Awe and Wonder – Science, Mathematics and the Outdoors.

Part 1:

(Source: Keith Aston, 2019)

Part 2:

Learning story

I believe this photograph provides scope for several learning opportunities for young children, including promoting mathamatics and science in the outdoors. There are opportunities for the children to explore the uneven surfaces, the different textures in the environment, and the pond where conversations can be had about the different wildlife that lives here, as well as the different sizes and shapes of rocks or sticks they can find. Within this learning story ten four year olds will have the opportunity to go to this park/woodland area to explore and engage in open-ended play which will be linked back to the curriculum for Wales and the curriculum for funded non-

maintained nursery settings. I will also bring different resources and loose parts along for the children to explore and experiment with.

The children arrive at nursery first thing in the morning. It is a drizzily spring day. There are five members of staff accompnying the children on our walk to the park/woodland area today, where we will observe the children as they play. I start by asking the children “what is the weather like today?” “It’s raining!” A few of the boys and girls reply excitedly. They all run over to the window and one little girl is tracing the raindrops on the window and counting them, “one, two, three”. “How do we think the ground will feel outside?” I asked the children curiously. “Wet!” Because rain is wet and it makes our clothes wet when we’re outside” they say enthusiastically. “We can read some books about rain before we go home to learn more about it if you like?” “Yay!” The children shouted.

(Source: Dreamstime, no date)

The children being curious and eager to learn about the rain is enabling them to learn about the world around them and ask many questions which links to them deepening their understanding of the ideas and dicipines within areas of learning and experiences stated in the curicculum for Wales (Welsh Government, 2022b).

The children have all come to nursery wearing wellington boots and waterproof all-in-ones ready for some outdoor exploring. We all make our way to the park/woodland area by foot, the ground is wet although it has stopped raining. “It is not raining anymore, why is the ground still wet?” One little boy asked. “What an interesting question” I replied. “Why do we think the ground is still wet?” I asked inquisitively. The children looked puzzled, they did not know the answer. “It has only just stopped raining. The sun is out now though, so the warmth from that will soon dry up all the rain and the ground will be dry again” I told them. “Waw”, the children said with amazed looks on their faces. A few of the children notice that there is a rainbow in the sky. “Miss, a rainbow!” they shout exitedly. I ask them if we can sing the colours of the rainbow together as we walk, which they do joyfully. One little girl then asked how a rainbow happens, I explained that when the sunlight reflects off the raindrops

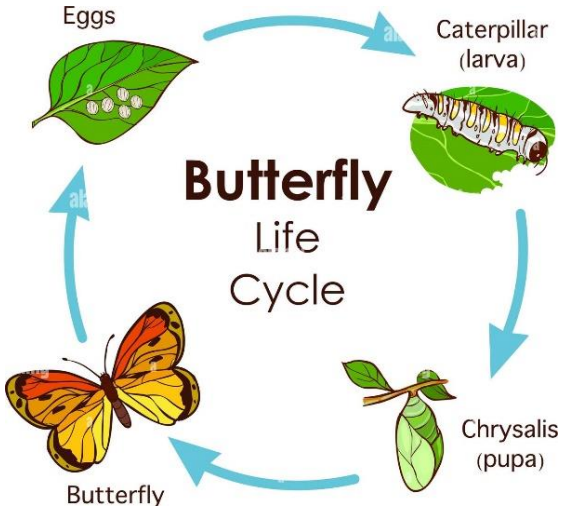
this shines rainbow colours into the sky. “I have a video back in nursery that will show you exactly how rainbows are made, we can learn about this when we get back!”

(Source: The Sun, 2017)

Once we reach the park/woodland area I explain to the children that I will be putting some cones out and we must not go past that point, because this is a public area and anyone can come here. As soon as the children are free to go and play they imediately scatter. Three children head straight for the pond and immediately their hands are in the water, another two children wobble up and down the sloped ground, and the other five children head to the woodland area by the trees. The staff members are here to observe and model a joyful approach to learning for the young children and support their natural curiosity, which links to both the curriculum for wales and the curriculum for non-maintained nurseries which encourages staff to be enabling adults for our children and make use of the teachable moments that occur naturally as children play (Welsh Government, 2022a).

