

Student Number 2517872 ECEY5005

Cover Sheet

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ECEY5009: Awe and wonder- science, mathematics and the outdoors

For this assignment I have submitted the following:

Part 1: A photograph of an outdoor space

Part 2: A learning Journey word count: 1,416

Part 3: A risk benefit assessment word count: 1,150

Part 4: Evaluate how adults working with early years children support and encourage children engage with mathematical and scientific concepts in an outdoor environment.
Word count :1,825

I acknowledge the use of co-pilot between the dates 25/9/26-27/9/26 to help find relevant research.

I used the prompt(s): 1. Help me find relevant research I can look at to help me with the adult's role of math and science in the outdoors between 2016 and 2026.

[Prompt] 2. What do I write in google scholar to find these relevant articles?

I confirm that I have not presented any AI generated text as my own work. I confirm I have copies of my drafts, notes, and other resources I used before, and after the use of AI tools which I may be asked to provide in evidence.



Lewis, R. (2026) *Personal Image* [Photograph].

Learning Journey at Bellevue Park

It is a crispy autumn morning at Bellevue Park, we have walked here from playgroup which is across the road as we have 6 children with us aged 3-4 years. Children held an adult's hand. We pressed the button and talked about waiting for the green man. One child said, "Rhiannon it's green can we go?" I answer, "Yes let walk carefully into the park." Bellevue Park is a beautiful natural environment that offers plenty of space for open-ended exploration. The park has gentle grass slopes, tall trees and a plenty of fallen leaves, creating a calm and inviting outdoor space where the children can move freely, investigate natural materials and follow their own curiosity.

As we arrive at the park, the children are filled with excitement as we walk through the trees. They immediately notice the long grassy slope stretching down from the woodland area. They begin to move towards it with curiosity, running their hands through the fallen leaves as they go. Child A asks, "Can I roll down the hill?" and Child B quickly adds, "Me too!" Child C and Child D look at me and say, "I'm scared." I reassure them that it is okay to watch first and that they can join in later if they want to. The other children are all happy to give rolling down the slope a go.

The children lie down at the top of the slope, giggling as Child A announces, "I'm going to roll!" Child C and D watch to begin with. The children begin to experiment with different ways of moving their bodies, rolling sideways, sliding on their bottoms, and at one point Child B tries to run down before stopping to steady themselves. As practitioners we are spread out to ensure safety and I observe closely, offering encouragement and ensuring the children feel safe, while still giving them the freedom to explore how their bodies move on the slope. Before long, Child C and Child D decide to join in too.

Through this playful movement, the children begin to investigate early scientific ideas such as speed, gravity and friction. They notice how the slope helps them move faster, how the grass slows them down at the bottom, and how different movements change the way their bodies travel.



Lewis, R. (2026) *Personal Image* [Photograph].

The children have been on the slope for a good twenty minutes, and I can see them all becoming more confident. I notice their play beginning to change. Child A has moved further up the slope and says, “I’m going to go faster this time!” They push off with more force and roll quickly, laughing as they reach the bottom. One practitioner says, “You went super-fast that time. What do you think made you go faster?” Child A stops, looks back up the hill and replies, “I went higher.” The other children hear this and begin to experiment too.

Child B wants to see how far the leaves will roll down the hill. He places a handful of leaves on the slope and watches how they slide down. “They don’t go far,” he says. Child D joins in, adding, “The leaves stop!” I kneel beside them and ask, “Why do you think the leaves stop but your body keeps going?” The children look at each other, and one says, “We are bigger,” giggling to their friend as they continue to enjoy the slope. The children from exploring on the slopes are beginning to make simple connections between the materials, the surface and how things move. Their play becomes more purposeful as they test different ways of travelling down the hill, noticing how the grass slows them down, how rolling feels different to sliding, and how starting from a higher point changes their speed.

