

Awe and Wonder – Science, mathematics and the outdoors.

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Photograph



(Davies, T., 2026).

Discussion following photograph

As discussed by Kiviranta *et al.* (2023), outdoor spaces offer natural learning opportunities for young children. By engaging in real-life learning experiences, hands-on exploration, awe and curiosity, outdoor learning sessions shift from playtime to valuable and interesting experiences. It provides children with a meaningful context for learning.

Not only can the outdoors provide engagement, but there are also opportunities for children to strengthen their scientific and mathematical knowledge (Waite-Stupiansky and Cohen, 2020). Observing living things, counting and measuring, exploring water and materials are all factors that contribute towards a child's knowledge of science and maths, and makes it easier for them to understand new concepts. Adults can also facilitate in a child's early development by modelling and extending thinking. Which in turn, influences the child to discover and experiment.

This essay will discuss how the environment in the photograph provided can support development of scientific and mathematical thinking within the early years.

There are many key features within this photograph that offer exploratory opportunities, such as the pond. This provides water exploration, which links to mathematical learning. A child could measure the depth of the pond, or compare density and see which materials or loose parts float.

The trees and flowers also provide scientific learning, by recognising life circles and how the seasons may change the appearance of the trees. This is a great opportunity to teach children plant growth, and how the weather may affect the environment.

The fence that is captured in the photograph is a man made object, which offers both scientific and mathematical thinking. By encouraging a child to question why it's there, or how it got there. Debating the shape, space and position can offer a valuable insight between the difference of man-made items and natural items.

This outdoor space also provides ample sensory and exploratory opportunities, by different textures, smells and visuals. Outdoor learning environments are great tools within the early years, as it help's children to explore and experiment naturally with no specific outcomes (Waite, 2011).

As study's show, outdoor learning sessions offer many opportunities for development both scientifically and mathematically. This also reflects upon Curriculum for Wales's (no date) focus on inquiry based learning and exploration throughout the early years. Theorists such as

Vygotsky and Piaget also offer insight on children learning through hands-on experiences and interactions with adults (Schwichow *et al.*, 2016).

With the environment chosen, there are many elements to discuss that target scientific and mathematical inquiry. I would encourage children to understand the habitat around them, and how many loose parts are actually living things. By letting them explore the different types of flowers, different textures on the trees and how different parts of the terrain may feel different. By also showing interest in the pond, I would be modelling observation and discovery. Demonstrating the different eco-systems and asking questions that encourage the children to want to discover more, independently. This activity would focus on a child-led approach, with adult-guidance. Leading the children to explore, but not controlling the outcomes or how certain experiments should look. This aligns with the Reggio Emilia approach, which emphasises on child-led learning, where the natural environment acts as a third teacher, supporting children's scientific exploration and investigation through hands-on experiences (Edwards and Gandini, 2018).

I would also provide some man-made loose parts, to accommodate the natural ones in the environment. I may bring paper, spades, buckets, recycled plastic bottles, and more to elevate the existing space. Asking open-ended questions such as "what do you think will happen?" when throwing twigs into the pond, or making boats with loose parts. This helps encourage independent investigation and experimentation. In this environment, the natural loose parts and water would contribute towards scientific learning the most, with using items brought into the session to elevate this further.

In conclusion, the outdoor environment I have shared provides a wide range of opportunities for children to develop scientific learning skills through hands-on exploration and investigation with adult support. Children will be able to explore living things, habitats, loose parts, water and seasonal changes through real-life experiences, which helps to elevate learning and make it meaningful and engaging. Through these experiences, children will develop important scientific skills such as observing, predicting, questioning, investigating and experimentation. With adult support through modelling and scaffolding, these experiences can be extended further to deepen learning. This approach aligns with Curriculum for Wales (no date), which emphasises experimental and inquiry-based learning through exploring the natural world.

