

Awe and Wonder – Science and Mathematics and Outdoors

Part 1



Part 2

The photo above is an outdoors environment in a forest with a waterfall, river and lots of amazing nature and wildlife. There are many opportunities for children to learn through outdoor environments like the photo above, including topics such as mathematics and science, having access to natural resources for a variety of activities. It is a great open environment to enable young children to explore and become curious about their surroundings. When children find themselves connecting with the natural world, they can grow compassion for the environment, showing their understanding for their potential influence on the living world. Being able to explore outdoor environments, children develop a sense of place in their immediate surroundings (Welsh government, 2021). Children learn through their senses, so the perfect outlet is provided by nature to use all of their senses to their fullest potential. The discoveries children make in an outdoors environment support their knowledge and development, and help create new knowledge. Children find their own unique ways to describe the outdoors, and due to the excitement of being outdoors the words they use tell us only a segment of the possibilities they see and discover (Rosenow, 2012).

It can be an enjoyable experience for children to learn mathematics in an outdoor environment which is a change to normal lessons inside, as they can explore concepts in the real world with natural resources. With natural resources being all around the children in this environment they

can explore mathematical concepts at a much larger scale. Children can naturally become curious by having mathematics in an outdoor environment like this as well as more motivation, finding themselves wanting to take part in activities. It is a place where more exercise and play based learning can take place which is a huge concept for early years children, it promotes an active and healthy lifestyle and encourages movement, a sense of well-being and freedom (Brooks, 2021). It is most important for young children to be outdoors as it supports their physical, emotional, social and spiritual development as well and their well-being. Children's confidence and engagement can also be majorly supported by being outdoors. Children's skills can be enhanced and explored from being in an outdoors environment. Awe and wonder is inspired by opportunities provided by the outdoors, which allows children to be relaxed and open (Welsh Government, 2022). Taking mathematics outdoors can offer children a sense of freedom without limitations that can be caused in an indoor environment. It encourages children to have a mathematical outlook and make useful links to their learning in future. In an outdoor environment mathematics can be taught in a context that children wouldn't normally associate with maths, like using sticks to make shapes is an activity children would not normally do indoors, so this can be more memorable for them. Finally, mathematical work outside encourages children to take risks and explore their environment independently (Wisbey, 2018).

As there are so many different shapes and sizes of materials in the picture above there is a large variety of mathematic activities that can be undertaken in this environment to expand children's knowledge on the subject, using different methods. By giving the children a simple mathematical task to begin with, like finding leaves of all different sizes, shapes and colours gives them a chance to explore and get to know the environment they are working in. The rocks in the river can be used in a similar activity, where the children find as many different shapes as they can, like a rock in the shape of a square, circle or triangle, they can then draw these shaped rocks in their book and write the name of the shape alongside it. As well as looking at the shapes of the rocks the children can also look at the sizes and measure them with different types of equipment such as a ruler, meter stick other materials like a pencil, how many lengths of the pencil in the rock or even their footsteps/shoe size. They can then put them into order of the smallest to biggest by the measurements they have taken. Another way children can use this environment to learn about shapes is collecting a bunch of different size sticks and making as many shapes as possible out of them and make the shape in different sizes. The activity can have different stages of difficulty, starting with shapes like squares and triangles, then the adult can ask the children "So now you have made a square and triangle, can you try and make a hexagon and pentagon? And maybe find a way to make a circle with sticks" The children could also use different size sticks and sequencing them from biggest to smallest with their measurements. Equipment like dice can be useful in this environment for mathematic activities. An activity with the dice can be, whatever number it lands on they have to find an object that can relate to that number, for example, if the dice lands on six, the children can bring back a leaf with size corners or edges, or they can find 6 sticks or stones the same/similar size. Another piece of equipment that is useful in the outdoors for mathematics activities is a weighing scales, children can collect natural resources like different size stones and rocks to see the difference in weight. Including natural resources like stones, sticks and leaves into children's learning, will show them that mathematics is rooted in nature and the outdoors. It will help children in the future to use mathematics as a tool in real life

problem solving. Children begin to understand the importance of mathematics in daily life when they start to use it to solve problems that occur in play (Olson, Mazzocco and Williams Ridge, 2021). In early years, the aim is for children to become ambitious, capable learners, healthy confident individuals, enterprising, creative contributors and ethical informed citizens (Welsh Government, 2022).