As the children continue to explore, they look around to see what else will roll down the slope. Child C picks up a small stick and places it at the top of the slope. It rolls a short distance before stopping. “It didn’t go far,” they say. Child B shouts, “Try a big one!” and together they look for a bigger, thicker stick. These roll further, bumping over the grass before coming to a stop. I have brought some balls from setting and encouraged the children to look around for some natural items a practitioner says shall we see what else will roll down this slope” lots of the children shout “yes” and start searching they find more sticks and pinecones and we add the balls and start to notice how each object moves differently on the slope. They begin guessing which of the objects will roll the furthest, testing their ideas through playful trial and error. The children are beginning to explore motion and friction as they compare all these resources. There are also clipboards paper and pens for the children to mark make and record their ideas and what they notice, this will encourage problem solving and help the children learn these early scientific concepts through playing and exploring the slopes and the natural resources at Bellevue Park.



Lewis, R. (2026) *Personal Image* [Photograph].

Welsh Government (2022) within the Curriculum for Non-Maintained Nursery Settings, highlights that outdoor experiences are essential for young children's development. Being outdoors supports children's social, emotional and physical growth, and contributes strongly to their overall well-being. Natural environments help the children to grow in confidence and really engage, be curious and create those moments of awe, because the children have the freedom to explore, practise skills and build on what they already know. The Outdoors give children the space to relax, express themselves and engage in meaningful, enjoyable experiences. The outdoor environment offers sensory learning through different sounds that can be heard, the different textures to explore, what different things they can see and smell as they explore.

The curriculum explains that outdoor environments provide the physical space children need to understand how their bodies move and how they fit within the world around them. This links to the activity which the children have experienced at Bellevue Park it supported balance, coordination, motor development and physical confidence. The children through challenges they encountered learned how to assess and manage risk, which helped them build resilience and independence.

The activity has links to all five developmental pathways of the Curriculum for Wales. The children feel safe and secure as they have time and freedom to explore their surroundings, managing their emotions as they develop self-esteem through exploring what they can do and feel comfortable doing. This is linked to Well-being. The children are beginning to understand and follow some boundaries as they cross the road and explore the park. They are also making connections with the environment. This is linked to Belonging. The Communication pathway is supported as the children are noticing what they see and talking about what they can see in the environment. They are having time to think and process their ideas, and they are developing their attention and listening. The next two pathways are essential to outdoor learning with young children. Exploration gives them opportunities to explore, investigate and discover. They are able to share their curiosity with others, and they are developing their understanding of how things work through those hands-on experiences and open-ended play. Finally, Physical Development allows the children to naturally move and manipulate objects, express themselves and move in a variety of ways, maintain balance and take risks in their play. All of this is a holistic approach emphasising the importance of the outdoors and the learning experiences created in this environment. (Welsh Government 2022)

Overall, the learning experience at Bellevue Park demonstrates how powerful outdoor environments are for young children's developmental needs. Through open-ended exploration, natural materials and opportunities to assess their ideas, the children were able to engage deeply in meaningful learning that connected directly to the five pathways of the Non-Maintained Curriculum for Wales. Their curiosity, confidence and independence grew as they explored the slope, investigated how objects moved and

stopped, and supported one another in their play cooperatively. This experience shows how outdoor learning provides rich, authentic opportunities for children to develop holistically, strengthening all five developmental pathways while building a strong sense of well-being, belonging and physical capability in the children. Bellevue Park offered a natural, stimulating environment where the children could follow their interests, take risks safely and learn through hands-on experiences, demonstrating the true value of high-quality outdoor provision.

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RISK-BENEFIT RATING TEMPLATE

Date of risk assessment.....Bellevue Park

Name of assessor.....Rhiannon Lewis

Area/activity being assessed.....Exploring the outdoors.....

Key	
Very low risk	1
Low risk	2
Moderate risk	3
High risk	4
Very high risk	5

We have Hi vis vests for all staff and children we have a ratio of 1:2 We have emergency contact numbers, we have a phone and a first aid kit the nearest Minor injuries unit to us is the Royal Gwent hospital and the closest A&E is the Grange hospital.

