

Awe and Wonder, science, mathematics and the outdoors

Part 1:



(Source: Mathias, 2023)

Part 2:

Learning Journey

Forest school adventure

09.09.2023

9:00am The time had approached for us to visit the forest to explore the nature, the curiosity of the world around us and for the children to have the space to be curious and inquisitive (Welsh Government, 2022). As the children began lining up child A shouted, "Can I be at the front" the teacher replied, "Yes you can". As child A was walking to the front of the line, he began to count his peers "1,2,3,4,5" the teacher asked child A "how many friends are in the line?" "5" he replied. Through enjoyment the child was showing ordinal number experience and exploration within the environment. This mathematic concept is highlighted in the new curriculum for Wales, progression step 1 (Welsh Government, 2020). At the forest the children were surrounded by trees, plants, leaves, sensory paths, kitchen sink, wooden benches and a veg patch. The environment provided opportunities for the children to apply their knowledge and skills to generate ideas and take calculated risks (Welsh Government, 2020). The children began to wondered off, exploring the beauty of the nature. They were becoming ambitious, capable learners and where ready to learn (Welsh Government, 2022). They were picking different size and shape leaves off the trees and balancing along the benches. I encouraged the children to make a pattern with the different leaves they had found. This enabled the children to build on mathematical concepts and ideas, as well as connecting the children's curiosity through mathematical ideas (Welsh Government, 2022).



(Source: Mathias, 2023)

9:20am The smell of nature captivated child B's senses. "I can smell grass." "Yes, what a wonderful smell, I responded. As he twisted the strands of grass and picked up the leaves, child B proceeded to select some of the grass and examine the leaves with his fine and gross motor talents. Child B was employing the Kinaesthetic learning approach in this manner (Experihub, 2020). Child B began to balance on the benches constructed of natural materials such as tree stumps and wooden planks. The fire pit overpowered him as he neared the end of the wooden plank. "Wow, let's make a fire!" he exclaimed. I started asking open-ended inquiries. "How can we make a fire?", "What do we need to make a fire?", child B responded, "we need sticks".

9:30am Child B and his peers continued to wonder off in the forest area and began to collect natural materials. Through exploring children develop a sense of belonging by investigating their surroundings (Government, 2023). Through observing the children, I noticed that they were improving their social and communication abilities. While they were gathering materials, I moved the table closer to the fire pit and added some loose parts, newspaper, conkers and rocks. The children proceeded to arrange the twigs on the table. Child B determined that his twig was the largest on the table. I started to wonder how he knew it was the biggest. Child B took two twigs and placed them next to one another, saying, "look Miss, it's bigger." Child B was able to reply to questions and improve his problem-solving abilities (Welsh Government, 2022).

The children then began to arrange the sticks in a line from smallest to largest. This was motivated by child B's abilities, and all the children benefited. The children were enterprising, imaginative contributors ready to take on life's challenges (Welsh Government, 2022). Mathematical language began to flourish "it's big", "it's bigger" "that one is small" "I picked the long stick" without realising the children were developing mathematical concepts within the outdoors.



(Source: Bisnath, n.d.)

9:45am The children had completed gathering natural materials for the fire. As they sat on the benches surrounding the fire pit, I started teaching about fire safety and how the children should never touch fire because it is hot, and it will burn them. I asked the children if they wanted to start the fire, the words "yes, yes fire" were hurled at me.

9:55am Though imaginative and creativity the children began making their fire on the fire pit. Child A began with the biggest sticks. "let's get the big ones" he yelled. Everybody joined in and started placing the big twigs at the bottom of the fire. Child B noticed the fire was building up "its tall, we got enough". Child A picked up the newspaper and started to roll it into a ball shape. He then placed it on top of the twigs. The children were encouraged to enquire into and use scientific information to increase their understanding of how our world works (Welsh Government, 2022).



(Source: Atlas & Boots, 2023)

10:00am The children began sharing their imagination through mathematical and scientific concepts. Child A began exploring his senses “I can smell the fire; it is getting hot”. Child B could hear the cracking coming from the twigs as they were burning. “listen” he yelled “it’s crackly”. There was sudden moment of silence. I explained to the children why the wood was making such noises. When the wood heats up it creates air pockets that need releasing which creates the noises. Child B responded, “like a firework, bang”. I was amazed by the curiosity and response from the children. The children were developing progression step 1 of the science and technology area of learning (Welsh Government, 2022). This Allowed the children to connect their learning and blend multiple experiences, knowledge, and abilities (Welsh Government, 2020).