The Welsh Government (2015) believes that learning outcome 4 for foundation phase is that children should be able to count up to 20 objects which they are able to do in these mathematical activities and within in this environment when collecting natural resources like sticks and leaves. They believe children should also be able to half and double their numbers which they can do in these mathematics activities with their resources and objects. Children can learn how to measure using non standard units, like in the activity above where they have to measure the rocks in the river by using non-standard units as well as a ruler or meter stick.

The enclosing schema is one that links to mathematical concepts as children are exploring the properties of shape, size and measurement. The Enveloping schema is also linked to mathematical concepts, and it involves exploring volume, space, weight, capacity and spatial awareness. Finally, the transporting is another schema which is related to mathematical concepts by exploring quantities by moving and transferring objects, or a group of objects from one place to another (Welsh Government, 2022). This schema links to loose parts. Loose parts are an amazing way for children to use their imagination, when they are given materials, they can use them to make or become anything they want. Loose parts are things that are freely used to explore and create different textures and develop their imagination and curiosity. They are materials that have no rules and can be used however they desire. For example, children using loose parts like sticks in a mathematics activity, can snap the sticks to make them into different sizes to help them get the size they need to make a shape. Loose parts are also a good way to provide sensory experiences (Play Scotland, N.d.). When children make or create things from loose parts, this could be during an activity or even just playing, it can give them a sense of achievement and pride after they have completed it This helps increase their self-confidence and skills. The power of loose parts is endless (Play Scotland, N.d).

Part 3

RISK BENEFIT ASSESSMENT

Location / Activity:	Forest area with water fall and river	Date:	20/4/22
Assessor:	Sophie Pritchard	Review date:	20/7/22

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury
Collecting leaves and sticks	- Children will have the opportunity to explore the area independently can make children feel a sense of freedom. - They can have their daily exercise by walking around the forest looking for resources. - Children can feel connected to nature and the outdoors. - Children can help check the area to see if it safe before they start exploring to ensure they are fine to go ahead and search for resources. They have a sense of impendence and can create a sense of ownership.	- Picking up something sharp (e.g. glass) - Picking a holly leaf/stingy nettles. Could cause pain, breaking their skin.	Children	- Adult should check over area and ensure children know if there is any plants or bushes that they should avoid.

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury
River	- Children will feel connected to nature and the outdoors. - Children will have an awareness to maths and science, sinking, floating and flow of water.	- Falling into water. - Failure to swim. - Drowning. - River potentially flooding in heavy rain fall. - Accidently consumption of water, can cause illness.	Children adults in needed to help children in the river.	- Adult to check area beforehand to ensure it is a safe place for children to explore. - Adult to supervise at all times. - Adult to demonstrate the task to ensure children are aware of the risks.
Walking over rocks in the river	- Young children will benefit from this experience by taking risks and learning to naturally risk assess their surroundings themselves. - Young children will gain confidence through taking risks.	- Slipping on rocks. - Slipping into river.	Children	- Adult to assess area beforehand to ensure the area is safe. - Adult to present and show children a safe way to cross or walk over the rocks. - Supervision in the area at all times when children are on the rocks.
Trees	- Children can use different trees to find different shape and coloured leaves. - To help them find natural resources like stinks and branches that have fallen from the tree onto the ground below.	- Hurting themselves/ falling, from climbing the trees. - Pulling off stingy nettle leaves.	- Children - Adults children need assistance/ help off the tree.	- Adult to make children aware about hazards and their safety. - Supervision in the area at all times.

Waterfall	Children get an awareness of maths and science, how waterfalls are formed and the force that the water falls.	- Waterfalls can be fascinating to young children so they may want to go near it which can cause them to slip or fall. - Which may lead to drowning. - Consumption of water.	- Children - Adult if they have to help assist children out of the area/water.	- Adult to make children aware about hazards and their safety. - Ensure children know what areas of the environment are a risk to them. - Supervision in the area at all times.
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Part 4

The creators of early years education, including Margaret McMillan, Friedrich Froebel and Maria Montessori, highlighted the importance and significance of the role outdoor experience and nature have in the development of maturation of individuals (Meol Cop Research School, 2020). Being outdoors brings nature's version of maths. Shapes, order, patterns, symmetry and quantities are everywhere outdoors. During outdoor experiences children effortlessly use mathematical thinking and continuously learn new skills. Children will measure, count, discover new shapes and through creative play and their imagination they will develop new mathematical ideas (Meols Cop Research School, 2020). Pedagogy is having an understanding of the way children develop and learn, and the practices through which we can enrich the process. It is supported by experience, knowledge and practice and is rooted in beliefs and values that adults want and have for the children (Department for Children, Schools and Families, 2009).

