

Awe and wonder- science, mathematics, and the outdoors

Section 1



Section 2

The image above shows an outdoor area with a range of opportunity for environmentally friendly activities for children to take part in to develop their mathematic and scientific learning. The environment in the image above will be used by a group of ten children aged three to four with practitioners present to observe possible hazards or risks that may occur and support the children's curiosity in mathematics and science.



One area of the environment in the image above is four large rocks placed on the ground. Seeing large rocks placed on the ground may encourage the children to jump from one rock to another, this activity could support the development of

mathematical learning within their play. From doing this activity, the child or children could jump across each rock and count how many there are. The practitioner can ask questions that will encourage the children to engage in the activity such as “should we count how many rocks are on the ground?” or “how many rocks can you see?” The practitioner could promote mathematical learning by supporting the children in counting the rocks slowly, for example “one, two, three, four.” The child may start conversations with the practitioners or other children and say things such as “look how high I jumped” or “look how many rocks there are.” The practitioner can support metacognitive talk in the children by saying “I wonder if I can count backwards by jumping back over each rock” while carrying out this activity, this can allow the children to think while they carry out the same activity. While this activity takes place the practitioner should be distant from the children but close enough to observe the children in case any risks come in to place, the practitioner should allow the children to play freely and not be interrupted unless the child or children approach the practitioner and ask them to join in, this will allow the children to play independently and develop their learning. This links to the Curriculum of Wales as play promotes mathematic and numeracy learning in children by giving them the opportunity to problem-solve, create relationships and work with others (Hwb, 2019a). There are possibilities to develop the play in the area by adding wooden planks to the rocks and placing them across the rocks to make a balance beam. By doing this, it can allow the children to develop their scientific learning by balancing on the planks and walking across. This could also encourage the child’s imagination as they could pretend to be someone else, for example, a ballerina or astronaut. This activity will support the development of the child’s balance, coordination, and strength, and also develop muscle movements. This form of movement promotes the development of mathematical learning from stepping forwards and backwards. The practitioner can support the child by holding their hand to jump from one rock to another while encouraging the child to think and count from one to four.



Another area of the environment in the image above which can support the children's scientific and mathematical learning is the area of different types of plants. This area can encourage the children to learn about the life cycle of plants, this will be the main activity for this area. This activity can allow children to learn about the different types of plants that grow in our environment, it allows children to learn about life changes which will enhance their self-understanding. It is important to educate children about life cycles as it can support the children in developing respect for the world that we live in. This activity links with the Curriculum for Wales as through exploration a child's knowledge progresses from an individual's view of the world to an ideal one that enables children to understand and defend what they believe (Hwb, 2019b). This activity would be suitable for a small group of children so they have a better understanding of what is being taught. Conversations and questions that may arise from the children could be "how does this plant grow?" or "this plant is spikey." This can support a child to develop sensory processing skills as the plants will have different textures, some may be smooth and some may have spikes. Practitioners may encourage metacognitive talk by asking the children questions such as "if I add water to the plant, I wonder if it will grow?" While the children take part in this activity, the practitioner teaching the children about the life cycle of the plants should include what the plant needs to grow for example sunlight and water. As there is a variety of plants practitioners should also educate the children on what plants are safe to touch and which ones are not safe as they may be poisonous. To add more scientific and mathematical learning into the activity, the children could also take part in a minibeast hunt. Practitioners could add magnifying glasses for the children to see small minibeasts and a chart with pictures of each minibeast to note down which one and how many they have discovered. This will encourage mathematical learning in

the children as they can develop numeracy skills by counting how many minibeasts they have discovered. This will also promote the children's independence, communication and coordination skills working with the other children.

