

Awe and Wonder, Science, Mathematics, and the Outdoors.
Section 1



(Source: GPS Cycle and Walking Routes, 2022)

Section 2

The photograph in section one is called “the Japanese garden”, and can be found in Bryngarw Country Park, Bridgend. This photograph is an example of a picture of the outdoors that shows many different areas in which a group of young children from an Early Years Setting, can explore and start to learn about science and mathematics outside of their classroom.

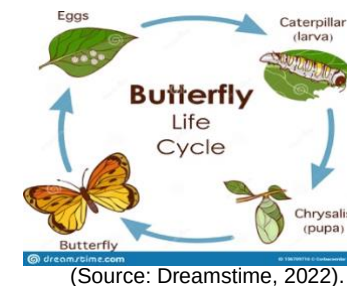
The outdoors is also a place for practitioners to enable and support children, to engage in learning experiences and to help them build their confidence and curiosity when they are exploring outdoors and having fun while learning. The grass, flowers, trees, bridge, pond, and rocks that can be seen in the picture, make up an environment for the children to climb and explore, and to look for different types of trees, plants, insects, and pond life.

With extra resources that can be brought along by the practitioner such as nets, magnifying glasses and tubs or jars, paper, crayons and pre-printed information sheets, children can be made aware of what different types of living things there are, in the environment that they have been taken to.

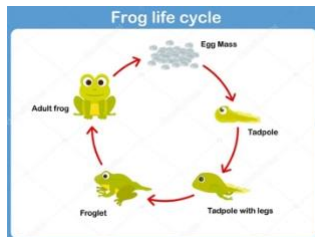
The Curriculum for Wales (2021) say that children should experiment and participate in activities both indoor and outdoor, as this aids in their Personal, social, and well-being development, and to enhance the knowledge of young children, The curriculum for Wales also states that it calls upon the sciences of biology, physics, and chemistry, along with computer science, and design and technology for the learners.

Within the area of the photograph children can start to learn about science, with the life cycles of the insects, pond life, flowers, and the trees that are living and growing around the garden, which starts to lay foundations for learning about biology in later school years. When looking at flowers and leaves with the children, Open ended questions can be asked and, discussions and sustained shared thinking can be started, how many different colour flowers can you see? where do flowers come from? What do they need to grow? How do they make you feel? why do they make you feel that way? If they are bright cheery flowers, do they make children feel happy? If they are dark and thistly, do they make the children feel sad? Asking questions makes children think, so children should not feel rushed to answer, they should be given the time to process and answer the questions that are put to them.

If children find eggs, or caterpillars on leaves, the adult can ask open ended questions such as, what do you think this is? What do you think it will turn into? What does it need to live? how big do you think it will grow? what do you think it will eat? Practitioners can then show the children the life cycle of a



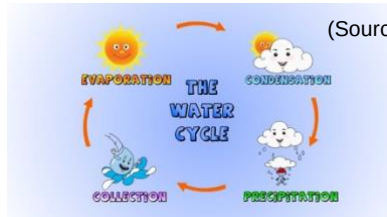
(Source: Dreamstime, 2022).



(Source: DepositPhotos, 2022)

butterfly from the eggs to a caterpillar, to a pupa and then on to the butterfly which can then lay more eggs, which starts the cycle over again. If finding frogspawn in the pond, again the same open-ended questions can be asked to the child, and again the children can be shown the cycle from spawn to tadpole, tadpole with legs, froglet then frog, and the cycle can then start again.

Trees and flowers are an effective way to learn about mathematics and science, trees can be measured as they grow upwards, the circumference of the tree can be measured to see how old it is, or the rings inside counted to tell how old the tree was. The wooden pagoda that can be seen to the back part of the garden, could be talked about as the end of some tree's life cycle. Children can be asked if they know where wood comes from? And if they can tell you about anything that has been constructed from wood,



(Source: Learning Juntion, 2014)

By looking for patterns on flowers and leaves. Open ended questions, such as, what do the trees and flowers need to grow? Sun and Rain, Children can learn about the science of the weather, and its cycle. How the water evaporates when the sun warms it, and then falls down again when it gets cool.

When looking around the environment they can try to catch insects, butterflies, or tadpoles in their nets and with the adults help, put them into tubs or jars to look at closely with the magnifying glass and try to identify what they have caught, before putting them back where they were found.

Climbing over the rocks and looking at the cracks in them to find insects, children can further develop their balance and their proprioception, which is their body's natural ability to sense movement.

