

Awe and wonder

Science and mathematics in the outdoors.

Section 1



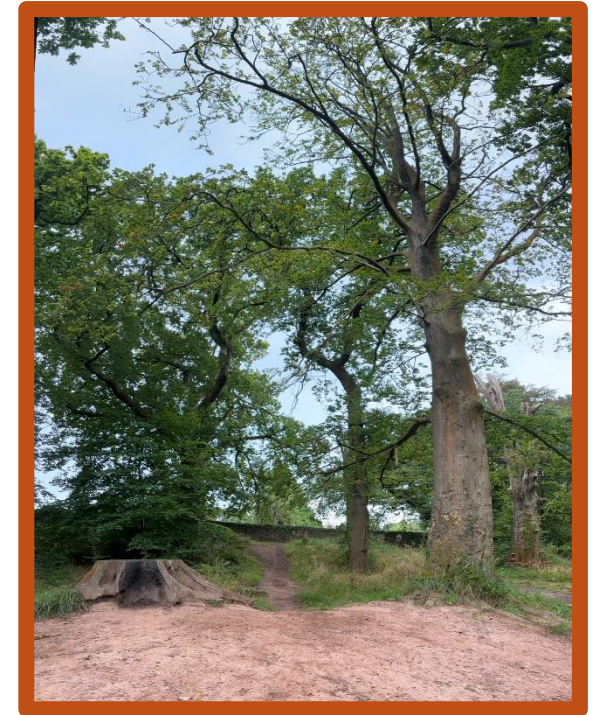
Section 2

Feature 1 - Uneven, sloped, muddy surface.

Mathematical and scientific opportunities.

The sloped, wet ground at the far end of the feature may encourage children to move up or down the hill, offering a chance for physical, muddy play. Moser (2020) acknowledges that mud play fosters a connection with nature. Children might roll, slide, or climb uphill, while an adult observes or joins in with the play.

As the children slide, they may use some comparative mathematical language such as fast, faster, slow, and slower to measure time (BBC Bitesize, 2024). The adult could scaffold this activity by introducing a timer, pencil, and paper for measuring and recording. This would be modelled and supported by the adult. In addition, the adult could encourage the children to make predictions such as, who will be faster or slower. According to Schmidt (no date), this allows the children to use prior knowledge and experiences to make reasonable predictions. The adult could further scaffold this by asking, "Why do you think A will be faster?" Furthermore, asking "How can we make sure this is fair? What have we kept the same? What is different? Was your prediction right or wrong?" These skills align with being ambitious, capable learners and are building up a body of



(Source: Graham 2024b)

knowledge and having the skills to connect and apply that knowledge in different contexts, as well as questioning and solving problems as part of the Curriculum for Wales (Welsh Government 2022).

Alternatively, children might engage in mud play, using natural materials like sticks, stones, pinecones, and leaves found in the area to build mud pies, cakes, ramps, or other structures. Adults can enhance this experience by providing loose parts such as spoons, containers, measuring cups, sieves, and pans, encouraging creativity and developing fine motor skills.

The soil in this area transitions from wet, muddy ground from the top to the bottom of the slope at the far end of the feature to drier, silt-like soil at the near end of the feature. This change in soil type can promote discussions with the children about the properties of soil, such as its texture, colour, and consistency. The adult might ask, "What happens if we add water to the dry soil? How does it change? Can you make a shape with it? Is it easier to shape wet or dry soil? Is it a 2D shape or a 3D shape?" Such questions encourage critical thinking and exploration of mathematical and scientific concepts, as children experiment with how soil reacts to water and how it can be moulded into various forms.

Curriculum Links:

Area Of Learning - Mathematics and Numeracy, progression steps (Welsh Government,2020a).

- Understanding and applying the language of time to daily life.
- Making estimates and comparisons with measures.

- Exploring shape through investigative play.
- Investigating, collecting and recording data.

Area Of Learning - Science and Technology, progression steps (Welsh Government 2020b).