A large area of the environment in the image above that can be used for many different activities is the long wall. This wall can be used for a variety of activities such as jumping from the wall to the ground, counting how many children can fit on the wall together, walking from one side of the wall to the other using balance, but the main activity to focus on here is by adding wooden planks to make slopes and adding balls to roll down the slopes. This activity would be suitable for a large group of children as the wall is quite large and doing this activity with more children can allow the children to collaborate and develop their communication skills by problem solving. The children may ask questions such as "how many of us can fit on the wall?" or conversations may emerge and children could say things such as "watch me jump off the wall." The children may find the activity of rolling the ball down the slope easy, practitioners could then encourage metacognitive talk here by asking the children "I wonder what would happen if I try and roll the ball back up the slope?" This would then encourage the children to develop their problem-solving skills to elaborate how they can get the ball back up the slope. The practitioners present should allow the children to play and take part in the activity independently but also observe the children in case of any risks of harm appear. This activity can encourage the children to learn about gravity by rolling the ball down the slope and how gravity pulls it down and how much more difficult it may be to roll the ball back up the slope. Practitioners can give the children a variety of loose parts such as stools, boxes or guttering which can allow the children to use their imagination to create different slopes to see which one is faster or slower.

Section 3

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
Jumping over rocks.	It will promote a child's gross motor skills. It promotes muscle development. Children develop balance skills. Children will count numbers from one to four which will encourage mathematical learning.	Children could possibly trip over the rocks if they are running. The children could slip while jumping on the rocks. Practitioners could walk and trip over the rocks.	Children. Early years practitioners.	Ensure a practitioner is present while the children are taking part in the activity. Take a small group of three or four children to reduce risk of injury. Ensure children do not run around the area. Ensure children have appropriate footwear on.	L
Balancing on beams.	It will encourage imagination in the children. It will allow a child to develop balance skills. It can help the children to develop coordination skills with other children. Muscle movement and strength can be developed.	The child could be unable to balance and fall off. The beam could be wet and the child could slip off. The wooden plank that creates the beam could fall to one side of the rock which would cause the child to fall off.	Children.	Ensure the wooden planks are stable for the children to balance and walk over. Make sure the wooden planks are dry if the weather is wet/rainy. Support the children by holding their hand if needed to walk along the beam. Ensure children wear appropriate footwear.	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
Discovering minibeasts.	Children learn identification skills. It allows them to identify different insects. Children can develop communications skills by discussing what minibeasts they have found. Mathematic skills can be developed by practicing their counting and addition. Allows children to be active outdoors and improve wellbeing.	Some minibeast could sting. Specific minibeasts can be endangered. Risk of damaging the minibeasts habitat. Weather could be bad which can cause minibeasts to hide. A child could have a potential allergic reaction to a minibeast.	Children. Early years practitioners.	Educate the children on which minibeasts are safe to hold or touch. Ensure children wear gloves or wash hands immediately after contact with minibeasts to reduce risk of any bacteria spreading. Have practitioners to supervise and always observe. Take a small group of children at a time to lower risk of injury.	L
Life cycle of plants.	Helps to develop children's understanding of the world. Learning about life changes enhances a child's self-understanding. Can allow children to develop respect by understanding the world. Opportunity for children to develop sensory processing skills from different plants.	Sharp objects could be found in the wild plants. Some plants could potentially be poisonous. Specific plants may be sharp/spikey and cut the children's fingers.	Children. Early years practitioners.	Ensure children are educated on which plants are safe to touch/ encounter. Children to wear appropriate clothing for example long sleeves, trousers, appropriate footwear.	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
Walking across and climbing on and off the wall.	Children can develop balancing skills. Supports fine and gross motor skill development. Allows children to enhance their strength and balance. Encourages problem solving skills.	Due to weather conditions the wall may be wet and the children could slip and fall from the wall. Children could decide to run on the wall instead of walk and this could cause the child to fall. There may be something sharp in between the rocks placed to make the wall which could cause the child to cut or injure themselves.	Children. Early years practitioners.	Ensure the weather is dry which will lower the chances of the children slipping. Ensure practitioners observe the children closely to make sure they do not run. Ensure the environment around the area is clean with no litter or anything that could cause harm to the children.	M

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
Rolling balls down the slope.	Encourages turn taking and sharing with other children. Allows children to develop problem solving skills. Encourages children to use their imagination using a variety of loose parts. Children can develop their coordination skills. Stimulates hand-eye coordination.	Some of the loose parts can be broken or damaged which can cause harm to the children. The weather could be wet which can cause loose parts to slip and fall on a child's foot.	Children.	Make sure to pair children up and let them take turns and share. Ensure all loose parts have been checked over for cracks/broken pieces and replaces with safe parts. Ensure a practitioner is there to observe the children in case of possible harm. ensure the weather is dry for loose parts to stay stable and not slip.	L