“Miss, come and look at this!” I hear as two little boys are calling me over to look at what they have found. I see them pointing at a small caterpillar on a tree branch. “What is it?” They ask me curiously, without taking their eyes off it. “What do you think it is?” I asked them. “Is it a worm?” One boy asked. “No, worms are brown and do not have legs”, said the other boy. “It is a caterpillar”, I told them. “Do you remember the hungry caterpillar book we read together?” I asked them. “Yes, but this looks different”, they said looking puzzled. “You are right, the caterpillar in the book is a cartoon drawing of one. This is what a real life caterpillar looks like!” I explained to them. “Waw! Is this going to turn into a butterfly?” They asked. “Yes, it is!” I say excitedly. I then begin to explain the life cycle of a butterfly to them, starting

with the eggs hatching giving you a caterpillar, then the caterpillar creates a cocoon where it will sleep til it is ready to become a butterfly.



(Source: Steam Powered Family, 2022)

The children are demonstrating curiosity about science here and are searching for answers in order to learn about their environment and the world around them. According to Welsh Government (2022b) this links to progression step one in being curious and searching for answers which is essential to understand and predict phenomenon.

I also inform the children that we should treat these insects with care and kindness and ensure we never take them out of their habitats. This is encouraging the children to become compasionate and kind young learners.

Next I decided to place some of the loose parts and resources out around the different areas. I put jugs, cups, funnels and sponges next to the pond, there are also some puddles there too. I put 5 coloured balls of different sizes on the grass where the ground is fairly uneven. I place some magnifying glasses and some insect cups next to the woodland area and I also put kitchen utensils, pot's and pan's in the soft mud area.

(Source: Onbuy, no date)

(Source: Gumtree, no date)

(Source: Amazon, no date)

Initially the staff members take a step back and observe as the children all gravitate to certain resources. Three children immediately ran over to the woodland area and started playing with the mud and utensils. They started scooping up some mud and mixing it. One child had collected some sticks and leaves to mix in with it too. They quickly learnt that the utensils were all different shapes, and decided amongst

themselves to create patterns in the mud. They started with spirals and zig-zag patterns. I decided to ask one of the children if they could draw a triangle for me, which they did perfectly. “How many sides does a triangle have?” I asked them. They did not understand the question, therefore, I knelt down and drew a triangle in the mud with my finger and counted every side as I drew it. The child imitated me and counted “one, two, three”, as they drew the sides of the triangle again. “A triangle has three sides!” said the child proudly. I then asked the child how many sides other shapes have and took a step back to observe their work. They copied the same steps as before, counting each side as they drew them.

(Source: Artful Kids, 2011)

These activities outdoors have several opportunities for children to learn about science and mathematics in a fun and engaging way which is important for their holistic development, including counting, recognising shapes, and life cycles of insects. The curriculum for non-maintained nurseries suggest that through exploration of an effective and engaging environment, children withing the early years start to develop a sense of belonging and an appreciation of the world around them (Welsh Government, 2022a). At this satge of development the children will be heading towards progression step one within the new curriculum for Wales, which states that children will start to show an interest in science and mathematic concepts and are able understand basic mathematical concepts which can be transferred during play, which is part of them developing mathamatical proficiency (Welsh Government, 2020). They can also demonstrate curiosity and question how things work, as well as explore the environment, make observations and communicate their ideas (Welsh Government, 2022b). Welsh Government (2021b) also states that through these rich learning experiences, children will become ambitious, capable learners which is one of the core purposes of the curriculum for Wales.

Part 3:

RISK BENEFIT ASSESSMENT

Location / Activity:	Park/woodland area.	**Date:**	20th March 2023.
Assessor:	Emily Morgan	**Review date:**	20th September 2023.

The boxes in the table below will expand as you type into them; pre-entered text is simply for illustration. You should delete irrelevant items and replace with text relevant to your circumstances.
Your overall risk rating – Low, medium or high – is based on your judgement about whether the BENEFITS of the activity or opportunity outweigh the RISKS.

