

Awe and Wonder: Science, Mathematics and the Outdoors

No AI has been used in this assignment.

Contents:

1. A photograph of an outdoor space which has opportunities for children to explore through play
2. How the environment in the photograph can be used by young children to develop specific scientific or mathematical concepts
3. A risk-benefit assessment for the outdoor space in the photograph
4. How adults working with early years children support and encourage children to engage with mathematical and scientific concepts in an outdoor environment

1. A photograph of an outdoor space which has opportunities for children to explore through play



Figure 1: Forest floor (own image, 2025).

2. How the environment in the photograph can be used by young children to develop specific scientific or mathematical concepts

On a Thursday afternoon, it is our class's turn to spend some time in the school's forest area where we can do outdoor learning. This space gives children the opportunity to explore independently, discover new things, and enjoy being in nature. Our class is made up of 20 children, all who are 4 years old. There will be three adults present during outdoor learning to ensure the children are safe, supported, and able to make the most of their learning outdoors. It is the adult's job to support children's learning and development in line with the 'curriculum for funded non-maintained nursery settings' (Welsh Government, 2025).

Prior to arriving at our forest area, we had heavy rain which has left puddles and a wet environment. Before entering, I reminded the children of our forest rules and that we needed to follow them to keep ourselves safe. As soon as we entered the forest the children were happy, smiling and keen to get busy, and a small group of children went straight over to explore the muddy patches on the forest floor. One child excitedly began to walk in the mud and noticed the squelching sound it made. The other children were more hesitant, so I went over to see if I could encourage them. Once the child had finished in the mud, they noticed their footprints. 'Look at my footprints in the mud!' they said, which instantly got the attention of some more children. Another child said, 'I can do a bigger footprint than you' and put one foot into the mud, which left the bigger footprint. The first child asked, 'Why is his footprint bigger than mine?' At this point, one of the children who had been a little hesitant to get muddy said 'It's because he has bigger wellies than you.' The children looked down at their feet, then the hesitant child said 'Look, my wellies are smaller than yours, so my footprint will be even smaller!' She stood next to another child to compare wellies and then carefully stomped her foot into the mud, proudly showing her friends that her footprint was the smallest. The child who had made the biggest footprint smiled to his friends and said, 'That must mean I have the biggest feet!'. Lots of children decided to join in now, and some were discussing who's were bigger and who's were smaller. I decided to ask, 'I wonder what would happen if you stomped really lightly, or really hard?'. A few children stopped and looked at me and then started experimenting in the mud. Some children tested their light footprint by barely pressing into the mud, whilst others did big heavy jumps, and then observed

the depths of their footprints. 'Mine goes really far down!' said a child who had jumped really hard, whilst another child who was tiptoeing lightly said, 'Mine doesn't really go in at all'. I acknowledged them both and said, 'Yes you're right, your footprint goes deep because you added more pressure, and yours is shallow because you barely pressed down.' The children continued to make their footprints in the mud and carried on experimenting with the deeper and shallower footprints, showing an early understanding of pressure. This activity shows that the children are working towards Progression Step 1 of the 'Mathematics and Numeracy Area' in the Curriculum for Wales (Welsh Government, 2020), as they are beginning to compare size and depth. To extend the children's learning next time, I could bring rulers or string and see if they can measure how long or wide their footprints are, or I could encourage them to use sticks or other natural objects to compare sizes.

Whilst observing the footprints, another child called me over to the logs that were wet. The logs were different sizes, with some narrow and some wider and were spread across the uneven forest floor. The child wanted to walk across the logs but was nervous, so asked me to stay close just in case they needed help. She climbed onto one log and carefully placed her other foot on a narrow log in front. 'This log is really slipper!' she said and jumped off. She started again on a wider log and said, 'This one is easier' and continued to make her way across. Another child joined and tried to cross the logs quickly, but the logs wobbled and they lost their balance. The child got frustrated and asked their friend for help. The first child said, 'If you go fast the logs wobble, you need to go slow across them, so they stay still, and you can stay on longer!' With her friend's help, the child began moving slowly across the slippery logs, smiling and laughing. They reached another narrow log and seemed apprehensive. I said, 'Why don't you try holding out your arms? It can help you balance.' The two children put out their arms and successfully made their way across, smiling when they reached the other side. One child said, 'So Miss, if we go slow and hold out our arms, we won't slip on the wet logs because we can balance!' I nodded yes and the two children continued to move along the logs, taking their time and inviting friends to join in, showing them how to balance. Throughout this observation, the children noticed that wet logs were slippery and learnt that moving slowly and holding out their arms helped them stay steady on logs that were narrow, wide and on the uneven forest floor. They are beginning to understand how their