- Observing and describing ways in which materials change when they are mixed.
- Explore the environment and communicate ideas.
- Safely use simple tools, materials and equipment to construct and deconstruct.
- Explore the properties of materials and choose different materials for a particular use.
- Using knowledge and understanding to make predictions as part of scientific exploration.

Feature 2 - Secluded area in the woodland.

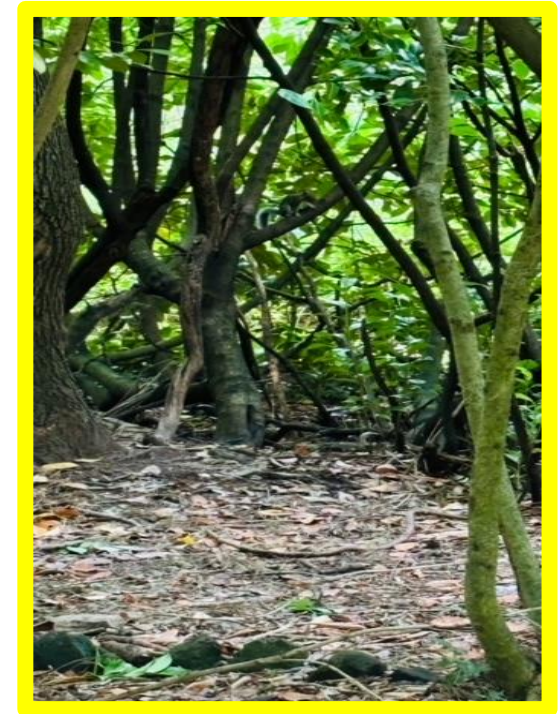
Mathematical and Scientific opportunities.

The secluded area provides children with an opportunity to explore nature, thinking about different animals and creatures that this area in the woodland might provide a home to. Nature Tots (2023), states that experiencing the natural world allows us to nurture a connection to wildlife and learn to take good care of it. This supports the purpose of Ethical, informed citizens who are knowledgeable about their culture, community, society and the world and show their commitment to the sustainability of the planet as part of the Curriculum for Wales (Welsh Government,2022).

In the feature, a squirrel can be seen sitting on one of the branches. This may encourage different reactions from the children. Some might go quietly, telling their classmates to "shh," while others could become excited, possibly scaring the squirrel away. This could spark curiosity, leading the children to explore deeper into the woodland to search for more squirrels. The adult could support this

by asking open-ended questions like, "Where do you think we will find more squirrels?"

and "Why do you think they are there? Why do you think they live in the woodlands?" According to Kane (2021), children should know that natural habitats provide homes to lots of animal and creature species. Additionally, Explorify (2016) states



(Source: Graham 2024c)

the importance of children learning about habitats and how they provide the food and shelter necessary for an animal or organism to survive. To further engage the children, the adult might encourage them to count the squirrels they see and record their findings on a tally chart, with the adult modelling how to create a tally using a clipboard, pencil, and paper.

In addition to observing squirrels, the adult could extend the activity by prompting the children to think about other animals or creatures in the woodland, asking, "What kinds of animals or creatures do you think we might find? Where would they be?" This could lead the children to search for mini-beasts and insects, using magnifying glasses provided by the adult to observe them. The children could also document what they have found by taking photos or recording on an iPad. Throughout the activity, they might naturally use positional language, such as "up," "under," "behind," and "in front of," to describe the location of the squirrels or other creatures they encounter. Collier (2024) states that positional language lays the foundation for mathematical concepts such as measurement, and geometry and introduces spatial relationships.

Curriculum Links

Area of Learning - Mathematics and Numeracy, progression steps (Welsh Government, 2020a).

- Counting sequences of numbers and one-to-one correspondence to count reliably. I can count objects that I can touch and ones that I cannot.
- Recognise and write numbers in a range of media, through a multisensory approach, from 0 to 10 and beyond.