Section 4

According to White (2011) practitioners who appreciate spending time outdoors and understand its benefits and effects on young children's development are essential for working with children. Children's appreciation and comprehension of the natural world must be encouraged as an important component of outdoor education. Similarly, Richardson (2014) suggests that early childhood professionals that appreciate the distinctive qualities of the outdoor environment understand that it offers a vastly independent and holistic developing for encouraging children's wellbeing and promoting their educational development. Therefore, Welsh Government (2022) emphasise that it is crucial for children to be able to spend time playing outdoors. It promotes wellbeing and development of one's physical, social, emotional, and spiritual self. Children are curious by nature, and through sensory play and everyday interactions, they learn mathematical language, ideas, and skills. To support children's deeper understanding of concepts related to mathematics in daily life, they should have frequent opportunities for outdoor play. Furthermore, White (2013) states the accessibility of the outdoors is a crucial component of a child's everyday surroundings and lifestyle. The indoor-outdoor environment has two completely distinct components. Each one deserves to be given equal significance and consideration for their impact on young children's health, happiness, stimulation, and all aspects of development. It is essential that they must be available at the same time and experienced in combination. Also, Waite (2011) believes by involving children in real-world activities, practitioners can encourage them to embrace a mathematical mindset, or a belief that mathematics is present and that mathematics is constantly useful. Children can be given the opportunity to solve mathematical issues that might be more difficult to solve in other ways by using the outdoors as a learning environment. However, Campbell and Speldewinde (2020) draw a study based on play which uses educational concepts to take into account how children's scientific learning and how their initial observations of scientific events can relate to their exploration and understanding of the world. Childhood experiences are included in observations, which are related to the method they use their five senses to obtain knowledge. Waite (2011) mentions how combining the study of technological and scientific subjects can lead to longer activities that promote more comprehensive

learning since both fields value original thinking, analysis, and questioning. As stated by Ernst and Tornabene (2012) a diverse atmosphere for learning where children's imaginations, creative thinking, and curiosity are encouraged is provided through outdoor play in the natural environment, from a cognitive point of view. Compared to indoor areas, outdoor spaces typically have a greater variety and less organisation. Russell (2016) explains how children's numeracy abilities can be developed outside of the classroom in a variety of ways. Successful teaching of mathematics and literacy emphasises the use of everyday life, appropriate, and pleasant context that builds on the experiences of children. Children learn how to take measurements of objects, calculate money, problem-solve, show responsibility, and engage independently and responsibly in everyday situations. Bilton (2010) also believes the outdoor environment is a fully developed educational environment that meets all of the needs of young children, including their language development, cognitive abilities, social, emotional, and physical requirements. It needs to be accessible at all times of the year along with the indoor class each day.

Children can pursue their present interests and preferences in outside environment with space, duration, independence, and access to pure fresh air. For young children, the natural environment is an ideal location for educational activities, and many children feel comfortable and confident there. Undoubtedly, adults will occasionally participate in activities, but the strategy should be one of engagement rather than interruption. As stated by Maynard (2014) In accordance with the fundamental ideas established in the early childhood tradition, playing outdoors will be given more attention in early years practice. It is an important and fundamental component of the growth of young children. While encouraging outdoor activity can bring up a number of difficult problems including independence, safety, and risk of harm, this focus may conflict with the need to concentrate on promoting the growth of mathematical and literacy skills. However, Campbell and Speldewinde (2021) emphasises how the development of children's knowledge of their environment in nature and scientific learning are related. As children are introduced to scientific ideas from the biological, chemical, earth, and physical sciences in environments that are natural, there are considerably larger opportunities to increase their feeling of "wonder" about science and the environment as a whole. In outdoor

environments, young children instinctively connect scientific and environmental concepts. Their sensitivity, comprehension, and awareness of the connections of every living and non-living thing can all be improved by increasing their scientific knowledge.

Waters (2017) tells us the theory of affordance by Gibson (1977, 1979) was created as a theoretical framework for thinking about and comprehending how we see things. The concept of affordance originates from origins in the ecological field of psychological research and mainly allows us to think theoretically about the space between the natural world and human beings. However, Early Years Educator (2016) highlights that a child has a set of values, passions, abilities, understanding, feelings, and desires, and they use them to determine what affordances the environment is providing for them. When all the factors are appropriate, the opportunity is fulfilled, children will see numerous opportunities that adults may miss.