The hazard/ activity	The risk/ what could happen	Who is at risk?	Benefits?	Risk rating before control measures	Control measures	Risk rating after control measures
Children rolling down the slope	Children may have Minor bumps, slips, fall, collisions with others, dizziness	Children	Supports children's gross motor skills – the children are learning how their bodies move as they role down the slope.	3	- Ensure slope is clear of hazards - Encourage controlled rolling - Ensure appropriate footwear	2

			• Supports the children with balance and spatial awareness. • Supports the children to build their confidence learning new challenges helps them gain confidence. • Encourages fun sensory exploration as they roll down the slope with their friend. • Links to the curriculum		• Support children who feel unsure	
Uneven ground /Natural terrain	Staff/Children may slip, trip, fall, broken bones, cuts, tear, strain and ligament damage head trauma medical treatment	Staff/Children	Supports risky play in in the outdoors. • Supports children to understand their spatial awareness. • Helps with muscle strength. • Support children to adapt quickly. • Support children with their balance. • Provides risky play.	4	• Supervise the children at all times. • Ensure correct footwear is worn. • Maintain safe walking practices e.g if holding a stick put thumb on top.	2
Natural materials (Sticks stones pinecones)	Using these items inappropriately can cause eye injury, cuts, tears, scratches, grazes	children	• Encourages explorations. • Supports children's fine motor skills. • Encourages the children to be creative.	3	• Model safe handling of holding the object • Remove sharp or unsafe items. • Supervise closely. • Establish rules (no throwing/hitting)	2

			• Encourages children to problem solve and work collaboratively. • Links to the curriculum			
Rolling objects down the Slope (balls sticks stones)	Objects may hit children, cause trips, falls, collisions, bruises	children	• Supports scientific thinking (forces, motion, gravity) • Encourages the children to problem solve how gravity pulls object downwards and friction slows them down. • Support children to understand different object will go down the slope faster than other depending on their shape and size	3	• Only use safe, lightweight objects • Ensure children stand clear of rolling path • Supervise closely • Guide children to wait until path is clear • Avoid heavy or sharp objects	2
Weather conditions wet grass wind	Slips, falls, reduced visibility, cold discomfort, wind blowing objects	Staff and children	• support resilience. • awareness of weather • adapting to conditions, supports outdoor learning. • support children to understand cause and effect e.g wind moves object; wet grass becomes slippery.	3	• Check weather before activity • Ensure appropriate clothing • Avoid steep slopes when wet • Increase supervision • Shorten outdoor time if conditions worsen	2
Children becoming scared overwhelmed	Distress, crying, refusal to participate, running away , becoming overwhelmed	Children	• Builds Children's confidence. • Builds children's resilience. • With adult reassurance and no pressure children have trust in adults,	2	• Offer reassurance • Allow children to opt out • Provide calm space • Pair with familiar adult	1

			Children understand their personal limits		Use positive encouragement	
Children running down the slope	Falls, collisions, head injuries, sprains, strains ,cuts, tears.	Children	- supports children's physical development, - supports children's confidence - supports coordination. - Encourages the children to understand risk awareness. - support working together.	4	- Clear rules: walking or controlled movement only - Supervise closely - Demonstrate safe ways to descend - Use verbal reminders - Position adults at top and bottom of slope	2
Dog mess	Infection, contamination, illness, slip, fall, cross contamination, emotional distress	Staff and children	- supports children to have awareness of object that may be dangerous. - support children with hygiene not to touch any foreign objects. - responsibility by letting a staff member know to be able to pick it up and dispose of Safley	3	- Check area before use. - Avoid contaminated areas. - Clean safely if appropriate - Ensure handwashing afterwards. - First aid kit - Wet wipes	1
Little sharp objects	Deep cuts, open wound, puncture wounds, infections eye injury, embedded foreign bodies,	Staff and children	Encourages environmental awareness, responsibility, care for community spaces	4	- Conduct pre-visit sweep - Remove hazards safely - Avoid areas with significant litter	1