- Using mathematical language to describe position.
- Recording and representing data in a variety of ways, including tally charts.

Area Of Learning - Science and Technology, progression steps (Welsh Government 2020b).

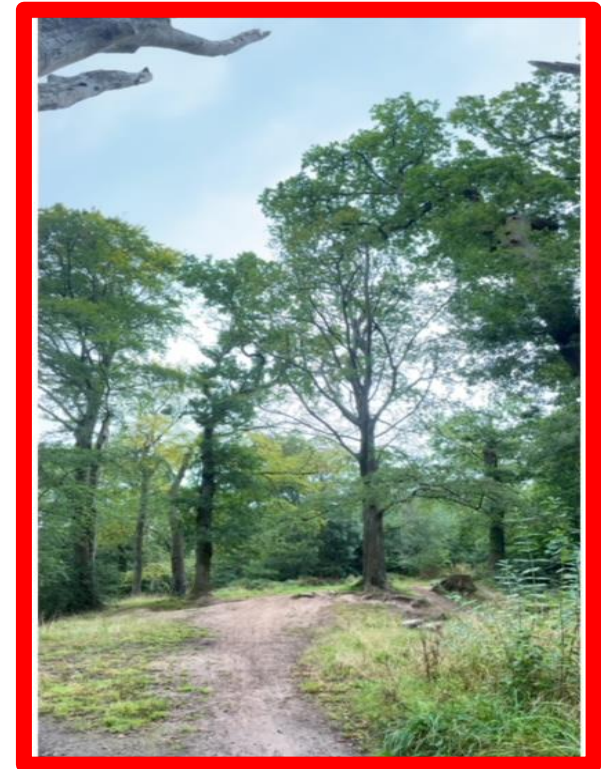
- Explore relationships between living things, habitats and life cycles.
- Make observations of the environment and communicate ideas.
- Recognise that plants and animals are living things that grow.

Feature 3 - An open space with a footpath.

Mathematical and Scientific opportunities.

This open space offers children a safe environment to explore nature. It allows them to walk freely (which supports independence), engage with their surroundings, and investigate the natural world. Australian Government (2023) suggests that nature walks may awaken the children's senses and encourage a deep connection with the natural outdoors, adding, that it can be a reflective experience.

The children are encouraged to explore independently within the designated safe zones agreed upon by the adult. This offers the opportunity for a nature scavenger hunt. Larose (2024) highlights the importance of children becoming detectives and sharpening their observational skills in discovering the diversity of the outdoor, natural environment. In the scavenger hunt, children can search for and collect lots of different natural items found in the woodland, such as leaves of different shapes, sizes, and colours. As the children collect these items, they might also count and discuss the textures and colours of the



(Source: Graham, 2024d)

leaves. The adult can scaffold this conversation by asking questions such as, "Why are the leaves changing from green to yellow?" "How many leaves are yellow?" or "Why do they crunch under your feet when you walk?"

Additionally, this allows for further exploration in seasons. According to Ito (2024) learning about seasons can help children understand time. The adult can encourage the children to think about the changes that they notice during the different times of the year.

The scavenger hunt provides an opportunity for children to explore the environment around them. As the children collect items like pinecones, stones, flowers, berries, tree bark, and sticks, the adult can enhance this experience by introducing concepts like living and non-living things. Sorting the collected items into two groups, living and non-living encourages children to think critically about the world.

To scaffold, the adult might ask questions such as, "How can we tell that a rock is non-living?" or "What makes flowers and plants living?" These questions can support children to think about the characteristics of living things, such as growth, and the need for food and water.

Finally, when moving around and collecting items, the children must be aware of things that they should not touch or things that can harm them. The children should tell a grown-up if they feel something is not safe. This aligns with one of the four



(Source: Graham, 2024e)

purposes of Healthy, confident individuals who know how to find the support to keep safe and well, as part of the Curriculum for Wales (Welsh Government, 2022). I have used an image of blackberries, which children may be familiar with. However, it is stressed that not all berries are safe, and they should not be picked or eaten.