Children will gain maximum benefit from experiences outdoors if practitioners, carers and parents all understand the value of the benefits it has. The adults in the company of children and their attitude towards the outdoors and the children's experiences are vital for the development of children's self-esteem and confidence. Children's experiences in an outdoors environment is most effective when they are in partnership with parents, carers and practitioners or as a whole community (Welsh Government, 2009).

Children need adults to enjoy, value and want to be outdoors as much as they do to see potential and concerns it may have for children and their development and well-being (Waller, 2011). Understanding, positive thinking, attitude and commitment are all important concepts alongside the skills to make the most of what is in the outdoor environment they are learning mathematics and science and to ensure they are successfully supporting child-led learning. It can be effective for adults working with children outdoors inform parents and other adults who work with the child about working outdoors so they can also become inspired. To ensure children are engaging

in appropriate and regular experiences outdoors, the role, behaviour and attitude of practitioners is essential (Waller, 2011). For outdoor learning and play to be at its highest potential for young children, it needs to be prioritised the same amount as indoor learning and play. To help achieve this, adults need to have the same attitude towards outdoor learning as indoor learning (Williams, 2016). In the Reggio Emilia approach the role of the adult is vital for children's learning. If the role of the adult is to facilitate, then they have to offer a large amount of encouragement for children to have been given opportunities to make independent choices and learn to take their own risks through their learning. However, adults should not give children complete reasonability and freedom but they should make an environment that children feel comfortable and happy to explore on their own in a safe environment (Scottish Government, 2006).

The founder of kindergarten, Froebel believed that a 'children's garden' is the most influential setting for educating young children; he invented a curriculum based on children's intrinsic need to play (Härkönen, 2013). Wilson (2007, cited in Härkönen, 2013, p.7) explained that Froebel believed that activities taking place in the outdoor environments should be planned carefully. Froebel encouraged regular nature walks where adults and children explore together in natural environments using a range of loose parts to allow the children to experiment. Froebel believed play and learning outdoor offers rich, first-hand sensory experiences and this is vital for growing minds. Children can engage with the wonder and mystery of the natural world and they can do this is mathematics and scientific activities when looking for resources and exploring their environment. The outdoors gives opportunities to take risks and challenge themselves in a new natural environment (Tovey, n.d.).

Cognitive development is supported by loose part play, they facilitate imagination, creativity and curiosity (Play Scotland, n.d). This can have a positive effect when participating in a mathematics or science activity in an outdoors environment as it makes it more interesting when children can incorporate their own imagination into their work. To keep developing children's imagination it is essential to provide opportunities to continue development and learning (Play Scotland, n.d). Simon Nicolson wrote an article in 1971 called 'How NOT to Cheat Children- The Theory of Loose Parts'. He believed that everyone can be inventive and creative and this can be seen by observing children of all different abilities playing with loose parts (Creative STAR, 2017).

Another way adults can support children in child-led learning and play in and outdoor area is to ensure they are always offered a safe learning environment where they can explore freely and independently. It is essential to allow children to follow their urges to play and explore and the adults role here is allowing them to do so. This also applies to mathematics and science activities to allow children to work independently in an outdoors environment, children should be supporting children without interrupting their child-led learning or play so they have a sense of independence, adults should watch from a distance and let the children explore, invent, create and discover by themselves (Caro, 2012).

From the very beginning, in a young child, the Mathematical Mind is active. The experiences provided to children that support the Mathematical Mind in the first part of a child's development, can help build the foundation that learning later in life will rely on as children's

development continues. Children are curious people, and curiosity makes them want to explore to gain an understanding about the world around them. This arises questions like, when, what, how and why and it is good to embrace this type of curiosity as it is the groundwork for creative mathematical learning. This type of questioning that children use triggers scientific inquiry, continuing to find new and complete or more accurate knowledge (Wisbey, 2018). The scope for learning offered by nature was recognised by Maria Montessori. The every day living world is intriguing and interesting when you look closely enough and it is full of awe and wonder, when children find a ladybird for the first time, and they count all of the dots on the back of the ladybird. This is why children need to explore, discover and creative learning and adults will help and feel fulfilled if they help children to achieve this throughout their lives (Wisbey, 2018).

