEY5005 part 2.pdf (Command Line)

Location / Activity:	School grounds woodland / Outdoor learning (Maths and Science)	Date:	20/09/2026
Assessor:	Chloe Smith	Review date:	20/09/2026

Part 3

RISK BENEFIT ASSESSMENT

The boxes in the table below will expand as you type into them; pre-entered text is simply for illustration. You should delete irrelevant items and replace with text relevant to your circumstances.

Your overall risk rating – Low, medium or high – is based on your judgement about whether the BENEFITS of the activity or opportunity outweigh the RISKS.

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
Exploring the stump-circle area, including tree stumps, uneven ground, moss, leaves and natural surfaces.	Children develop confidence moving across uneven natural terrain, improving balance, coordination and physical development. The space encourages curiosity, independence and exploration as children climb, step, crouch and observe the environment. They begin noticing patterns, textures and natural features, supporting early scientific and mathematical thinking.	Uneven ground, slippery moss, unstable stumps, tripping or falling from low heights.	Pupils and staff	Area checked before the session. Weather and suitable clothing checked before session. Suncream applied with parental consent. Shelter available if needed. Children briefed on safe movement. Staff positioned near higher stumps. Encourage stepping rather than jumping. Appropriate footwear worn. Clear boundaries marked around the stump-circle using natural markers. Children reminded to stay within the agreed area. Regular headcounts carried out.	L

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
Handling natural materials such as sticks, pinecones, bark, stones and leaves found around the stump-circle.	Children develop fine motor skills, sensory awareness and early mathematical thinking as they sort, compare and organise natural objects. Using loose parts encourages creativity, problem-solving and imaginative play. Children learn to make decisions, test ideas and collaborate with peers while building structures or arranging materials.	Sharp edges, splinters, heavy or unstable materials, accidental pokes with sticks.	Pupils	Remove unsafe or broken materials before the session. Demonstrate safe handling. Supervise construction play closely. Encourage children to carry materials carefully. Ensure handwashing after the session.	L

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
Investigating insects, worms, woodlice and ants found under leaves, moss and bark around the stump-circle.	Children develop scientific enquiry skills as they observe living things closely, ask questions and make predictions. They learn about habitats, life cycles and how creatures survive in natural environments. This supports curiosity, empathy and respect for nature, while encouraging communication and collaboration as children share discoveries with peers.	Bites or stings, allergic reactions, unsafe handling of unknown insects, sudden movements causing startle or slips.	Pupils.	Teach gentle handling and respect for living things. Remind children not to touch unknown insects. Staff supervise lifting of leaves and bark. Handwashing after the session. All medical needs known beforehand. First Aid kit to be carried by lead practitioner.	L

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
Using magnifying glasses to examine bark, moss, soil, fungus and insects within the stump-circle.	Children develop observation skills and early scientific enquiry as they look carefully at textures, patterns and tiny details in nature. Using magnifying glasses encourages curiosity, questioning and comparison. It supports communication as children share what they see and builds confidence using simple scientific tools in a meaningful outdoor context.	Looking directly at the sun, dropping equipment, misuse of magnifying glasses, minor scratches from leaning too close to rough surfaces.	Pupils	Demonstrate safe use before the activity Remind children never to look at the sun Staff supervise use closely. Ensure magnifying glasses are collected at the end of the session Provide handwashing after the activity. If the fire alarm sounds, staff follow school evacuation procedures immediately and lead children safely out of the woodland area.	L

Part 4

Introduction

Outdoor learning is widely recognised as a powerful context for early mathematical and scientific development, offering children opportunities to explore, investigate and make sense of the world through active engagement. Research highlights that the quality of adult interaction is central to shaping these learning experiences, particularly in environments that encourage curiosity, experimentation and problem-solving.