Similar to scientific inquiry outdoors, there are also many factors that benefit mathematical thinking. Within the early years, numeracy can be hard for children to understand, but by creating a space that encourages numeracy without the confusing elements can have positive benefits.

The outdoors is a great environment for mathematical factors. In this environment, I would encourage children to collect and count natural materials such as leaves and sticks. The natural loose parts provided by this environment are great for understanding mathematical concepts. By reinforcing counting and asking questions such as "how many?", can encourage a child to independently collect and count loose parts. I would also encourage children to measure the lengths of sticks, or the depth of the pond and to help them understand spatial awareness and size.

Along with natural loose parts, I might add some man-made materials to deepen this experience. For instance, providing a ruler to help with measuring, or paper and pen's for tracing patterns the children might encounter. This helps a child to test ideas, problem-solve and think critically with adult guidance.

Again, I would model curiosity and introduce mathematical vocabulary by asking questions such as "which is bigger?" And "how can we make it taller?". This helps the child with their mathematical development, without overwhelming them with classic classroom strategies. Bilton and Waters (2017) believe that learning extends beyond the classroom, and emphasises the importance of adapting outdoor learning daily to make teaching more meaningful and engaging.

Adults are co-constructors within outdoor learning settings, and their aim should be extending the existing play, not controlling it (Sedgwick, 2012). Offering support when a child may be confused, and encouraging them to test ideas and experiment. But it is also important for an adult to know when to step away and let the child explore naturally, without forgetting their role in creating a memorable lesson. Curriculum for Wales (no date) supports mathematics and numeracy being learnt through real-life, practical experiences.

In summary, the environment I have chosen provides many opportunities for children to develop their mathematical skills, and explore new scenarios and ideas. With the exploration of natural materials, children can develop their understanding of counting, measuring, shapes, space, patterns and problem-solving. With the support from adult questioning and modelling, children's numerical understanding can be further developed. This approach aligns with Curriculum for Wales (no date), which emphasises the importance of developing mathematical and scientific thinking through experimental learning.

As previously mentioned, when observing the Curriculum for Wales's (no date) aims for outdoor learning, my photograph supports these aims in practice. This environment allows for curriculum to be delivered in a meaningful way. Scientific and mathematical opportunities can occur naturally through play, and supporting this in practice is important for a child's development. Curriculum for Wales (no date) is very skills focused, and shares focus on children achieving their full potential. Skills such as problem-solving, critical thinking, observation, numeracy skills and independence are all skills developed through outdoor play.

Curriculum for Wales (no date) states its four purposes, which includes ambitious capable learners, enterprising creative contributors, ethical informed citizens and healthy confident individuals. These are all purposes that adults should remember in practice, to ensure high success in outdoor learning. It is also important to note that adults deliver the curriculum values through play, exploration and support.

In conclusion, the outdoor environment shown in the photograph provides a rich and stimulating environment for young children to develop both scientific and mathematical understanding through hands-on, real-life experiences, supported by adults.

The adult role throughout this outdoor session is essential in facilitating and extending children's learning through scaffolding, and encouraging children to test new ideas. Adults are also there to help children learn new concepts, especially within a scientific and mathematical context.

With referencing the Curriculum for Wales's (no date) aims and purposes, it can promote experimental learning, skills development, and learning through new and engaging meaningful contexts. Exploring study's on outdoor learning and their outcomes discovered new perspectives and ideas when attempting to understand the importance of natural spaces in early years development and education.

Therefore, it is obvious that outdoor learning plays an important role in supporting children's holistic development and engagement in science and mathematics.

1,443 words.

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[Link to Risk-Benefit](#)

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548 words.

Academic Essay

Throughout early childhood care learning is not only confined to the classroom, but it actually expands beyond that (Waite, 2011). There are ample benefits to outdoor learning, such as; holistic development, improved learning and engagement, communication and collaboration skills, peer interaction and shared experiences and enhanced play and creativity skills (Grigg and Lewis, 2016).