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
10 Minute walk to the park/woodland area.	Children may experience a place they have never walked before. Good exercise for the children. Children can talk about all the things they can see. Practice walking with a partner.	Trips or falls which may cause cuts, bruises or grazes. Cars on the road. Other pedestrians walking around you. Animals such as, dogs not on a lead.	Children and adults	Appropriate clothing to be worn such as, sensible shoes. Ensure there is enough staff to supervise all the children. Ensure children are aware of road safety and put boundaries in place such as, always holding your partners hand, never running out onto the road and only cross the road when a teacher says it is safe to do so. Children and adults to wear high visibility vests.	Low
Walking/running on uneven ground.	Children will become aware of gradients and slopes, as well as the different textures such as, soft grass, puddles, leaves and mud. Helps to support children's vestibular (balance) sense. Helps children develop an awareness of forces and energy. Children develop awareness of what their bodies are capable of and helps develop co-ordination and strengthens bones and muscles. Discovering different ways to move about such as, jumping, tip toeing, crawling and rolling.	Children or adults may trip or fall on the uneven ground which could cause cuts, bruises, grazes, sprains or other injuries.	Children and adults	Ensure appropriate clothing is worn such as, long trousers and wellington boots. Inform the children that the surface is a new experience so they may want to walk slowly until they become more familiar with it. Make up a fun game or a song for the children to help with their balance. Adults should inspect the area to determine if any areas should be cordoned off if deemed too high risk for this stage of development.	Low

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
Children exploring the natural objects in the environment such as, plants, flowers, trees, bushes, rocks, insects and other mini beasts.	Opportunities to discover nature and learn about the environment around them. Opportunities to explore different colours, textures and patterns which promotes both mathematics and science. Opportunities to learn about other living things and the habitats in which they live. Opportunities to learn about the life cycle of insects and mini beasts. Outdoor activities help to promote children's physical development, such as their gross and fine motor skills from bending, stretching and climbing. Learning the importance of being kind to other living things and becoming ethical informed citizens. Opportunities to explore the different flowers and plants and learn about their importance to our environment. Builds children's social and communication skills as they discuss ideas with their peers.	Weather depending, there may be slippery ground surfaces if it has been raining, especially in the muddier areas. Children may slip, fall or slide, potentially injuring themselves as a result. Children may get stung or bitten by an insect potentially causing irritation, discomfort, illness or allergic reaction. Low hanging branches eye level to the children could potentially cause eye/head injuries or scratches. Bushes may contain stingy nettles or poisonous plants/flowers that can be harmful to young children. Children may wander out of bounds causing them to become out of sight of the adults with risk of getting hurt or lost.	Children and adults	Ensure enough adults are there to supervise the children and ensure they are kept safe and well. Discuss with the children that they may experience some new and surprising objects/living things and reassure them. Ensure children are made aware of materials that are not nice to collect such as, rubbish or sharp objects for example. Put boundaries in place so children know where they can go without an adult and where they cannot go. Golden rule – no objects to be put in their mouth and all hands must be washed after the activity. Ensure staff have a first aid kit with them including alcohol wipes, plasters and ice packs. Ensure at least one member of staff is first aid trained. Staff to take plenty of drinks and nappies for those who need them to ensure the children are comfortable. Ensure children are aware of strangers and not to talk to anyone who is not a member of staff or another child in their group.	Low

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
Playing in the pond and splashing in puddles.	Children can develop curiosity about the water cycle and where rain comes from. Exploring the reflections, ripples and patterns in the puddle/pond and how they change. Opportunities to understand depth and how items float or sink in the water. Also develop a basic understanding of scientific concepts such as, volume and weight. Opportunities to explore any wildlife that lives in the pond and learn about their life cycle. Children can combine water with other materials such as, soil or sand to observe and describe how the texture changes when made wet. Opportunities for multi-sensory experience. Develops imagination, creativity and exploration.	Children may slip or fall due to slippery surfaces, resulting in injury. Potential of drowning in the pond or deep puddles if children are not aware of the depth. Ground under puddle may be uneven resulting in the children losing balance and injuring themselves.	Children and adults	Staff to supervise by the pond and puddles at all times to ensure children are safe to explore. Appropriate waterproof clothing and wellington boots to be worn. Staff to assess puddles to check their depth and ensure children walk until they are familiar and comfortable with their surroundings.	Low
Outdoor in different weather conditions	Become aware of different temperatures and learn to use words such as hot, cold, windy, dry and wet. Use of different senses to explore how the wind, rain or sun feels on their faces. Explore how the different weather conditions effect the environment.	High winds can cause trees and branches to fall resulting in head injuries and other serious injuries. Children could be too hot or too cold – extreme cases could cause hypothermia or hyperthermia. Sun exposure could cause sun burn or sun stroke. Children may become wet, causing them to be uncomfortable.	Children and adults	Appropriate waterproof clothes, warm layers, hats and wellington boots to be worn. Take suncream, first aid kit, plenty of water and ensure there are shaded areas. Teacher to monitor weather with met office to ensure it is appropriate to take young children outdoors. Activity to be cancelled if stormy weather or extreme high winds.	Low
Loose parts/resources provided by the teacher.	Children can explore their surroundings with magnifying glasses, examine insects in a pot before returning them to their habitat and experimenting with cups and jugs in the water. Opportunities for open ended play and engage in imaginative play with the resources provided.	Children may accidentally break resources causing them to be sharp and not safe to touch.	Children and adults	Ensure enough adults are there to supervise the children and allow them to engage with the resources without fear.	Low