Siraj-Blatchford et al. (2002) emphasise that effective adult engagement supports deeper thinking and sustained shared conversations, while McClure et al. (2017) argue that early STEM learning is strengthened when adults provide rich, open-ended opportunities for exploration. This evaluation therefore focuses on how adults create enabling outdoor environments that support mathematics and science through the intentional use of loose parts and curiosity-driven exploration. Enabling environments are those that provide children with meaningful opportunities to investigate and construct understanding, supported by responsive adults who extend learning through sensitive scaffolding (Department for Education, 2023). The Welsh Government (2022) also highlights the importance of environments that promote exploration and inquiry.

Daly and Beloglovsky (2015) say that loose parts offer children open-ended materials that can be moved, combined, redesigned and manipulated in countless ways, supporting mathematical thinking and scientific inquiry. Piaget (1952) argues that children construct knowledge through hands-on exploration, suggesting that environments rich in loose parts naturally support cognitive development. Bruner (1966) shares similar views and explains that adults can enhance this learning by offering guidance, modelling and opportunities for problem-solving. Vygotsky (1978) further emphasises the adult's role in extending learning within the Zone of Proximal Development, highlighting how questioning, co-exploration and shared dialogue deepen children's understanding of mathematical and scientific ideas.

The Curriculum for Wales (2022) promotes curiosity-led learning, stating that children should be supported to explore and make sense of their environment through meaningful experiences (Welsh Government, 2022). Estyn (2023) also notes that curiosity-rich environments encourage children to develop independence and critical thinking. This introduction evaluates how adults support mathematical and scientific learning outdoors by designing enabling environments, providing loose parts, and fostering curiosity rich interactions that promote deep, exploratory learning.

Enabling Outdoor Environments

Outdoor environments offer rich affordances for mathematical and scientific learning, providing children with opportunities to explore, investigate and make sense of the world through active engagement. Gibson's (1979) ecological theory of affordances explains that environments invite certain actions depending on the possibilities they offer, in early years outdoor spaces, these affordances might include climbing, balancing, transporting, rotating, sorting, and observing natural phenomena. Heft (1988) extends this by suggesting that children perceive environments in terms of functional possibilities, meaning that a well-designed outdoor space naturally encourages mathematical and scientific exploration. For example, slopes afford rolling and trajectory play, logs afford balancing and force exploration, and natural collections such as stones or leaves afford sorting, patterning and classification.

Adults play a central role in shaping these affordances. Bilton (2010) argues that outdoor environments must be intentionally planned to support learning, rather than being an extension of indoor provision. Similarly, Maynard and Waters (2007), writing within a Welsh context, emphasise that outdoor learning should be purposeful, offering children opportunities to investigate, hypothesise and problem-solve through meaningful experiences. When adults design environments that promote curiosity and inquiry, they create spaces where children can engage deeply with mathematical and scientific concepts through hands-on exploration.

Schemas also play an important role in how children engage with outdoor environments. Athey (1990) explains that schemas are repeated patterns of behaviour through which children develop and express their thinking, and outdoor spaces provide rich opportunities for these patterns to emerge. Nutbrown (2011) further highlights that recognising schemas allows practitioners to plan environments that extend children's natural interests into deeper learning. For example, trajectory schema is supported through throwing, rolling and dropping objects; transporting schema emerges when children carry materials such as stones, sticks or buckets; rotation schema appears when children turn wheels, twist ropes or roll tyres; and enveloping schema is seen when children hide objects under leaves or soil (Nutbrown, 2011). Arnold (2010) emphasises that when adults understand these schemas, they can intentionally design environments that extend children's natural patterns of behaviour into mathematical and scientific learning, supporting exploration of concepts such as force, pattern, quantity and change (Arnold, 2010).

However, enabling environments do not happen automatically. Waite (2011) notes that outdoor learning is often limited by risk-averse cultures, lack of confidence, or insufficient planning. Some settings treat outdoor play as "free play" rather than a space for intentional learning, which can reduce opportunities for mathematical and scientific exploration. Practitioner confidence with STEM outdoors also varies, meaning some adults may not recognise the learning potential within everyday outdoor experiences (Waite, 2011).