weight and movement can affect their balance. This links to the 'Science and Technology Area' of the Curriculum for Wales (Welsh Government, 2020) and shows that the children are working towards Progression Step 1, as they are exploring movement, weight and friction through their play and developing an early understanding of forces and balance. To extend the children's learning next time I could introduce resources such as ropes, planks or tyres and encourage them to work together to create an obstacle course for their friends.

After the logs, the children continued to explore the forest and noticed lots of natural objects on the ground. One child asked me 'What are these?', to which I replied 'These are called husks. There is a seed or nut inside, so the husk has this hard shell to protect it until it is ready to grow.' Some children began collecting the husks on the forest floor, and a few spotted some still hanging on the branches in the trees. 'I've found a big one!' shouted one of the children excitedly, and a few children went over to see and then started looking for their own big husks, some searching independently, others in groups. One child asked their friend if the bigger husks were heavier and then started experimenting by lifting a big and small husk and comparing them. A group of children came to show me the handful of husks they had found. I asked the question 'How many do you have there?', and the children instantly started counting '1, 2, 3, 4, 5, 6!'. Another child came over with 2 more husks and added them to the pile, so the children started counting again. They were all very confident that they now had 8 husks altogether. I said, 'I wonder if you can put them from smallest to biggest', one child told me 'That's easy!' and they started comparing the size of their husks. After five minutes, they called me over with smiles on their faces and told me they'd done 'Good teamwork' and pointed to the husks lined up from smallest to biggest. The children continued to play the husks until the end of our outdoor session. Other children also joined in with counting and finding husks, and some even created patterns with them on the forest floor. This activity links to the 'Mathematics and Numeracy Area' of the Curriculum for Wales (Welsh Government, 2020), as children working at Progression Step 1 are counting, sorting, and comparing objects, and are beginning to notice patterns in nature. To extend the children's learning next time I could bring Numicon down the forest and encourage the children to collect and match the number of husks to the Numicon shape.

3. A risk-benefit assessment for the outdoor space in the photograph

Location / Activity:	School Forest Area	Date:	10 th September 2025
Assessor:	Lucy Willimer-Cant	Review date:	10 th March 2026