Part 4:

According to Maynard and Waters (2014) outdoor play is beneficial for children's holistic development. This allows children the chance to immerse themselves in nature, explore and develop an understanding of the world around them (Waters and Rekers, 2019). Sisson and Lash (2017) and Bilton and Crook (2016) state that outdoor play also helps develop children's self-esteem, confidence and independence.

During outdoor play children are continuously learning mathematics and science naturally through exploring, investigating and experimenting in their environment (Edgington, 2014). According to Ryder Richardson (2014) it provides children with opportunities to engage in sensory play by jumping in puddles, feeling the different textures of bark on the trees, discovering different insects and other wildlife, feeling the mud, climbing or rolling, and communicating with their peers whilst making a fort/den, where they will also learn problem-solving skills (Montague-Smith and Price, 2012). Whilst engaging in these activities the children are discovering and developing an understanding of mathematic and scientific concepts such as, balance, hight, weight, gradients, gravity, patterns, shapes, colours, more than and less than through play (White, 2014). They are also developing an understanding of cause and effect, and trial and error through experimentation (Keith, 2017).

It is of great importance that children have access to consistent and regular outdoor play for them to repeat their learning, as Grigg and Lewis (2016) suggest that children learn through repetition. This allows children to understand that certain activities will have different results on different days, for example if a child were to make a mud pie on a wet rainy day, the mud would be very soft and pliable, however if they were to make a mud pie on a hot summers day, the mud may be dry and hard. The adult observing could take this opportunity to step in and ask the child what might happen if they added water to the dry mud, this could be a good learning opportunity for the child according to (Waters and Rekers, 2019).

German educator Froebel believed that play is the principle means of learning for young children (Tovey, 2020). He believed that during play children construct their understanding of the world through direct experience with it (Tovey, 2013). He also believed that through the provision of rich outdoor play experiences with

knowledgeable and supportive adults observing, this allowed for cognitive, social, emotional and physical development (Tovey, 2013). According to Smedley and Hoskins (2018) Froebel believed the key role of the adult in outdoor play is firstly the provision of rich enabling environments for the children to engage in play. Secondly, to take a step back and observe the children, whilst supporting and extending their play and learning when needed (Macblain, 2021). According to Bilton (2020) adults play an important role in outdoor play with children by role-modelling curiosity and imagination, displaying interest and enthusiasm, whilst also building on questions the children ask them, encouraging sustained shared thinking and therefore, aiding the children's learning.

According to Geurten and Leonard (2023) it is good practice to use metacognitive talk with the children during play, for example if a child is experimenting with something the practitioner could extend their learning experience by asking them questions such as, "What will happen next?", "Why is that happening?" or "What would happen if we did this…?".

The curriculum for Wales encourages child-led play-based learning within the early years, however, it is the role of the practitioner to provide the children with the opportunity for child-led play within a rich, engaging environment (Welsh Government, 2021a). According to Waters and Rekers (2019) the outdoors is a wonderful learning environment for young children, as mathematics and science can be seen all around them and in everything they do. Bilton and Waters (2016) believe outdoor play also gives children the opportunity to learn about their ever-changing surroundings, such as the different seasons, the leaves falling from the trees, plant growth, birds flying and the different weather, as well as opportunities for investigation and discoveries. Through observations, practitioners will develop an understanding of the interest of the children and will be able to use these findings for future outdoor play sessions by expanding on these interests, ensuring the children are provided with an enjoyable and engaging experience (Wilson, 2018).

According to Smolucha and Smolucha (2021) it is the adult's role to scaffold the children during outdoor play. The term scaffolding comes from Vygotsky's Zone of Proximal Development, meaning the space between what a child can do on their own, and what they can do with the support of a more knowledgeable other

(MacBlain, 2018). If the practitioner notices that a child is struggling or does not understand something during play, it is their role to step in and provide the necessary support in order to aid their learning (Smolucha and Smolucha, 2021). Similar to Vygotsky, Bandura believed that children learn best in social environments with their peers and suggested that children observe the actions of others during play and mirror them, enabling them to develop new skills and acquire new information (Pritchard and Woollard, 2010) and (MacBlain, 2018).