	trip, fall, emotional distress				support children not to touch unknown objects	
Carrying resources clipboard pencil	Trips, falls, pokes, minor injuries, eye injuries, scratches grazes	Staff children	- Encourages children to look after resources and be responsible, - Encourages independence, - Supports mark-making outdoors. - Links to the curriculum	2	- Teach safe carrying - Use blunt pencils - Ensure children walk when carrying items - Limit unnecessary items	1
Walking near busy road	Staff/ Children getting run over by moving vehicles causing a tear, open wound, bump, back pain, bruising, protentional broken bones, sprain, strain and ligament damage, head trauma, death. Require medical treatment	Staff children	- Safety: The children learn to follow basic instructions, they need to stop at the kerb and look left and right and wait for the green man to be able to cross safely, and to follow the adult's guidance by listening. - Building confidence: the children are learning that this ok to do with adult help and with clear guidance to cross the road safely. - Social and communication: the children will be talking to each other and to the adults about things they can see, they will be able to ask questions and respond to simple instructions.	4	- High supervision - Children wear hi-vis. - Adults positioned at front/back. - Clear walking rules - Hold hands at all times. 1:2 adult child Ratio	2

Crossing at pelican crossing /Walking near a busy road	Staff/ Children getting run over by moving vehicles causing a tear, open wound, bump, back pain, bruising, protentional broken bones, sprain, strain and ligament damage, head trauma, death. Require medical treatment	Staff Children	• Safety: The children learn to follow basic instructions, they need to stop at the kerb and look left and right and wait for the green man to be able to cross safely, and to follow the adult's guidance by listening. • Building confidence: the children are learning that this ok to do with adult help and with clear guidance to cross the road safely. • Social and communication: the children will be talking to each other and to the adults about things they can see, they will be able to ask questions and respond to simple instructions.	5	• All children will wear hi vis vests. • The adult to child ratio will be 1:2 allowing the adults to hold the children's hands. • Staff are all first aid trained and we will have a first aid bag with us. • The crossing will only be crossed when it is safe to. • The staff will have a phone and emergency contacts	2

According to Tovey (2017), outdoor environments play a crucial role in shaping children's early development, offering rich opportunities for mathematical and scientific learning. Research consistently shows that natural spaces support children's social, emotional and cognitive growth by providing freedom, sensory stimulation and open-ended possibilities for exploration. Tovey (2017), writing from a Froebelian perspective, also highlights that the adult who creates a high-quality outdoor environment, where children can follow their own interests, be curious and engage in hands-on investigation, plays a key role in shaping children's learning experiences.

Welsh Government (2022) embed these principles within the Curriculum for Non-Maintained Nursery Settings, emphasising that time outdoors is central to children's growth. Outdoor learning encourages curiosity, problem solving and self-directed exploration, while natural environments offer moments of awe and wonder and provide rich sensory experiences through sound, sight, smell and touch. However, Welsh Government (2022) stress that these benefits depend on the enabling adult, who is expected to create emotionally safe environments, model a joyful approach to learning and make effective use of teachable moments as they observe or engage in children's play. Enabling adults are also responsible for strengthening children's sense of belonging by making connections with home and community, supporting children's decisions and choices, and responding sensitively to uncertainty and change. They are expected to refine planning, adapt provision and make cross-curricular links based on children's previous experiences and current fascinations. This aligns closely with Tovey's (2017) Froebelian perspective, reinforcing that high-quality outdoor learning does not occur automatically but is intentionally shaped by adults who observe, guide and nurture children's curiosity and emerging mathematical and scientific thinking.

Constructivist theories provide a strong foundation for understanding how children learn outdoors. Piaget argues that children build knowledge through exploring and interacting with their surroundings, reorganising their cognitive structures as they manipulate materials and test ideas (Ginsburg & Oppen, 1988). His view that action forms the basis of thought is particularly relevant outdoors, where children encounter real-world variables such as uneven surfaces, changing weather, natural materials and physical forces. Adults who provide time, space and freedom for exploration support children to engage in the kind of hands-on investigation Piaget considered essential for cognitive growth. However, Piaget's theory alone does not fully explain how adults influence learning. Vygotsky's sociocultural perspective highlights that cognitive development is the foundation for social influences, shaped through interaction with more experienced others. His concept of the Zone of Proximal Development (ZPD) illustrates how adults extend children's thinking by offering guidance that helps them achieve more advanced reasoning than they could playing or exploring independently outdoors (Bidita, 2024). This might involve an adult asking purposeful questions to spark curiosity and prompt prediction, such as "Who do you think will go down the

slope faster — you or the stick?” Such questioning encourages children to think critically, compare outcomes and engage in early problem-solving. These interactions transform spontaneous exploration into purposeful mathematical and scientific inquiry.