Tovey (2012) believes that undoubtedly the most influential child development and education innovator was Froebel (1782–1852). Froebel established the first kindergarten, allowing young children to mature and develop at their own rate while being supported and guided by experienced adults. The beginning years of a child's life, according to Froebel, is the most significant for their education and it creates the groundwork for all successive learning. Froebel declared that play, talk, and self-activity are the best ways for young children to learn. Similarly, regarding Froebel, Maynard (2014) states a location where children may develop their abilities in accordance with nature, a garden was essential to his idea of a "kindergarten." He established it as a place where children might develop their skills at their own personal rate, surrounded by adults who recognise their growth and encouraged their special talents. It serves as a space for innovative and creative play, research, and discovery, as well as for activities, singing, music, and movement. Unity was a key component of Froebel's theory of learning because it helped children understand in a way that was relevant and connected to what they previously knew. Moreover, Robertson (2017) explains how the 'Gifts' Froebel produced are thought to be the initial instructional objects. A child was only given these when they were considered

developmentally prepared for them. Children gain a knowledge of deeper concepts by engaging with and investigating the Gifts. Froebel had a clear understanding of the necessity for children to gain knowledge immediately through unrestricted outdoor experiences and mathematical inquiries. Also, Tovey (no date) suggests Froebel understood the significant influence adults may have on encouraging or restricting children's outdoor participation and curiosity. Froebelian educators emphasises the value of carefully engaging to assist and extend children's learning by making arrangements for additional resources, new opportunities, or adult help. Beginning from where the child is, using concentration and close attention to what they find appealing, and encouraging and extending it in significant and desirable ways are essential components of a Froebelian approach. Understanding children well and keeping a close eye on them can support adults in deciding when to take a step back and when to take greater action.

Keith (2017) tells us Simon Nicholson, a British architect, used the phrase "loose parts" to describe components that might be implemented in a variety of ways. Children can learn to take responsibility, develop their critical thinking abilities, and create original, creative solutions to issues through experiences with loose components. As children make interesting discoveries regarding what these items can do and what they are able to do with them, connections to the beginning phases of mathematical development are created. However, Gull, Bogunovich, Levenson Goldstein and Rosengarten (2019) mention how the theory of loose parts, in accordance with Nicholson (1971), offers children a chance to express their creativity through the use of objects that may be moved around, changed, and made through self-directed play. Giving children an opportunity to play actively outside in their natural surroundings is crucial for their overall growth and increases their probability of engaging in independent play in any setting. Furthermore, Creative Star Learning Ltd (2017) explain how in addition to open-ended reading materials, Nicholson's term embraces a wide range of other events, including music, the force of gravity, experimenting with words, concepts, and thoughts. This includes far more than just environmentally friendly, waste, and recycled materials. Practitioners have to be aware of the range of options. According to Play Scotland (no date) the growth of a child's creativity, curiosity, interest, learning, and most significantly happiness may all

be attributed to loose parts play, according to studies. Because it gives them more authority over their individual independent play and offers countless opportunity to utilise their own imagination, studies have shown children prefer to play with loose components. Based on a child's age, abilities, and developmental stage, children will interact with loose parts in a variety of approaches. Young children can learn about materials that are both natural and synthetic with a variety of textures, forms, colours, and physical characteristics by interacting with loose parts.

Conclusion

In conclusion, it is clear that adults and early years professionals have a large impact on supporting and encouraging scientific and mathematical concepts in the outdoor environment. It is important that adults working in the outdoors understand the benefit it has on young children and how it supports their development. By doing this the young children will learn to appreciate the outdoor environment and be encouraged to learn. It is important to highlight that adults encouraging children to spend time being outdoors encourages independence promotes their well-being and educational development in mathematics and science. A crucial element to add is the importance of adults considering theory and research and implementing these into practice, for example, using Froebel's theory outdoors will support adults in understanding the importance of unrestricted outdoor play, which encourages children to learn. Adding additional resources such as loose parts offer new opportunities for children to gain knowledge. To promote children's wellbeing and development, adults must encourage children to engage in the outdoor environment.

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