Curriculum Links:

Area of Learning - Mathematics and Numeracy, progression steps (Welsh Government 2020a).

- Make estimates and comparisons with measures.
- Explore, compare and use the general language of shapes through investigative play.

Area of Learning - Science and Technology, progression steps (Welsh Government, 2020b).

- Show curiosity and question how things work.
- Identify things in the environment which may be harmful and act to reduce the risk to myself and others.
- Recognise that plants and animals are living things that grow.

Section 3

RISK ASSESSMENT - TRIP TO ST WOOLOS CEMETERY (JEWS WOOD) Date: 16th September 2024.

Reception Children Adult Ratio 1:6 ALN 1:1

5 staff members

1 parent

30 Children

Outdoor Experience	Benefits of Activity	Hazards and risks	Risk before control measures in place	Person at Risk	Control Measures	Residual Risk Rating H/M/L
Walking to and from the location.	➤ Develops motor skills. ➤ Inclusion ➤ Learn how to adapt to their environment, assess risks around them and make safe choices with the support of	➤ Fast-moving traffic, particularly around main roads near the city centre. ➤ ALN pupil danger awareness. ➤ Uneven/damaged pavements or	➤ Injury, death.	➤ Pupils and staff.	➤ Parental Consent. ➤ Pre-planned safest route using zebra, pelican, toucan and puffin crossings available. ➤ Keep children on the inside of the pavement.	Low

	responsible adults. ➤ Increases physical activity. ➤ Improves sleep. ➤ Teaches road awareness and safety. ➤ Promotes independence. ➤ Number and counting ➤ Colours ➤ Understanding of cause and effect. ➤ Comparative mathematical language such as fast, fastest, slow, slower.	roadsides (kerbs). ➤ Pupil lost or separated from the group. ➤ Unfamiliar adults approach the children and adults. This may also include those under the influence of a substance.			➤ Adequate supervision and adult-to-child ratio in line with current guidelines of 1:6. ALN 1:1 with parent and use of safety restraints/reins. ➤ Children to 'buddy up' and go into smaller groups with a designated adult. ➤ Register and headcount to be carried out before, during and after the walk to the location. ➤ Full First Aid kit and First	
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					Aider to attend the trip. ➤ Staff and pupils are aware of what to do if they become separated from the group whilst moving to and from the location. ➤ Mobile phone to hand and emergency contact details for children and staff carried throughout the trip.	
Nature Walk	➤ Develops gross motor skills. ➤ Use of positional language such	➤ Uneven/ sloped ground. ➤ Tree roots are revealed through the ground.	➤ Illness , injury and death.	➤ Pupils and staff .	➤ Children reminded of uneven ground and to take care where they	Low

	as under, on top of, and behind. ➤ Mathematical language such as shape, size and number ➤ Scientific language such as push and pull. ➤ Cause and effect. ➤ Properties of natural materials. ➤ Use of comparative language such as fast/slow. ➤ Making predictions relating to cause and effect. ➤ Habitats	➤ Wet, muddy surface and surface water. ➤ Discarded sleeping bags and tents in wooded area. ➤ Drug and alcohol substance cans/ paraphernalia. ➤ Smashed glass. ➤ Unrestrained domestic animals. ➤ Cyclists, scooters. ➤ Unfamiliar adults. ➤ Children lost or separated from the group. ➤ Animal/Human excrement. ➤ Insect bites or stings/allergies.			are walking and moving around. ➤ Appropriate clothing, such as wet weather gear and appropriate footwear. ➤ Street scene was contacted to clear away drug and substance paraphernalia, litter, soft furnishings, excrement and broken glass. ➤ Appropriate supervision within adult-child ratio and guidelines 1:6. ALN 1:1 with parent and reins when needed.	
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		➤ Tree pollen, mould and other pollutants which may trigger asthma attacks or respiratory issues.			➤ Reminding children not to touch approaching animals even if they look friendly. ➤ Full First Aid kit and First Aider to be with the children for the duration of the trip. ➤ Children to be reminded to be aware of their surroundings and to remain in the safe areas where a safe adult is present. ➤ A further sweep of the area on the morning of the	
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					trip to ensure the area was free of debris or danger. ➤ Awareness of what to do in an emergency in case of an unknown allergy to an insect bite /sting. In addition, carrying asthma pumps and any medication such as epi-pens or antihistamines.	
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An introduction to science and mathematical concepts in the outdoors.