Bruner strengthens this argument by emphasising that learning is an active, children learn from building their own understanding through their interactions and experiences. His work highlights that teaching should help learners be able to extend their thinking beyond what they already know, encouraging them to recognise patterns, assess ideas and make connections through collaborative exploration (Bruner, 2020). This aligns closely with outdoor learning, where adults can prompt children to notice patterns, assess ideas and reflect on outcomes. Together, these theories highlight that while outdoor environments provide the foundation for children’s exploration, adults play a crucial role in shaping that exploration into deeper conceptual understanding and helping children build on their previous experiences.

Affordance theory provides a helpful way of evaluating how outdoor environments support children’s mathematical and scientific learning. Ingold (2018) describes affordances as the possibilities of the environment the opportunities and hazards that appear as children explore their surroundings. From this perspective, outdoor features are not simply objects but become meaningful through engagement: slopes can be for rolling or climbing, natural materials create opportunities for sorting and comparing, and puddles allow experimentation with symmetry, force or cause-and-effect. Ingold’s point that children feel their surroundings as they play and learn reinforces the idea that children encounter mathematical and scientific concepts through physical exploration rather than through explanation. Crucially, he argues that affordance is not a fixed property of the environment; it only exists when a child acts on it and finds it significant. Although outdoor spaces may be rich in potential, children do not always notice or make use of these possibilities without that enabling adult to offer support and guidance. The Adult enhances affordances by offering a variety of materials, arranging the outdoor spaces to encourage exploration and opportunities for the children to encounter risk and observing the children closely so extend the children’s mathematical or scientific thinking. For example, if a child a child is rolling down the slope an adult might introduce language about Forces this will help the children to grasp that gravity is helping them push down the slope. Ingold (2017) highlights that adults must provide time, space and encouragement for children to explore meaningfully in the outdoors. Without the enabling adult involvement, many affordances remain unnoticed or underused, limiting opportunities for deeper physical and conceptual development.

Loose parts are widely recognised as powerful tools for promoting mathematical and scientific learning outdoors. Nicholson's theory of loose parts emphasises that flexible, open-ended materials encourage creativity, experimentation and problem solving. Outdoors, loose parts such as stones, sticks, pipes, tyres, shells and containers provide strong affordances for mathematical thinking, including sorting, patterning, comparing, measuring and spatial reasoning. Research shows that children's exploration deepens when the materials offer multiple possibilities for children to test ideas, observe cause and effect and investigate physically (Cankaya, Leach & Akdemir, 2024). However, the effectiveness of loose parts depends heavily on the involvement of the adult within the environment. Adults who think outside the box use their training to select varied materials create environments that promote a higher-level of thinking exploring and engagement. Observing closely can also identify moments where children are engaging mathematically or scientifically and offer guidance that extends the children's thinking without dominating their play. For example, when children are playing with sticks the adult can introduce vocabulary such as this one is longer and this one is shorter, these interactions transform open-ended play into deeper learning. Neill (2018) highlights that loose parts also support sustained shared thinking, as adults and children problem solve together through conversation. Loose parts do not automatically produce mathematical or scientific learning on their own; it is the enabling adult who recognises potential, scaffolds inquiry and encourages reflection that determines the depth of conceptual understanding a child can explore in the outdoors.