Loose Parts to Support Mathematical and Scientific Learning

Loose parts are widely recognised as powerful tools for supporting mathematical and scientific learning outdoors, offering children open-ended opportunities to explore, manipulate and investigate materials in ways that promote deep cognitive engagement. Nicholson (1971) first introduced the concept of loose parts, argued that environments rich in movable, adaptable materials stimulate creativity, problem solving and discovery. Daly and Beloglovsky (2015) extend this idea, explaining that loose parts can be combined, redesigned and manipulated in countless ways, enabling children to construct understanding through hands-on exploration. When adults provide loose parts intentionally, they create environments that naturally support mathematical concepts such as measurement, pattern, sorting, shape, quantity and comparison, alongside scientific concepts including force, motion, balance, gravity and prediction (Daly and Beloglovsky, 2015).

Outdoor environments offer unique affordances for loose-parts play. Gibson and Pick (2000) emphasise that affordances arise from the relationship between the child and the environment, meaning that materials such as sticks, stones, crates, pipes, tyres and natural objects invite exploration of mathematical and scientific ideas. Casey and Robertson (2019) highlight that loose parts encourage STEM thinking by prompting children to test hypotheses, investigate cause and effect, and engage in trial-and-error experimentation. For example, when children roll tyres down a slope, they explore trajectory, speed and force. When they build structures with crates or logs, they investigate balance, stability and measurement. When they sort stones by size or colour, they engage in classification and patterning.

Loose parts also support curiosity in learning. The Welsh Government (2022) states that children should be supported to explore and make sense of their environment through meaningful, hands-on experiences. Loose parts provide this by offering children opportunities to investigate natural materials, observe changes, test ideas and engage in imaginative exploration. Russell (2022) highlights that outdoor STEM learning is strengthened when children have access to varied materials that provoke inquiry and experimentation. Mud kitchens, for example, offer rich opportunities for exploring consistency, volume, measurement and change, while collections of natural objects encourage sorting, comparing, counting and pattern-making.

However, the effective use of loose parts requires intentional adult involvement. Waters-Davies (2022) notes that loose parts can become “busy work” if adults do not scaffold learning or recognise the mathematical and scientific potential within children’s play. Safety concerns can also lead to over-restriction, limiting opportunities for exploration and risk-taking. Some practitioners may lack confidence in linking loose parts to STEM concepts, meaning professional development is essential to ensure high-quality practice. Learning Through Landscapes (2020–2021) emphasise that training helps practitioners recognise the learning potential within loose-parts play and design environments that support rich mathematical and scientific exploration.

When adults provide loose parts thoughtfully and responsively, they create powerful opportunities for children to engage with mathematical and scientific concepts through curiosity, experimentation and hands-on discovery. Loose parts are a central part of enabling outdoor environments that promote deep, meaningful learning.

Interaction and Scaffolding in Outdoor Learning

Adult interaction is central to children's mathematical and scientific development outdoors, shaping how children make sense of their experiences through dialogue, co-exploration and sensitive scaffolding. Siraj-Blatchford et al. (2002) emphasise that high-quality interaction supports deeper thinking, particularly through sustained shared thinking, where adults and children work together to solve problems, clarify ideas and extend understanding. Siraj-Blatchford and Manni (2008) further highlight that sustained shared thinking is most effective when adults respond to children's interests, ask thoughtful questions and engage in two-way conversations. In outdoor environments, these interactions often emerge naturally as children investigate natural materials, observe changes, test hypotheses and explore physical phenomena (Siraj Blatchford and Manni, 2008).

Scaffolding is a key component of effective adult interaction. Wood, Bruner and Ross (1976) describe scaffolding as the process through which adults support children to achieve tasks they could not complete independently. Bruner (1966) argues that discovery learning is strengthened when adults provide guidance, modelling and opportunities for problem solving, enabling children to build on their existing knowledge. Vygotsky's (1978) concept of the Zone of Proximal Development (ZPD) reinforces this, suggesting that learning occurs most powerfully when adults support children just beyond their current level of competence. Outdoors, this might involve helping children predict what will happen when rolling a tyre down a slope, encouraging them to compare the weight of stones, or prompting them to observe how water flows through pipes.