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
Making footprints and walking on wet or muddy ground	Children can develop their mathematical skills as they can compare the size and depth of their muddy footprints. It can support and encourage children's scientific understanding by observing cause and effect. For example, how the impact of different pressures can create deeper or shallower footprints. Supports children in developing their gross motor skills through stomping, jumping and balancing. Gives children the opportunity to experience different textures of wet and dry mud, which can stimulate senses. Messy play can encourage children's curiosity, can help them feel closer to nature, and can give them the confidence to explore the outdoor environment on their own.	Children may slip, fall or lose their balance when making muddy footprints due to slippery/uneven/wet or muddy ground. There may be a risk of children getting mud in their eyes or their mouths from jumping/stomping or touching/throwing mud. There is a risk that children's clothes may get dirty or wet, which could make them cold and uncomfortable afterwards. Children may become more adventurous and go into an unsafe or unsupervised space.	Children and adults	Adults will discuss with children prior to entering the forest space that the ground may be wet and muddy, and that they may want to walk slowly until they feel comfortable to move at a quicker pace. Adults will inform children of the rules and that we do not throw mud at others. Clean water will be available for children to use for hand or face washing if they get muddy. A first aid kit and eye rinse will be available in case mud gets into a child's eye. Adults will encourage parents to supply their child with appropriate outdoor clothing for forest sessions, including waterproof trousers/coat and wellies, and to have spare clothes in bag in case a full change is needed after the session. Fencing and a padlock gate is placed around the forest area to keep children within the area and safe.	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
Balancing on slippery logs	Children can develop their gross motor skills from balancing and climbing and can build their coordination and become more confident physically. Allows children to become independent as they problem solve and learn to assess and manage their own risks. Children can develop their understanding of how different surfaces and movements affect balance and also be introduced to vocabulary such as friction and forces. Children can develop their social skills with turn-taking and helping their peers. Builds children's resilience and confidence in exploring the outdoors. Encourages children to focus and concentrate when trying to balance.	Children may slip or fall off the logs and hurt themselves, which causes bumps, bruises or small injuries. Children may get splinters or scratches from moving or touching any rough or loose bark. Logs on uneven or wet/muddy surfaces may roll or move unexpectedly and harm someone. Children may collide with each other if following behind too closely.	Children and adults	Adults will check how stable logs are before children use them and will discard any broken/rotted ones. A first aid kit and tweezers will be available. Adults will encourage the children to take it in turns and go "one at a time" to eliminate any collisions. There will be an adult nearby to supervise and support children if needed on the logs. Adults will model to children safe balancing, for example, arms out to maintain balance and slow steps, and feeling first to make sure it is not too slippery.	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
Exploring husks on branches or the forest floor	Children can develop their mathematical and problem-solving skills by counting, sorting or comparing the size, shape or number of husks. Children can develop their fine motor skills by picking up and handling husks. Children can explore different textures, sizes, shapes and patterns of natural objects. Children can develop their social skills by working collaboratively to gather, count or sort husks which also supports sharing and turn-taking skills.	Children may put husks in their mouths which would be a choking hazard. Children or adults may have unknown allergies from husks or the surrounding forest area. Husks on low branches off trees may cause eye or eye injuries. Children may hurt themselves on husks due to splinters or the sharp edges. Children may slip or fall on the uneven forest floor where the husks have fallen. Husks may carry dirt or fungi inside them, which means children could get dirty or be exposed to bacteria.	Children and adults	Adults will inform children of the rules that we follow in the forest, one being that we do not put anything from the forest into our mouths. Adults will supervise children closely when they are exploring husks. Adults will remove low lying branches which could cause harm. Adults will remind children to handle the husks gently to avoid injury. A first aid kit with an eye wash will be available. Children are reminded at the start of the forest session that the floor is uneven and slippery and to take their time. Adults will encourage handwashing before and after the forest session to reduce the risks of bacteria and germs.	L

4. How adults working with early years children support and encourage children to engage with mathematical and scientific concepts in an outdoor environment

According to Welsh Government (2025), allowing young children to spend time outdoors plays a vital role in their overall development. Being outside can encourage their social, emotional, physical and spiritual growth whilst also supporting their wellbeing, build confidence and keep them engaged for longer. The outdoors offers plenty of space and gives children the freedom to explore and learn at their own pace in the environment. Being in nature provides children with lots of sensory experiences that can spark their curiosity, creativity and a want to explore the environment. By spending time outdoors, children can begin to care and learn about the environment, and can engage in hand-on experiences that support different areas of their learning, such as maths or science. This view reflects Friedrich Froebel's beliefs, as according to Tovey (2016), he argued that outdoor experiences are essential for young children's holistic development. Froebel highlighted that being in the natural environment and engaging in first-hand experiences support children's learning and development across all areas. For example, in one of the observations above, the children were making muddy footprints and then comparing their size and depth. With the support from the adult, who encouraged them, asked questions, and helped them notice patterns, they were able to explore early mathematic ideas, such as measuring, through this hands-on experience.

Kiviranta *et al.* (2023) suggests that letting children play outdoors also allows them to develop their gross motor skills and coordination, through activities such as running, jumping, climbing, balancing and even walking on uneven ground. Being outdoors encourages children to take appropriate risks, which then helps build up their resilience and confidence. By allowing children to face challenges in a supportive environment, can help them make their bodies strong, learn to make decisions, solve problems and trust themselves. Sandseter (2023) supports this view and argues that risky play is an essential part of children's outdoor learning because it allows children to experience different emotions when facing challenges. When children take risks, such as balancing on a log or climbing a tree, it can be fun and exciting, but it can also give them feelings of nervousness and fear. This creates a feeling of "positive butterflies" in their stomachs, which children are keen to experience repeatedly.