Child-led play is central to outdoor learning, and theories from Froebel, Piaget and Reggio Emilia emphasise its importance. Froebel viewed nature as essential for children's development, arguing that outdoor environments support creativity and allow children to be active learners. He also believed that a sensitive adult guide nurtures children's growth. (Flemig & McNair, 2022). Reggio Emilia builds on this by positioning the environment as an additional educator, designed to provoke curiosity, collaboration and investigation (Fernández Santín & Feliu Torruella, 2017). Clements, Lizcano and Sarama (2023) argue that while children may notice mathematical ideas during free play, this only provides the starting point for early mathematical and scientific exploration. However, they state that free play alone does not lead to deeper conceptual learning. Studies across several countries show minimal maths learning without adult involvement, and the authors note that clear concepts rarely develop without support. They emphasise that guided play is more effective than free play or direct instruction, and that understanding children's thinking and using learning pathways is essential. This means deeper learning depends on intentional adult support.

Sustained shared thinking (SST) is one of the most effective ways adults deepen children's mathematical and scientific understanding outdoors. Norland College (2020) describes Sustained Shared Thinking as a collaborative process where adults and children think together to solve problems or extend their ideas. Outdoors, Sustained Shared Thinking is particularly powerful because natural materials and affordances encourage investigation. Adults strengthen these ideas by using open-ended questions that prompt prediction, comparison, explanation and hypothesis building. For example, asking "What do you think will happen if we went higher up the slope?" encourages children to test ideas and reflect on outcomes. These interactions support key mathematical and scientific processes such as force and gravity. High-quality Sustained Shared Thinking requires practitioners to be attentive, knowledgeable and responsive. Adults must recognise emerging concepts, build on children's existing understanding and avoid dominating the learning process. When done well, Sustained Shared Thinking transforms spontaneous exploration into meaningful play opportunities, helping children articulate mathematical relationships or scientific explanations that arise from their outdoor experiences.

Despite its potential, outdoor mathematical and scientific learning presents significant challenges. Research highlights that practitioners often feel underprepared to deliver inquiry-based outdoor activities, particularly those requiring Science, Technology, Engineering and Mathematics (STEM) related knowledge (Norland College, 2020; Waite, 2011). Low confidence affects their ability to design meaningful tasks that encourage comparison, measurement or prediction. Access to suitable outdoor spaces is another barrier. Not all settings have safe, open or well-resourced environments, limiting opportunities for loose parts play, maths trails or scientific exploration. Assessment also becomes more complex outdoors, as learning is often spontaneous and collaborative. Practitioners must rely on observation, dialogue and documentation rather than written evidence, which can be difficult to capture consistently (Mardia et al., 2025). Curriculum pressures add further constraints. Practitioners must balance child-led exploration with formal learning expectations, which can be challenging when outdoor learning is unpredictable. Environmental factors such as weather, noise and uneven surfaces require flexible planning and additional supervision, placing extra demands on staff. Recent research emphasises that outdoor STEM teaching requires specialised pedagogical content knowledge (Pitiporntapin et al., 2025). Practitioners must adapt the learning to fit the conditions, use natural materials creatively and respond to children's emerging ideas. Without adequate training, leadership support and resources, these demands can limit the effectiveness of outdoor learning.

Outdoor environments offer rich opportunities for mathematical and scientific learning, but these opportunities are only brought into practice through skilled adult practice. Theories from Piaget, Vygotsky, Bruner, Froebel and Reggio Emilia highlight that exploration, social interaction and guided support are central to the children's cognitive

development. Affordance theory and loose parts research demonstrate that environments rich in open ended resources that spark a stimulate inquiry, but only when adults set up these spaces intentionally and scaffold learning sensitively. Sustained shared thinking emerges as a particularly powerful strategy for deepening children's understanding of the outdoors. However, significant barriers including limited training, curriculum pressures, inconsistent confidence and environmental constraints affect practitioners' ability to deliver high-quality outdoor STEM learning. Addressing these challenges requires investment in professional development, supportive leadership and clear pedagogical guidance. Outdoor learning becomes most effective when adults combine theoretical insight with responsive, reflective practice, creating environments where mathematical and scientific concepts emerge naturally, creatively and meaningfully through children's exploration.

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