The curriculum in Wales promotes opportunities and environments that encourage play, exploration, and hands-on learning. In an early years setting, adults can enhance children's learning by offering supportive, responsive environments (Pacey,2021). According to Nature Days (2018), the four core purposes of the new curriculum for Wales strive for independence and real-life learning. The Muddy Puddle Teacher (2023) states that outdoor learning helps children build essential skills like problem-solving, critical thinking, confidence, and resilience, Furthermore, Tinney (2023) suggests that taking part in outdoor learning can offer a range of benefits, such as stimulating awe and wonder, curiosity, encouraging exploration and enhancing wellbeing and a sense of belonging. These are skills that are integral to the four purposes of the curriculum for Wales (Welsh Government,2022).

Wilson (2015) suggests that adults can promote science in the outdoors by simply just providing buckets to collect rain, filling a container with soil and planting seeds in it, and then discussing what plants need to grow. Additionally, becoming ambitious capable learners by measuring a tree and comparing their height to it. These types of outdoor experiences can give context to the learning taking place (Edwards,2022).

"The outdoors offers limitless potential to children. It becomes a place where they can go to relax their mind, to be inspired and to dive deep into the world of imagination. It is a place where they can design, create and explore. The possibilities are endless." Angela Hanscom (Cosy,2021).

This Portfolio piece will explore the ideas of educational theorists, and studies on the importance of outdoor learning and the role of the adult in supporting scientific and mathematical concepts in the outdoors.

Maria Montessori (cited by Apple Montessori Schools,2024) believed that children need to have quality time in the outdoors to develop holistically and to discover the wonders of nature. Birth to 5 Matters (2021) emphasises that children thrive when their setting provides diverse opportunities for exploration and play.

The role of the adult is to help create stimulating environments that encourage children to investigate and explore their surroundings. Lewis (2023) states that this can spark natural curiosity, leading to a deeper understanding of concepts. Asher (2024) supports this by stating, that time spent outside is consistent with higher performance in subjects such as maths and science. This is supported by Long (2021), suggesting that children who can explore and construct knowledge through hands-on experiences show a good understanding of scientific concepts. The role of adults in encouraging outdoor science exploration is important. Natural environments like woodlands and other landscapes provide children with direct, real-world experiences in science (Envoplan,2023). The Association for Science Education (2018) states that the outdoor environment offers opportunities to engage children in hands-on science, allowing them to gather and analyse data and make real-world predictions.

White (2022) states that adults can support science in the outdoors by allowing children to explore their interests. The adult can support children's learning by providing tools for scientific observation (Social Sciences,2024). Furthermore, Dewey (cited in Aubrey and Riley,2019) believed that children learn through a hands-on approach. Piaget (cited by

Currell,2021) suggests that children construct knowledge and learn by assimilation and accommodation through schemas. Similarly, Bruner (1960 cited on Culatta,2018) believed that learners construct knowledge from prior experiences. Moreover, Piaget (1936 cited by Brodie,2024) and Vygotsky (cited by Janelle,2024) believed that children learn by exploring and manipulating their environment.