Sandseter (2023) also notes that risky play supports children's brain development, helps them learn to assess risks effectively, and can even reduce the risk of injury in the long term, as children become more skilled and confident in their abilities. One of the observations above shows how risky play outdoors, as well as adult support, can promote children's learning and development. When the children were moving between the wet and uneven logs, they were faced with physical challenges that tested their balance, coordination and confidence. The adult supported them by suggesting ways to stay steady and safe. Through trial and error and by sharing ideas, the children learnt how their movements affect their balance. The children's choice of play helped develop their gross motor skills, encouraged problem solving, supported their teamwork and resilience, and helped them develop an early understanding of forces and friction.

According to Gilbert and Barrable (2022) using natural loose parts outdoors can be beneficial for children's learning and development as they support children's creativity, problem solving and confidence. Loose parts are everyday open-ended objects, such as stones, shells, planks of wood or even bits of fabric, which children can use in numerous ways, using their imagination and through play. As loose parts do not have a set purpose within the setting, they can be turned into whatever the child imagines, for examples, a stone might become a character, or a scarf could be used as the roof of a fort. Children can use loose parts, like planks of wood, to explore early maths concepts such as weight, angles or height, whilst building and creating in the outdoors, and they can also explore early science concepts, for example rolling a ball down a plank of wood or along the grass to investigate force, motion or different textures. Natural loose parts outdoors can encourage teamwork and problem solving between children, which can help children build on their social skills whilst exploring the outdoor environment (Daly and Beloglovsky, 2014). One of the observations above shows just how beneficial natural loose parts can be, as the children discovered husks in the forest and began collecting, comparing and counting them. Some experimented with their size and weight, lifting big and small husks to see the difference, whilst others worked collaboratively to sort them from smallest to biggest. This activity shows how easy it is for natural loose parts to support early mathematical development and an early science understanding, along with the support and open-ended questions from the adults, which allow children to

lead their own learning. As the husks are natural open-ended resources, children can play with them in ways that suit their own level of understanding, and they give a glimpse into the schemas being developed. Boulton and Thomas (2022) supports this and notes that using loose parts allows children to build on their own knowledge and do their best learning, as they can explore and play with materials themselves, using their imagination. They also mention how loose parts can highlight the different 'schemas' that children are developing, such as trajectory (throwing, rolling), positioning (lining objects up) or rotation (spinning objects). Atherton (2014) describes schemas as repeated patterns in children's actions and thinking. It can begin with simple physical movements, such as going over or around objects, and can later develop into more 'symbolic or thoughtful behaviours.' This links to Piaget's views as he 'believed that children organise their knowledge and understanding of the world into cognitive structures - or Schemas' (Boulton and Thomas, 2023). Recognising schemas is important because it helps practitioners understand what children are doing, plan learning that meets their needs, and supports children to make sense of the world in their own way. This aligns with Froebel's theory, as he believed that first-hand experiences with natural materials are important for children's holistic development. He thought that the outdoor environment offers children unlimited open-ended opportunities to solve problems, be creative and use their imagination, whilst also providing endless chances for adventure and challenge (Bruce, 2012). Montessori also saw the importance in hands-on experiences and loose part objects for children and highlighted the value in them having the freedom to explore and learn without adult instructions. In the outdoor environment, this could look like children playing with natural loose parts, such as rolling stones or pinecones down a hill to see what happens. Through this kind of play, children begin to explore early science concepts, as well as mathematics concepts, such as counting or comparing. This freedom to explore allows children to learn in meaningful ways and at their own pace (Smith-Gilman, 2018).