(Source: Counterfit, 2023)

The session was a great success due to the stimulating and inspiring outdoor area. Through observing it was evident the children developed a range of mathematical and scientific concepts through their imagination and creativity by exploring, engaging and using newly learnt mathematical and scientific vocabulary and becoming ambitious capable learners. As highlighted by Government, (2020) ambitious, capable learners who are eager to learn throughout their lives should participate in scientific change.

Throughout the morning the children collected natural materials, used their senses to look, touch and feel in the nature, explored shapes and patterns, balanced along benches, explored the nature outdoors, learnt about fire safety, compared the twigs by size, learnt new mathematical and scientific vocabulary, explored the colours and shapes of the leaves, noticed scientific changes and showed understanding of number through counting. The children were able to bring a range of information and abilities together through experiences, allowing them to use and apply them in new and challenging contexts (Welsh Government, 2021).

Part 3: Risk assessment

Location / Activity:	Howardian Primary school forest area.	Date:	14.09.2023
Assessor:	Mrs. Mathias	Review date:	14.09.2024

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
Develop their senses through touch by exploring different textures.	Encourages children's curiosity while allowing them to take calculated risks when walking on uneven surfaces. Children must move their centre of gravity, resulting in increased range of motion and muscle strength.	Uneven surfaces on the sensory footpath. Children can trip and injure themselves. A trip hazard can cause injuries such as cuts, bruises, and grazes.	Children and practitioners	Before taking the children to the forest area, make sure they are informed of the rules and personal safety precautions. Check the sensory route for loose objects on a regular basis. Discuss with the children the importance of safety when using the sensory trails. Appropriate footwear is required. A first aider should always be present and have access to a first aid kit.	L
Develop special awareness, balance and co ordination	Children will be confident explorers, take part in physical activity and will be able to take responsible risks.	Climbing on the benches can cause wounds, bruises, scratches, and splinters to the children.	Children	Regularly check that the planks of wood are appropriately positioned on the tree stumps and that the tree stumps are laid flat facing down. Examine the wood for any rough or loose parts. Talk to the children about being cautious while climbing to avoid injury. Check that children are climbing responsibly.	M
Develop scientific and mathematical concepts to create a fire.	Gain knowledge and understanding how to make a fire in the outdoors. Use newly learnt scientific and mathematical language. Show understanding of fire safety.	Burns to the body are possible if the children touch a lit or previously lit fire pit that is still hot. The fire pit's stand may cause a child to tumble and injure themselves.	Children and practitioners	Prior to their journey to the forest, the children will be shown the fire pit area and reminded of the restrictions. Extra care will be taken to ensure that the children do not touch the fire pit by always having an adult present. Ensure the children are never left alone in the fire pit area at any time, and that they have a solid awareness of fire safety.	L
Develop mathematical skills by collecting branches by size.	Develop a sense of belonging in the outdoor environment. Using mathematical language big, little, small, bigger, longer, tall and shortest. Developing mathematical concepts counting, size and amounts.	Tree branches that have been broken can cause scrapes, wounds, and splinters to children.	Children and practitioners	Examine the area to ensure that no branches are presenting a tripping hazard. Look for sharp branches and, remove them. Remind the children to pick up the branches with caution.	L