By looking for shapes and patterns in nature, Practitioners can ask children about the colours, shapes and patterns that are on caterpillars and butterflies, what shapes can they see and if they can identify different patterns, such as symmetric patterns, which have perfect regularity like a butterfly's wings or growing patterns which can increase or decrease, like the veins on a leaf. If practitioners give children paper and crayons, the children could then try and copy the patterns that they have found around the garden or place the paper against the tree and get rubbings of the bark.

Children can start to learn about mathematics by using the bridge, and being asked questions like, how many footsteps do you think it will take for the child to cross the bridge? How many footsteps for the adult to cross the bridge, do you think it will be the same or different, why do you think it might be different? Loose parts such as sticks or twigs or extra resources like the nets can be laid out end to end to find out how many lengths do you think it will take to cross over the bridge? Are there any patterns on the

floor of the bridge or how many patterns can you see on the side of the bridge? Can you see the squares or triangles? This can lay foundations for learning about geometry in later school years.

Physics can also be learned by dropping small items off the bridge and seeing if they sink or swim. Small items can be different sized stones, twigs, and leaves, that can be picked up off the ground and not broken from trees or plants.

By asking questions to a group of children about what they can see outdoors, what they have found and what they have learned, they can share their own ideas with each other, this can also give practitioners a chance to assess the children's learning, by observing the children and taking photographs or videos, and documenting the observation, other practitioners in the setting can also use the information, for further lessons or how the child learns best, as all children learn in different ways and at different rates. Outdoor activities can afford the children to develop the skills to learn independently and with their peers, make choices, communicate ideas, and solve problems. Walking around on different surfaces looking for different flowers and insects can aid in gross motor skills, balance, and muscle strength, holding a magnifying glass and moving little insects into tubs or jars can aid in their fine motor skills.

Section 3**RISK BENEFIT ASSESSMENT**

Location / Activity:	Bryngarw Country Park.	Date:	29/09/22
Assessor:	Kelly O'Leary	Review date:	01/11/22

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	Overall risk RATING: L/M/H
Exploring in a public space.	Children have fun outdoors, and they are afforded the freedom to move about. Developing social skills with peers. Starting to learn about Maths and Science by being outdoors.	Members of the public/strangers entering the Japanese garden, potential risk of abduction or inappropriate behaviour toward the children. Dog walkers with dogs that may not be on leads and not friendly. Child getting lost.	Adult And Child.	Explain to children before hand, the importance of Golden rules, for example, Not talking to and keeping a distance between themselves and the adults who are not with them. Practitioners to ask if dogs can be put on leads so the area is safer for the children. Appropriate adult to child ratio.	High.

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	Overall risk RATING: L/M/H
Being outdoors.	Outdoors benefits children's wellbeing. Children can learn about weather cycles, learn about appropriate clothing and why we need them.	May get sunburn if out on a sunny day. May lose footing and fall over or into the pond if running around. Being stung by a wasp or bee.	Adult And Child.	Practitioners planning: watching weather forecast. Make sure parents know about the trip, and for them to provide sunscreen and appropriate footwear and clothes for their children. Explain to children about the ground being wet and slippery by the pond and to take care when in that area. Explain to children to stay away from flying insects such as wasps and bees.	Medium.
Being aware of litter.	Children can learn about recycling and sustainability	Hazardous objects maybe found in the public area. Dog faeces my be left by dog walkers.	Child	Practitioner to do a walk around the garden looking for unsafe litter and asking if it can be removed. Golden rule, do not touch or pick up anything without asking the adult first.	Medium.
Exploring Plants	Finding different patterns in flowers and leaves	May come across harmful plants, such as thistles or nettles.	Child.	Practitioner to plan and show pictures of thistles and nettles to children beforehand. Golden rule, do not touch without asking the adult first.	Medium.
Looking in the pond.	Exploring for pondlife. Exploring what sinks or floats.	Child might fall in the pond.	Child.	Practitioners to ask before hand how deep the pond is. Appropriate adult to child ratio. Golden rule, do not go near the pond without an adult	High.