It is not just the open-ended outdoors that supports children's development, but also the role of the enabling adult. Welsh Government (2025) states that adults play a vital role in young children's learning because they create safe and supportive environments, encourage curiosity, and make the most of teachable moments. Adults can do this by observing children closely and helping them build on their

interests through asking open-ended questions. Children's confidence, resilience and independence can be supported when adults help them to take risks in the outdoors. When adults have a good understanding of child development, they can provide meaningful and engaging learning experiences that suit each child. ESTYN (2024) expands on this and suggests that adults create environments where everyone is welcome, this then gives children a sense of belonging within the classroom, which is vital for their social and emotional development. When adults pay attention to what children are curious about, it can lead to exciting and unexpected learning experiences, which can encourage children to ask questions and explore ideas themselves. *Observations are important in practice because they help adults understand children's developmental and social progress. Observations should be made by adults throughout the day, both indoors and outdoors. Having planned and natural observations is important, as well as during independent play and group activities (Welsh Government, 2025).* Adults can support children's learning through scaffolding, which means supporting children and then stepping back so they can continue their learning independently. This can include modelling behaviour, such as showing a child how to count objects, or asking open-ended questions that encourage thinking rather than yes or no answers. Adults can also give prompts to support learning, for example giving words or ideas to describe what they notice, and they also encourage children to work collaboratively together which can develop their social and problem-solving skills (The Bell Foundation, 2025). Vygotsky's theory on the 'Zone of Proximal Development [ZPD]' shows just how crucial adults are to children's learning. The ZPD highlights the space between what a child can do on their own and what they can do with a bit of support from adults. He believed that children do their best learning when adults give them just the right amount of support. This links closely to scaffolding, where adults give support, such as asking questions or modelling, and then slowly step back as the child grows in confidence (Open Education, no date).

Even though adults play a vital role in supporting children during their outdoor play and learning, there are many challenges that come with it. Cheng *et al.* (2022) suggests that adults can sometimes limit children's outdoor play because they are unsure of what risks are allowed, or they do not fully understand the benefits that outdoor free play has for children. Learning Through Landscapes (2023) also

highlights that some settings not having suitable outdoor spaces can be a challenge, for example limited or no access to the outdoors can limit children's opportunities to experience and learn through the natural world. The British Educational Suppliers Association (2025) notes that some staff may not be confident in facilitating outdoor play or may not see it as valuable compared to more focused work tasks.

Practitioners are also pressured to meet curriculum outcomes, which can lead to less time spent playing in the outdoors, despite the benefits it has for children's learning, creativity and holistic development. This links to Bronfenbrenner's ecological systems theory (Hayes, O'Toole and Halpenny, 2017), which shows how a child's microsystem, such as practitioners and their school environment, and their mesosystem, such as curriculum pressures, all play a part in the experiences the child has. If adults do not recognise the value of play, or if outdoor spaces are limited, children can miss out on opportunities to explore, take risks, and build independence. However, when adults do give children the right support, for example giving gentle guidance to support learning that is within their ZPD, outdoor play can become an essential part of their learning and growth.

References

- Atherton, F (2014) *Learning & development: schemas - on repeat*. Available at: <https://www.nurseryworld.co.uk/content/features/learning-development-schemas-on-repeat> (Accessed 23 September 2025).
- Barrable, A. (2022) *Independent thinking on nature-based learning: improving learning and well-being by teaching with nature in mind*. Wales: Crown House Publishing Ltd.
- Boulton, P. and Thomas, A. (2022) 'How does play in the outdoors afford opportunities for schema development in young children?', *International Journal of Play*, 11(2), pp. 184–201. Available at: <https://doi.org/10.1080/21594937.2022.2069348> (Accessed 22 September 2025).
- Boulton, P. and Thomas, A. (2023) *Schemas, outdoor play and Froebel*. Available at: <https://www.froebel.org.uk/news/schemas-outdoor-play-and-froebel> (Accessed 22 September 2025).
- British Educational Suppliers Association (2025) *Barriers to incorporating play in schools, and how to overcome them*. Available at: <https://www.besa.org.uk/news/barriers-to-incorporating-play-in-schools-and-how-to-overcome-them> (Accessed 25 September 2025).
- Bruce, T. (2012) *Early childhood practice: Froebel today*. London: SAGE Publications Ltd.
- Cheng, T., Brussoni, M., Han, C., Munday, F. and Zeni, M. (2022) 'Perceived challenges of early childhood educators in promoting unstructured outdoor play: an ecological systems perspective', *Early Years*, 43(4–5), pp. 904–920. Available at: <https://doi.org/10.1080/09575146.2022.2034140> (Accessed 20 September 2025).
- Daly, L. and Beloglovsky, M. (2014) *Loose parts: inspiring play in young children*. Minnesota: Redleaf Press.
- ESTYN (2024) *The role of the enabling adult to support effective environments and engaging experiences*. Available at: <https://estyn.gov.wales/improvement-resources/the-role-of-the-enabling-adult-to-support-effective-environments-and-engaging-experiences> (Accessed 23 September 2025).