Piaget (1952) also contributes to understanding adult interaction, arguing that children construct knowledge through hands-on exploration. Adults who recognise this can step back at appropriate moments, allowing children to test ideas independently before offering support. Gopnik (2016) describes young children as "scientists in the crib", constantly forming hypotheses and experimenting with the world around them.

Observation is another essential aspect of adult interaction. Sylva et al. (2004) highlight that effective practitioners observe children closely to understand their interests, developmental needs and emerging concepts. Outdoors, observation allows adults to identify moments where mathematical and scientific thinking is unfolding, such as when children sort natural objects, compare sizes, explore balance, or investigate natural phenomena like shadows, wind or water flow. These observations help adults decide when to intervene, when to extend learning, and when to allow independent exploration.

The Curriculum for Wales emphasises the importance of curiosity-driven learning, encouraging adults to support children in exploring and making sense of their environment through meaningful experiences (Welsh Government, 2022). Harris (2019) notes that the Donaldson curriculum values inquiry, problem solving and active engagement, all of which are strengthened through responsive adult interaction outdoors. Dewey (1938) similarly argues that learning through doing is essential, suggesting that adults should create conditions that allow children to interact actively with their environment.

However, adult interaction requires balance. Over-scaffolding can limit independence and reduce opportunities for children to test ideas. Under-scaffolding, on the other hand, can lead to missed learning opportunities, particularly when children are exploring complex mathematical or scientific concepts. Waters-Davies (2022) notes that adult questioning must be purposeful rather than constant, supporting children's thinking without dominating their play. Practitioner confidence with STEM outdoors also varies, meaning professional development is essential to ensure adults feel equipped to recognise and extend mathematical and scientific learning.

Effective adult interaction involves sensitive scaffolding, purposeful questioning, co-exploration and thoughtful observation. When adults engage responsively with children outdoors, they create powerful opportunities for mathematical and scientific learning to emerge naturally through curiosity, inquiry and meaningful exploration.

Barriers and Challenges

Despite the benefits of outdoor learning for mathematical and scientific development, there are also barriers that can limit how effectively adults support these experiences. Nursery World (2016) highlight that many early years settings struggle with limited outdoor space, insufficient resources and inconsistent staff confidence, which reduce opportunities for rich exploratory learning. Health and safety concerns often lead to risk-averse cultures, where adults restrict activities such as climbing, transporting, or experimenting with loose parts. Waite (2011) argues that these restrictions can unintentionally limit children's access to meaningful mathematical and scientific exploration, particularly when practitioners feel pressured to prioritise safety over inquiry.

Environmental factors also present challenges. Weather conditions, time constraints and curriculum pressures can reduce the frequency and quality of outdoor learning experiences. Knight (2013) notes that practitioner confidence plays a significant role in overcoming these barriers, adults who feel unsure about STEM concepts may struggle to recognise the learning potential within everyday outdoor experiences. Learning Through Landscapes (n.d) emphasise that professional development is essential for helping practitioners understand how to use outdoor spaces intentionally and safely while still supporting exploration, experimentation and problem solving.

Policy expectations further shape practice. Welsh Government guidance (2009; 2014; 2015; 2022) reinforces children's right to play and explore outdoors, yet practical constraints often hinder this. UNICEF (n.d) also highlights children's right to play under Article 31, emphasising the need for environments that support curiosity and inquiry. These barriers require reflective practice, supportive leadership and ongoing training to ensure adults feel confident and equipped to provide high-quality outdoor learning.

Conclusion

Adults play a crucial role in supporting mathematical and scientific learning outdoors by designing enabling environments, providing rich loose-parts opportunities and engaging in responsive, curiosity-driven interaction. When practitioners intentionally plan outdoor spaces, recognise schemas, scaffold learning sensitively and encourage exploration, children develop deep understanding through hands-on investigation. Although barriers such as limited space, risk-averse cultures and varying practitioner confidence can restrict outdoor learning, professional development and reflective practice help overcome these challenges. High-quality outdoor environments offer powerful opportunities for children to explore mathematical and scientific concepts in meaningful, engaging and developmentally appropriate ways.

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