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	Overall risk RATING: L/M/H
The bridge.	Starting to learn about Physics by dropping things in the pond. Looking for patterns.	Child may fall off the bridge into the pond.	Child.	Appropriate adult to child ratio on bridge. Explain to children, do not lean out too far. Golden rules, do not go near the pond without an adult.	High.
Climbing over the rocks, looking for insects	Children are developing their balance and proprioception, getting to know their limits when climbing and when exploring uneven ground.	Falling off the rocks and hurting themselves.	Child.	Explain to children before hand to take care when climbing.	Medium.
Tree bark rubbing.	Fine motor skills are being developed while holding the paper and crayon on the tree to get the bark rubbings.	Possibility of splinters.	Child	Ask children to be careful when doing the rubbings, explain about getting splinters.	Low.

Section 4

Every child has the right to an education and the right to play, articles 28 and 31 of the UNCRC (UNICEF No Date). When Early Years Children are outdoors, they are using an ever-changing environment for their learning. When outside, children are provided with many opportunities as they play and learn, and natural curiosity takes over. The Froebelian Approach which, was created by Friedrich Froebel, a German born pedagogue, explains how First-hand experiences in the outdoors are necessary with young children, for them to encounter the awe and wonder of the natural world. Children can be given the time and space to explore and have engagement with science and mathematics such as speed and gravity. Children also have the freedom to try new things and experiment with risk. Practitioners can support the children's learning by looking for opportunities to ask open ended questions about what the child is doing or what they have found (Tovey 2016).

Some research has found that children can learn better outdoors. When children are playing outdoors, and not being rushed, they have the time for their imagination and creativity to thrive. Children have more learning opportunities outdoors, while playing and stimulating their own curiosity. Nature can encourage children to learn by developing critical thinking, and imagination. Learning in nature has become just as important as learning in the classroom, with children enjoying themselves more in their school day, using their imagination and making memories with their peers (Community Playthings, no date).

While learning and playing outside, children can enhance their creative, physical, and social development, whether they are playing and learning by themselves or with their peers (Welsh Assembly Government 2009).

For practitioners to enable children to learn outdoors, planning is key, an important part is making sure the environment is suitable for children, for example, no glass or needles in the area, keeping track of the weather so that the children have suitable clothes

and footwear for the outdoors. Practitioners should talk and listen to children, asking them questions that make them think, and ask questions back, give them feedback on what they have done, and importantly give them the time to do it (Bilton H. 2010).

Each child is different, each of them learn in a different way and at different rates. However, by doing things for themselves, children learn best, by regularly having child led lessons outdoors and guiding children, rather than telling them what to do, and asking open ended questions that make children think, practitioners can enable this type of learning. Practitioners should also help children to reflect and share on their experiences from the outdoors (Froebel Trust 2022). Montessori agrees that having child led activities, give children a sense of freedom, to choose how they learn, from the natural world. Montessori observed children and thought that classrooms and schools were not a place where children felt happy, she agrees that children are unique and should be treated as such, without the use of curriculums, where all children are treated the same and expected to do the same things at the same time. (Aubrey and Riley 2019).

The Reggio Emilia approach also views children as intelligent individuals and has the children in the forefront of their learning. Children can be influenced by others and different things that surround them and the way they learn, so the outdoors could be classed as, the third teacher (Reggio Children 2022). To enhance and support children's learning, documenting their work and having it on show, allows the children to see their work, and talk about it, with their practitioners and their peers, it provides children with evidence of their learning, such as drawings and writing. The Reggio Emilia Approach Puts children's documentation on the walls where the children can see their work, and have a sense of achievement, and accomplishment. Practitioners can also use documentation to assess the children's progress and plan further lessons for them and future classes. (The Compass School 2018).

The supporting learner progression is part of the Curriculum for Wales framework (Welsh Government 2021), which allows practitioners to support children in their learning by assessing them regularly and changing how we teach individual children if need be. Practitioners can do this by using a learning story, where they write down a record of what they have seen the children do. Learning stories can be one paragraph or a page, which documents the children's activity and learning over a certain amount of time. The practitioner can take photographs and videos to help assess the children and put in the story. However, the learning stories are only as good as the person writing it, knowing the child and what their capabilities are can help. Adding parts of the curriculum to the story can also explain show what children have learned (Early Childhood Education 2022).