Hayes, N., O'Toole, L. and Halpenny, A.M. (2017) *Introducing Bronfenbrenner: a guide for practitioners and students in early years education*. London: Routledge.

Kiviranta, L., Lindfors, E., Ronkko, M.L and Luukka, E. (2023) 'Outdoor learning in early childhood education: exploring benefits and challenges', *Educational Research*, 66(1), pp. 102–119. Available at: <https://doi.org/10.1080/00131881.2023.2285762> (Accessed 21 September 2025).

Learning Through Landscapes (2023) *5 barriers to outdoor learning at primary school and how to overcome them*. Available at: <https://ltl.org.uk/news/overcome-outdoor-learning-barriers-primary-school/#:~:text=%E2%80%9CBear%20in%20mind%20that%20a,5> (Accessed 20 September 2025).

Open Education (no date) *Vygotskian principles on the ZPD and scaffolding*. Available at:

https://www.open.edu/openlearncreate/8f/0d/8f0dad31356b941f01191a927e556a703ca8c89?response-content-disposition=inline%3Bfilename%3D%22Vygotskian_principles_on_the_ZPD_and_scaffolding.pdf%22&response-content-type=application%2Fpdf&Expires=1758855120&Signature=fgT9GzxAEQXkEV7UjJfTTk3w1KQINV4PIYOHhO7-9jdo3kVFyZ-Xrzd8Xbbgv058wVf8c7HAowVylyQVqRJAsO0b0GwDeOipINB1n15im81G4hJPNPiyobacEhjUYiwO4DKaFZDt1ySRODtrunXmQ2uupKIAN2rZBtDXTg0ANXvaRpS-QxgDbPeBrAcImY064UxfQbEnrg92XBjuPlmT2OqVSFXGAsxO3igL~yVsEIA2pYHMLoV2AdsWBJXjXJsOwlgNvv~iYMyZeJJXsS1uHaF7M9ivMNWUU0DvQxPJmomTONglB-PG9OZRqoRrcKn5~WmtpNqeDEB6m6JWyh9A&Key-Pair-Id=K19YM1UI0NPZI1 (Accessed 25 September 2025).

Sandseter, E. (2023) *How our understanding of risk is changing with Ellen Sandseter*. Available at: <https://www.youtube.com/watch?v=QeHvtlMJi0E> (Accessed 21 September 2025).

Smith-Gilman, S. (2018) "The Arts, Loose Parts and Conversations", *Journal of the Canadian Association for Curriculum Studies*, 16(1), pp. 90–103. Available at: <https://doi.org/10.25071/1916-4467.40356> (Accessed 25 September 2025).

The Bell Foundation (2025) *Scaffolding*. Available at: <https://www.bell-foundation.org.uk/resources/great-ideas/scaffolding> (Accessed 23 September 2025).

Tovey, H. (2016) *Outdoor play and exploration*. Available at: <https://www.froebel.org.uk/uploads/documents/FT-Outdoor-Play-Pamphlet.pdf> (Accessed 20 September 2025).

Welsh Government (2020) *Mathematics and Numeracy*. Available at: <https://hwb.gov.wales/curriculum-for-wales/mathematics-and-numeracy> (Accessed 19 September 2025).

Welsh Government (2020) *Science and Technology*. Available at: <https://hwb.gov.wales/curriculum-for-wales/science-and-technology> (Accessed 19 September 2025).

Welsh Government (2025) *Curriculum for funded non-maintained nursery setting*. Available at: <https://hwb.gov.wales/curriculum-for-wales/curriculum-for-funded-non-maintained-nursery-settings> (Accessed 17 September 2025).