Outdoor learning supports physical and social development, alongside supporting social and cognitive aspects of development (Kiviranta *et al.*, 2023). Combining both nature and learning offers open-ended flexible play opportunities, which will stimulate imagination and problem solving skills (Kiviranta *et al.*, 2023). Schwichow *et al.* (2016) states that children learn through hands-on experimental activities, especially when they are participating with other children. This boosts collaboration and social skills, and supports peer interactions which are key during early year development (Schwichow *et al.*, 2016).

Practitioners also play a key role in outdoor learning, by planning meaningful experiences children will thrive and become completely submerged in outdoor learning (Edgington, 2014). Although outdoor play is open-ended and flexible, Little *et al.* (2020) argues that guiding and structuring play can extend children's thinking and understanding. Being confident and acknowledging the benefits and challenges to outdoor play not only helps the practitioner, but eases the children into engaging and beneficial outdoor learning sessions (Richardson, 2014).

Outdoor environments naturally support scientific enquiry and mathematical thinking according to Waite-Stupiansky and Cohen (2020). By observing, exploring and questioning, a child is expanding their knowledge of the scientific elements that come with outdoor play (Waite-Stupiansky and Cohen, 2020). Meanwhile; measuring, counting and recognising patterns tap into the mathematical elements (Tucker, 2014). Using science and mathematics alongside outdoor learning supports a child's development, and suddenly play become interesting and purposeful (White, 2020).

This essay will discuss how outdoor learning supports children's development, and how adults can support the incorporation of science and mathematics.

Awe and wonder consists of feelings of curiosity, amazement, fascination and excitement. This is achieved through children encountering something new and surprising or even interesting, especially within nature (Grigg and Lewis, 2016). The feelings that come from learning new things motivates children to explore, ask questions, investigate and learn, which links to scientific and mathematical learning (Bilton and Waters, 2017). This stands as a starting point for scientific enquiry, and mathematical thinking (Robertson, 2017).

"The sense of wonder" is a theory designed by Rachel Carson (Carson, 2019) in 1956, which was later published in 1965 as a book following her death. This theory touches on the importance of learning and how adults play a key role. Children develop their love for learning through wonder, and being placed in environments where their curiosity can thrive (Murphy, 2024). Carson also argues that adults should be experiencing nature with children, and motivating them to ask questions and problem-solve. Through encouraging curiosity, exploration, noticing and question asking, adults help children to experience first-hand the importance of nature and awe and wonder (Zyl, 2021).

Outdoor environments harbour those authentic experiences which are fundamental to a child's development (Waite, 2011). As nature is constantly rotating; weather cycles, seasonal changes, growth, natural curiosity is heightened and children tend to ask more questions (Kiviranta *et al.*, 2023). Outdoor environments also offer multi-sensory experiences; sticks, leaves, water and mud are all materials that can be used in many different ways to stimulate a child's thinking and enjoyment (Richardson, 2014). Loose parts is the term often used for open-ended materials, which are either found naturally or provided by adults. Loose parts include sticks or twigs, shells, flowers, acorns or man-made items such as shovels, buckets and watering cans (Gull *et al.*, 2019). All of these items encourage children to try new things and experiment, with links to science and mathematics through counting and sorting, pattern making, building and comparing (Tucker, 2014).

These views are also shared by Piaget, throughout his constructivist theory (Waite-Stupiansky, 2022). Piaget believes that children learn through active exploration and hands-on experiences, and that knowledge is constructed through interaction (Pardjono, 2002). Outdoor elements provide concrete experiences that support understanding, while also encouraging discovery and exploration. Similarly, Froebel shares the same views within his play theory (Tovey, 2016), arguing that nature is an important teacher that harbours social interactions and development. He claims that play should be child-centered and exploratory. This can also closely relate to the sociocultural theory that Vygotsky theorised; that children learn through social interactions and scaffolding, extending what they already know with the help of an adult (Mermelshtein, 2017).