Although adults have a huge positive impact on children's outdoor experiences, they can also cause barriers. One barrier is time, some adults look to carefully at time and believe there is not enough time in everyday to spend time outdoors. It is essential for children to have movement throughout their day, and it is necessary to incorporate this into mathematics and science lessons too. No matter what lesson or task children have been given they should always be given the opportunity to move, it is not practical or appropriate for children to stay quiet and stay still for so long (Merrick, 2021). It is vital that time has been put aside throughout lessons or the day for children to be able to move and go outdoors, or for lessons to be planned to be suitable for outdoor learning. Outdoor provision is crucial part of children's daily life and environment they are surrounded by, it should not be an option or extra given by practitioners but it should be incorporated into their daily work routine. Indoor and outdoor environments offer significant different opportunities for children's learning (White, n.d).

Practitioners often find it hard to promote and encourage mathematics in an environment outdoor as a lot of emphasis is focusing on physical skills, social skills and understanding the world around them (Early years careers, 2017). However, children are usually more engaged too their activities and learning when being in an outdoor environment, this can help motivate practitioners to want to use an outdoor environment in more of their planning and provision. Effective relationships between children and practitioners can be formed from the freedom and space outdoor environments offer as children will become more involved in activities which then in turn builds their confidence (Welsh Government, 2018).

One of the most natural parts of working with children is sustained shared thinking. It can basically be described as thinking and working together with young children. This means having momentous, prolonged conversations, to help solve problems, which in turn expands their knowledge (Brodie, n.d). Sustained shared thinking needs to be considered from the start when planning within a physical environment. In an outdoor environment, all of the areas need to be carefully looked at. The environment needs to encourage conversations between the children and also between children and practitioners. It is good for the environment to have areas where children can sit or stand together to engage and start conversations, this also encourages sustained shared thinking between the children and allows practitioners to start conversations with the children easily (Brodie, n.d).

Reggio Emilia is a wealthy town located in the hills of Northern Italy founded by Loris Malaguzzi. The Reggio Emilia approach believes the practitioner should encourage and support children on their personal learning journey, encouraging them to question and reflect. This indicates they should not correct children or dispense information but practitioners should be used as a tool, children will ask for them if they need them instead. They should either act as observers or as a partner to the children in their investigations, including mathematics or science activities. Through using open-ended questions practitioners can provoke ideas from the children (Scottish Government, 2006). An essential part of the Reggio Emilia approach is documentation, and it is believed to be a crucial part of the practitioners role to document the progress of a child because it can give a structure to the practices and theories. The documentation should take place as the children are learning and it can be done through photographs or written documents and this allows the learning process to be visible. Practitioners, parents and children will all have the chance to look back and see how the child is progressing and show how the children are learning (Berg, 2021). Practitioners are considered partners within children's learning process instead of being someone who tells the children what to do and help guide the children through activities and projects that are set out in the current curriculum. In the Reggio Emilia approach practitioners role is to learn alongside the children. This allows them to listen closely, involve themselves and observe the children's learning at the same time. This gives them the chance to find opportunities to help the children to explore their interests further and help reach their full potential.

Reference list

Welsh Government (2022) *Developing a vision for curriculum design*. Available at: <https://hwb.gov.wales/curriculum-for-wales/designing-your-curriculum/developing-a-vision-for-curriculum-design/#curriculum-design-and-the-four-purposes> (Accessed: 20 September 2022).

Brooks, K. (2021) *The Importance of Outdoor Learning in Maths Classes*. Available at: <https://www.owis.org/blog/the-importance-of-outdoor-learning-in-maths-classes> (Accessed: 21 September 2022).

Olson, R. Michèle Mazzocco, M and Williams Ridge, S. (2021) *Taking Math Outdoors: A Natural Learning Environment*. Available at: <https://dreme.stanford.edu/news/taking-math-outdoors-natural-learning-environment> (Accessed: 21 September 2022).

Welsh Government (2022) *A curriculum for funded non-maintained nursery settings*. Available at: <https://hwb.gov.wales/api/storage/b1801d78-38c3-4320-9818-d9996c21aef8/220914-a-curriculum-for-funded-non-maintained-nursery-settings.pdf> (Accessed 21 September 2022).

Play Scotland (N.d) *Loose Parts*. Available at: <https://www.playscotland.org/wp-content/uploads/Play-Scotland-Loose-Parts-Leaflet.pdf> (Accessed 22 September 2022).