Loris Malaguzzi was best known for his creation and development of the Reggio Emilia approach, which is child-centred and recognises that young children have a deep curiosity and potential (Hall *et al.,* 2014). This approach encourages outdoor learning as Malaguzzi believed that being in nature sparked curiosity, awe and wonder in children and encouraged their learning and development (Smidt, 2013). He also believed that it is the children's innate curiosity that drives their interest to understand the world around them (Senent, Kelley and Abo-Zena, 2021).

There are vast amounts of research out there that suggests outdoor learning is beneficial for children, with evidence to support it, however, there are challenges and barriers many practitioners may face that prevents them from being able to offer outdoor learning (Wood, 2013). Moyles (2015) suggests some adults may lack the knowledge on how important outdoor learning is for children, and the possible benefits that come with it. According to Wood (2013) some settings may not have an outdoor play area that children can access or lack funding to provide this type of resource. Another barrier may be a shortage of practitioners to supervise and observe the children outside. Essa and Burnham (2019) suggest this is common in some settings as they do not have enough staff, which could result in children missing out on important experiences which could have an impact on their development.

Gibson's Affordance Theory believed that an outside learning environment has several natural affordance's such as, trees or log's which children can climb, different objects for children to run, swing or balance on, and objects to construct or be used in imaginative play (Waller *et al.*, 2017). According to Obee, Sandseter and Harper (2020) affordances like these spark creativity in young children, which encourages them to engage in open-ended play. This links well with the curriculum for Wales

which encourages practitioners to allow for child-led, open-ended learning opportunities within play which extend and apply to cross-curricular skills such as, mathematics, science, language and literacy (Welsh Government, 2022c). An example for this could be the pond in the above photograph being used as a 'kitchen sink' to wash the children's dirty pots and pans one day, the next day the pond could become a 'magical underwater kingdom' where different creatures live. These affordances encourage the children's curiosity and imagination and help to develop many skills across the curriculum (Wagman, 2019).

Affordances are objects of many uses, providing many possibilities within the outdoor environment (Waller *et al.*, 2017). In addition, they provide children with opportunities to explore new mathematical and scientific concepts (Waller *et al.,* 2017). According to Brooker, Blaise and Edwards (2014) when it comes to the environment, the way in which this space is utilised by practitioners is deemed as important as the play environment itself.

Another responsibility of the adult to enhance children's learning experience outdoors is the provision of loose parts and time to explore them. This comes from Nicholson's theory of loose parts, which are materials, both natural and man-made, that can be used however the child imagines so (Flannigan and Dietze, 2018). Loose parts can be used in child-led play to become something entirely different to what it is, they can be transformed during imaginative play, whilst also stimulating the children's senses (Casey and Robertson, 2016). Flannigan and Dietze (2018) believes that loose parts do not have to cost a lot of money, or any money at all. Objects such as tyres, sheets, tubes, or rope can be used, as well as natural objects like sticks, branches, stones or water (Casey and Robertson, 2016). Children can feel the textures of the materials, observe the patterns the tyre makes in the mud and hear the noises the different materials might make.

Children can learn about gravity when pushing the tyres over the uneven ground, noticing it is harder to push up a slope than it is going down (Sedgwick, 2012). They can also learn about balance and co-ordination when trying to walk across a plank of wood or rope, pretending it is a 'balance beam' (Wilson, 2018). According to Halpenny and Pettersen (2014) activities like these follow Piaget's theory that

children can become ‘little scientists’ when they are allowed to discover new concepts and ideas, whilst experimenting with different loose parts.

The curriculum for Wales is encouraging outdoor learning with a want to enhance outdoor environments, in order to provide young children with better educational opportunities (Williams, 2022). By providing larger, more open landscapes with different gradients and sloped ground, with natural resources such as, trees, sticks, water and mud, Waller *et al.* (2017) believes this will provoke children’s natural curiosity. According to White (2020) and Ernst (2014) in order to aid children’s holistic development, including their understanding of mathematic and scientific concepts within the outdoors, practitioners must become pro-active, and provide rich learning experiences through play. This includes creating an engaging outdoor space for the children, which will encourage play, and exploration (White, 2014). Through doing so, Welsh Government (2021b) believe young children will become ambitious, capable learners; enterprising, creative contributors; ethically, informed citizens; and healthy, confident individuals.