Scientific thinking in the outdoors is a process, and does not focus on getting right answers. Encouraging children to observe, predict, experiment, explore, investigate, ask questions and learn new vocabulary boosts a child's scientific thinking and development during outdoor learning sessions (Edginton, 2014).

The outdoors offers ample opportunities to help a child's scientific engagement. Loose parts such as the weather, life cycles, plants growing, mud and water are accessible and great resources to use to encourage natural exploration (Kiviranta *et al.*, 2023). This shows that the outdoors provides real-life scientific experiences (Warden, 2012).

Vygotsky's scaffolding theory is important to highlight here as it demonstrates the importance of theory within practice (Widiastutik *et al.*, 2025). By asking open-ended questions; modelling curiosity, introducing scientific vocabulary and doing sustained shared thinking extends a child's learning, and in turn boosts engagement and problem-solving (Grigg and Lewis, 2016). A term commonly used for this is adult-led play, which comes from adults supporting children's learning through guided and structured play (Sedgwick, 2012). By structuring and guiding play outdoors, the experience shifts from free play to learning new things and exploring new opportunities (Sedgwick, 2012).

Highlighted throughout many renowned theorists such as; Bruner and Piaget, learning through exploration and hands on experiences elevates discovery led learning (Myers, 2021).

When applying theory to practice, adults could take environmental factors such as growing plants and expand to create science experiences for children to investigate and explore. By observing what the child is doing, what science skills can be learned, how the adult interacts and helps the child demonstrates the importance of adult-led learning, and how theory can influence practice (Davies, 2014).

Similarly to scientific thinking, mathematical thinking and processes are not defined by correct answers. It is easy to view mathematics as just numbers, but within the early year settings it doesn't primarily focus on that (Sargent, 2015). Activities such as counting, sorting, matching, measuring, comparing, patterns, shapes and problem-solving are tools to boost mathematical thinking and development (Keith, 2017).

As children develop, numbers can become overwhelming and hard to learn, by incorporating fun methods of mathematical skills children will value their learning experiences and enjoy participating (Murray, 2019). This will boost numeracy development, without overloading the child.

Outdoor learning spaces have been proven to demonstrate many examples as to why exactly mathematics works outdoors (Robertson, 2017). Comparing leaf sizes, measuring puddles, counting stones and sorting natural objects provides real-life context for mathematics (Speldewinde and Campbell, 2022). According to Speldewinde and Campbell (2022), learning numeracy skills outdoors is meaningful, and adults can help by encouraging this.

The use of mathematical language, asking questions, encouraging counting and helping children to solve problems models mathematical thinking (Moffet, 2023). Bandura's social learning theory, developed in 1977, highlights the positive outcomes of modelling (Rumjaun and Narod, 2025). He believes that children learn by observing others, and copying behaviours (Rumjaun and Narod, 2025). This extends the play, and creates a learning experience.

As mentioned, numeracy within the early years can be complicated and overwhelming, Piaget argues that maths can be easier to understand when a child can physically interact with objects, and visually see differences and patterns (Waite-Stupiansky, 2022). Bruner also supports enactive learning, which is the theory of learning while doing (Myers, 2021). Children become familiar with mathematical concepts through practical hands-on experiences supported by adults.

By demonstrating to a child how to count rocks or measure twigs, the adult can then step back and observe how the children are playing and analysing (Bilton and Waters, 2017). Asking open-ended questions and supporting children with any confusion places theory into practice, and the adults become co-explorers, helping children develop critical mathematical knowledge (Zyl, 2021).

As mentioned by Karlsdottir *et al.* (2019); children learn through play, but adults help to extend learning. Helping children to notice new things, question and investigate, adults play a key role in early years development (McNair *et al.*, 2019). Adults can support children through guided and structured learning, keeping a child-led approach in mind (Cekaite and Simonsson, 2025). Without adult support, learning opportunities may be missed and overlooked. The main role the adult plays within early years development is to be facilitating, not controlling (Cekaite and Simonsson, 2025).