Allowing children to play outdoors every day, Practitioners can enable the children's curiosity for nature's mathematics: Patterns, shapes, and quantity. This is summed up by Montessori's Description of The Mathematical Mind, A mind that can classify and organise in the experiences of daily life. From a very young age our Mathematical mind is active and is there to develop foundations for later years (Community Playthings 2018). Mathematics is important, nearly everybody in the world, uses mathematics every day. We use it for money, engineering, and architecture. Practitioners can support the early years development of mathematics through play, which can enable young children to problem solve and work with others. As children grow and reflect on mathematics and what and how they have learned, they can strive toward the outcomes of "The Four Purposes" that is in the Curriculum for Wales Framework, by being: "Ambitious, capable learners. Enterprising, creative contributors. Ethical, informed citizens of Wales and the world and Healthy, confident individuals" (Welsh Government 2020). Practitioners can also support early years children develop mathematics through using their fingers, objects, drawings, and pictures. Children can start to understand more about number names when they are shown, holding a finger up for one, or being shown a picture of one object. For many children, their age is an important number, they will probably know how old they are, or what age they will be next. They will know how many siblings they have, or if they have any pets. Singing nursery rhymes with numbers in them can also help children to recognise numbers (Skinner and Stevens 2012).

When in an outdoor environment, practitioners can enable learning, by using loose parts, natural or manmade, to help support the learning of mathematics and science, objects that are found in nature, such as, sticks, leaves, shells, stones, and feathers can be collected by the children, and used in a completely different way than what they are supposed to. This is classed as affordance, where the object can be anything the user sees it to be, Sticks can become spoons when stirring and adding water to mud, to change the consistency in an outdoor kitchen, children can put stones and leaves into groups to be counted or sorted into size and weight. Practitioners can also supply extra resources and loose parts, such as tyres, wooden pallets, and planks of wood, enabling the child to utilise them and manipulate the environment around them, for it to become what they can imagine it to be (Inspiring Scotland 2016). Bilton (2010) agrees and argues that the outdoors is a starting point in facilitating children's mathematical development, as they use loose parts and label them to be whatever they wish, this is the start of separating meaning and objects which lends itself to learning mathematical symbols for later learning.

Practitioners can also support children's learning by using and stimulating metacognitive thought, by talking out loud about what you are thinking and what ideas you have, and by discussing and debating. Lev Vygotsky was a Russian born psychologist who is known for the work he did with psychological development in children. He brought about the thinking, that children and learners can gain knowledge through thinking out loud and engaging with social interactions. Having conversations and asking questions, children can get used to hearing other children's thoughts and ideas (Parrish 2022). With Reggio Emilia bringing the idea that the outdoors is classed as the third teacher, it is only right that the classroom teacher is the second and the children are the first. This idea lends itself to Lev Vygotsky's theory on learning within social contexts. Vygotsky proposed an idea of "learning communities" where children learn from their interactions with each other and share ideas amongst peers to expand knowledge (Vygotsky, 1978) Jerome Bruner, an American born psychologist shares his views with Vygotsky and highlights the importance of interactions with others in play. By creating opportunities for meaningful interactions between children in purposeful outdoor environments, practitioners can afford children the opportunity for scaffolding to take place amongst themselves, the environment and between

child and practitioner. Further, Vygotsky's theory of the Zone of Proximal Development (ZPD) has relevance in children's outdoor learning, as Montague-Smith and Price (2012) state that both teachers and peers can scaffold children and their learning by providing a ZPD in moments where comments on observations, open ended questions and direct challenges are appropriate. For example, using mathematical language within observations; "I like the colours that you have used in your repeating pattern". Marchant, Todd and Brophy (2019) state that outdoor learning has an abundance of benefits in relation to children's learning and development, moreover, children prefer learning outdoors, and it yields better progress in their accommodation of knowledge. This research gives evidence to Piaget's earlier theory of developmental constructivism, where children are capable of learning number concepts and mathematical reasoning, but only in an environment where they are interested and stimulated; and this is what an outdoor environment provides.

Bruner advocates for a cognitive theory known as the 'Spiral Curriculum' where children are able to revisit topics throughout each stage of development and increase the complexity and understanding each time it is revisited (Tucker, 2005; Education Partnerships, no date) This theory can lend itself to children's outdoor learning as the outdoors affords loose parts as a part of nature, children can use these interchangeably throughout their learning and revisit many times throughout their cognitive development stages. Each revisitation may provide children with new ideas on how to use such materials in different areas of their learning. Skinner and Stevens (2012) agree that revisitation of topics is highly beneficial for children's cognitive development in mathematical knowledge. However, it is important that the mathematical activity intentions are suitable to be used both in the indoors and indeed the outdoors interchangeably and seamlessly; it is possible that this can afford children accessible opportunities to make links within their learning whilst encountering different experiences.

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