Froebel's approach (cited in Maynard and Waters 2014) draws attention to the importance of giving children the space to explore independently, while adults take on the role of observers. This allows children to discover their own answers, engage in reflection, and make connections between different experiences. Gibson (1986 cited by Nolan,2024) suggests that providing environments with high affordances can provide children with different action opportunities. Striniste (2020) adds that these play spaces can inspire children to explore, imagine and create in a variety of ways. Additionally, Morgenthaler *et al.* (2024) state that a diverse play space can attract a broader population and enhance inclusion, benefiting children with varying abilities.

According to Leirner (2019), nature serves as a rich and enchanting learning environment for mathematical concepts. Mirage News (2023) and Yellow Door (2018) agree that nature is full of patterns, shapes and sequences. For example, adults can support children in recognising patterns on leaves, counting the number of rings on tree trunks or comparing sizes of sticks and using mathematical, comparative language. By asking open-ended questions adults can support children in developing problem-solving skills and promote independent thinking. McHugh (2024) states that adults can provide children with items

such as large crates, poles, planks of wood and pegs. Gull (2020) adds that these loose parts and experiences can support number, measure, weight, shape, position and problem-solving skills.

Nicholson's (1972) loose parts theory suggests that loose parts can be used in many ways (Penfold, 2018). Louv (2024) and Lyons (no date) both agree that the use of loose parts can support creativity, spark imagination and support problem-solving skills. Whilst having all these opportunities to explore, move, build or connect with loose parts, Carson (1965 cited in Daly and Beloglowsky, 2015) suggested that a child needs an adult to discover and enjoy the mystery of the world we live. Therefore, the adult can not only observe the children but allow them to be curious and ask questions. This supports Vygotsky's (1978) scaffolding theory, stating that the child will have knowledge but will have reached the Zone of Proximal development (ZPD) and needs support to obtain more information from an adult (McLeod, 2024). This could spark their natural desire to explore further and possibly find their own answers (Tovey, no date).

According to White Lodge News (2022), Malaguzzi believed children were capable, curious individuals. Malaguzzi's theory (Reggio Emilia) embraces child-led exploration, with the adult guiding and documenting the child's progress. The Reggio Emilia approach encourages children to explore, experiment, and learn together (Lucchinelli, 2023). Loose-part play sessions support collaboration and invite inquiry and problem-solving skills (Early Childhood Australia, 2020).

Hellyn and Bennett (2024) state that the Curiosity approach was inspired by theorists, Malaguzzi, Steiner, Montessori and Pikler. Additionally, Hellyn and Bennett (2024) state that it is the role of the adult to inspire and nurture the curious minds

of all children. To do this, the adult must recognise the different levels of existing knowledge and offer attractive resources to further inspire curiosity and discovery (Moorhouse,2021) According to Petrus (2024) Curiosity allows a deeper connection to the world around us and helps us to learn new things. Sensory Surroundings (2021) adds that the discovery and curiosity approach to learning has been the best learning method for topics such as maths and science.

Exploring the role of the adult in supporting science and mathematics during outdoor learning, the adult can aim to provide children with hands-on experiences and inquiry. The curriculum for Wales supports outdoor learning throughout the four purposes in promoting skills such as problem-solving, critical thinking, creativity and innovation (Welsh Government,2022).

The adult has a role in providing children with spaces of high affordances, such as in Gibson's theory to allow for a variety of play opportunities and experiences. Additionally, the adult can provide tools to support the children's learning and to promote curiosity and interest. This can be done by providing loose parts as in Nicholson's loose parts theory which will support collaboration, creativity, further discovery and learning experiences (Only About Children, 2020). Nevertheless, Simple activities like measuring trees or observing natural patterns link directly to key learning concepts, offering real-world contexts that enhance children's understanding.

The research suggests that adults creating stimulating, responsive environments will positively impact the learning that is achieved for the children. The adult can encourage and enable children to explore freely, allowing for trial and error, whilst also having an adult who is available to support where needed and to scaffold the children's learning and understanding. The

adult can support the children by being an observer and only intervening when it is appropriate to ask or answer questions which will support and embed new information that the child has received through their discoveries.

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