Adults should model curiosity, and observe children's interests to ensure they are stimulated and present in what they are doing (Rodger, 2012). It is also important to give children time to explore and become familiar with their surroundings, especially in a nature setting. Children require time to process new environments and materials in the early years, so encouraging children to engage and discover with an adult can help eliminate any feelings of overstimulation for the child (O'Sullivan, 2018). By also introducing new vocabulary that encourages scientific and mathematical thinking, and modelling curiosity and excitement helps a child understand the setting in a new and educational way. Sustained shared thinking is a term used by sources such as Purdon (2014) and Ritcher *et al.* (2017), meaning an adult and a child working together to solve a problem, clarify a concept or even extend thinking.

Vygotsky and Bruner are notable theorists here with their knowledge of scaffolding and the importance of supportive adults (Myers, 2021). Adults support a child's learning through scaffolding and extending their curiosity and knowledge (Gonulal and Loewen, 2018). Carson also believes that adults share the awe and wonder elements of outdoor learning with children (Carson, 2019).

A balance between a child-led approach versus and adult-guided approach in early year outdoor education is important, as both approaches target and support different aspects within a child's development (Moody, 2017). Child-led play is allowing a child to explore and follow their own interests freely, and experience awe and wonder naturally. Meanwhile, adult-guided learning is when adults can scaffold children's learning, introduce new vocabulary and extend thinking through sustained shared thinking (Moody, 2017). This links to Vygotsky's sociocultural

theory, where he emphasises the importance of the adult supporting a child to reach their full potential (Pardjono, 2002). The Curriculum for Wales (no date) also highlights the importance of experimental and play-based learning, and the impact of the practitioner facilitating and guiding new learning opportunities (Curriculum for Wales, no date).

Outdoor learning has many positives, and highlights how nature can become a holistic learning environment within the early years. But, there are limits and challenges.

Children are not the only ones that can develop throughout scientific and mathematical opportunities, but adults can also develop professionally (Bilton and Waters, 2017). Some adults may not recognise the learning opportunities outdoor play can offer to children, therefore valuable information and skills can be overlooked. This could occur from a lack of confidence in teaching science and maths outdoors, or there may be a lack of learning (Kiviranta *et al.*, 2023). Without constant observation or encouragement, outdoor time is seen as just playtime, and children will not feel compelled to explore or problem solve. It is important for adults to understand pedagogy, and where they can intervene to help a child reach fulfilment (Wishart and Rouse, 2018).

There are also factors outdoors that can limit learning due to safety concerns. Such as fear of injuries and risk assessments (Wishart and Rouse, 2018). Having an overly safe environment can limit exploration and become controlled, resulting in children not learning to their full potential (Sandseter *et al.*, 2016). According to Sandseter *et al.* (2016), risk taking is important and is a part of problem-solving and developing.

Other possible barriers may include lack of time and planning, pressure to focus on literacy and numeracy, weather, lack of outdoor space or materials and staff ratios. Despite these limitations negatively impacting outdoor learning sessions, they can be overcome with good planning and adults embracing a positive attitude and outlook towards possible limitations and challenges (McNair *et al.*, 2019).

To conclude, outdoor environments provide rich opportunities for children to experience awe and wonder, alongside developing mathematical and scientific skills. This essay has highlighted the importance of the adult role within in early years educations, and understanding theoretical concepts such as Piaget, Vygotsky and Carson. In line with Curriculum for Wales, it is important for adults to support child-led and adult-guided experiences to support holistic and meaningful outdoor learning, and understand possible boundaries and limits.

2,110 words.

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Ai Acknowledgment

I acknowledge the use of AI tools such as CoPilot and ChatGPT to structure my work.

I used the following prompts:

1. Create a strong academic structure for my academic essay
2. Please put the following references in alphabetical order without changing formats.

I also acknowledge that there has been no AI used to write the contents of my work.

All original copies and prompts have been saved.