Welsh Government (2021) *A curriculum for funded non-maintained nursery settings*. Available at: <https://gov.wales/sites/default/files/consultations/2021-05/curriculum-funded-non-maintained-settings-consultation-doc.pdf> (Accessed 22 September 2022).

Meols cop Research school (2020) *Early Years Maths Outdoor*. Available at: <https://researchschool.org.uk/meolscop/news/early-years-maths-outdoors> (Accessed 22 September 2022).

Waller, T. (2011) 'Adults are essential', in White, J. (ed.) *Outdoor Provision in Early Years*. London: SAGE Publications.

Härkönen, U. (2013) *Reorientation of teacher education towards sustainability through theory and practice. Reports and Studies in Education, Humanities, and Theology No 7*. Unpublished.

Creative STAR (2017) *Simon Nicholson and The Theory of Loose Parts – 1 Million Thanks*. Available at: <https://creativestarning.co.uk/early-years-outdoors/simon-nicholson-and-the-theory-of-loose-parts-1-million-thanks/> (Accessed 24 September 2022).

Williams, D. (2016). *Playworker, The Role of the Adult in Outdoor Play and Learning*. Available at: <https://www.firstdiscoverers.co.uk/playworker-outdoor-learning/> (Accessed 25 September 2022).

Scottish Government (2006) *The Reggio Emilia Approach to Early Years Education*. Available at: https://education.gov.scot/nih/Documents/ELC/ELC35_ReggioEmilia/ELC35_ReggioAug06.pdf (Accessed 25 September 2022).

Department for Children, Schools and Families (2009). *Learning, Playing and Interacting: Good Practice in the Early Years Foundation Stage*. Available at: https://foundationyears.org.uk/wp-content/uploads/2011/10/Learning_Playing_Interacting.pdf (Accessed 25 September 2022).

Tovey, H. (n.d). *A Froebelian Approach: Outdoor play and exploration*. Available at: <https://www.froebel.org.uk/uploads/documents/FT-Outdoor-Play-Pamphlet.pdf> (Accessed 26 September 2022).

Merrick, B. (2021). *Overcoming Barriers*. Available at: <https://early-education.org.uk/overcoming-barriers-2/2/#MakeTime> (Accessed 26 September 2022).

White, J. (n.d). *Vision and Values*. Available at: <https://janwhitenaturalplay.wordpress.com/vision-and-values/> (Accessed 26 September 2022).

Caro, C. (2012). *The Adult Role in Child-led Play – How to Become a Learning Ally*. Available at: <http://www.nature-play.co.uk/blog/the-adult-role-in-child-led-play-how-to-become-a-learning-ally> (Accessed 27 September 2022).

Wisbey, M. (2018). *Maths in the Great Outdoors*. Available at:
<https://www.communityplaythings.co.uk/learning-library/articles/maths-in-the-great-outdoors>
(Accessed 27 September 2022).

Welsh Government (2009). *Outdoor Learning Handbook*. Available at:
<https://hwb.gov.wales/storage/fcb8539c-9be7-4883-8542-35d7b54b56f2/foundation-phase-outdoor-learning-handbook.pdf> (Accessed 28 September 2022).

Welsh Government (n.d.). *First Steps Outdoors*. Available at:
<https://hwb.gov.wales/storage/79a90e4b-0385-4cc8-be9b-2b20be3a85d0/first-steps-outdoors.pdf> (Accessed 28 September 2022).

Rosenow, N. (2012). *The Wisdom of Nature: Out my back door*. Available at:
<https://www.communityplaythings.com/resources/Literature/Wisdom-of-Nature> (Accessed 28 September 2022).

Brodie, K. (n.d). *Getting the Environment Right for Sustained Shared Thinking*. Available at:
<https://www.designsforeducation.co.uk/sustained-shared-thinking/> (Accessed 27 September 2022).

Brodie, K (n.d.). *Sustained Shared Thinking: Part 2*. Available at:
<https://www.teachearlyyears.com/cpd/view/sustained-shared-thinking-part-2> (Accessed 28 September 2022).

Welsh Government (2015). *Foundation Phase Framework*. Available at:
<https://hwb.gov.wales/storage/d5d8e39c-b534-40cb-a3f5-7e2e126d8077/foundation-phase-framework.pdf> (Accessed 28 September 2022).

Berg, V (2021). *The Reggio Emilia Approach to early years education*. Available at:
<https://www.daynurseries.co.uk/advice/the-reggio-emilia-approach-to-early-years-education>
(Accessed 29 September 2022).