When putting out the fire, use water play to foster curiosity and develop scientific skills by observing the changes caused by chemical reactions.	Make use of freshly acquired scientific vocabulary. Develop as a capable and ambitious learner. Understand the scientific changes that occur when a fire is extinguished.	Slippery surfaces in the kitchen and around the water tray can lead to the children falling, slipping, and injuring themselves.	Children and practitioners	Any water spillages should be cleaned up straight away. Ensure children and adults are wearing appropriate footwear. Maintain adult supervision in the kitchen and around the water tray.	L
Develop mathematical skills by counting and comparing the tree branches.	Make use of freshly acquired mathematical vocabulary and concepts. Show knowledge and understanding in mathematical areas of learning.	When picking up the branches, the children may obtain splinters from the tree branches and scratch themselves and others.	Children and practitioners	Check the tree branches for any evident loose bits and remove any rough surface branches. Make sure the children are being cautious when picking up and comparing the branches. Remind children of the regulations and how to stay safe in the forest and ensure there is always an adult present.	L
Children can become more confident risk takers by participating in physical activities such as balancing on the benches and exploring the seating area.	Improve children coordination and balance. Allow children to take risks on their own.	Planks of wood balancing on the tree stumps to create seating area can cause an injury to children when climbing and balancing.	Children and practitioners	Ensure the wood is appropriately positioned on the tree stumps. Examine the area for any loose parts concealed behind the wood pieces.	L
Use of kitchen sink with water and soap. Develop personal hygiene.	Children will learn about personal hygiene and will be able to wash their hands as needed to avoid carrying or transmitting germs.	Edges of the kitchen sink can cause injury if the child falls and hits the edge.	Children and practitioners	Ensure the children do not run near the kitchen sink. Look for any sharp edges and remind the children to be cautious around the kitchen sink area,	M
Growing vegetables and plants	Beneficial bacterial exposure helps to develop healthy, functional immune systems.	Soil in plant pots and vegetable patches can become contaminated and children may put soil in their mouths.	Children and practitioners	Regularly check the plant pots for animal messes. Throughout the lesson, provide opportunity for children to wash their hands.	L
Use of wheelbarrow for collecting natural materials	Able to move objects around safely and show an understanding of weight when things get heavy.	Wheelbarrow handles can cause injury and pose a tripping hazard,	Children and practitioners	Ensure the children understand how to utilise the wheelbarrow correctly and that the wheelbarrow handles are facing the opposite direction to the children.	L
Using natural materials for loose parts	Picking up natural items and creating stimuli helps to develop fine and gross motor skills. Using kinaesthetic learning approach.	Reaction to the plants and natural materials. Possible choking hazard.	Children	Ensure children are aware not to put any objects in their mouths, Closely monitor individuals who you believe are at risk of putting objects in their mouths.	L

Part 4:

Science is defined as a process of discovery and a means of organising and reporting discoveries. Therefore, science as well as mathematics is viewed as a way of thinking, seeing and understanding the world around them (Lind, 1998; Montague-Smith et al., 2018). The Froebel approach is intrinsically considerate of young children as it sees children as dynamic learners who are driven to explore, learn, and be curious about the world from birth (Tovey, 2017). Therefore, maths and scientific concepts can be learnt as young children participate in conventional early childhood activities. Froebel (1782) argues how learning should be relevant to children's experiences (Tovey, 2016). Therefore, providing young children with the opportunity to see maths and science in their daily activities helps them develop basic understandings and an interest in future scientific and mathematical learning (Lind, 1998). In relation to this it's important for children perceive and investigate the mathematical and scientific aspects of their surroundings throughout their early years of their life. This can be evident by allowing the children to explore freely within the outdoors. By doing so children will begin to compare quantities, look for patterns, travel across space, and solve problems (NAEYC, 2010). Moreso, Lind (1998) argues how these fundamental concepts and process abilities are naturally integrated throughout mathematics and science. Therefore, processing skills are acquired when fundamental mathematics principles such as comparing, classifying, and measuring are applied to scientific situations. Similarly, Cohen and Waite-Stupiansky (2019) argues how early childhood scientific education is important for both later science development and cognitive skills. Furthermore, children must be able to apply scientific knowledge to make decisions that emerge daily (Cohen and Waite-Stupiansky, 2019). According to French (2004), science resources are particularly appealing to young children since they are biologically motivated to learn about their surroundings. Moreso, Sargent (2016) emphasises the importance of giving young children hands-on experience with scientific activities, as well as how spending time outside may teach young children about a variety of human processes and natural phenomena. In addition to this, children can observe living things, and explore various objects. Therefore, the outdoors allows for children to have more freedom to explore and be less restricted (Sargent, 2016). To support this, Froebel believes the outdoors is a place to move, think, feel and imagine (Tovey, 2012). Furthermore, the concepts of Froebel's approach about learning via nature and the significance of play have extended worldwide (Early Education, 2021). Although Bento & Dias (2017) argues how the quantity of time available for outdoor play is decreasing. As a result of this young children are becoming isolated from the natural environment. Wells and Lekies (2006 cited in Ernst and Tornabene, 2012) argue that early encounters in nature can alter subsequent environmental pathways. Furthermore, Oxfordshire County council (2021) points out how science in the outdoors promotes assessment of their resource utilisation and its impact on the environment. As a result, research by Oxfordshire County council (2021) states science and mathematical components are taught more effectively within the outdoors. In addition to this Beau Lotto, a neuroscientist, expresses the relationship between children's curiosity, play, and science. It is built on five principles: uncertainty, openness to possibility, cooperation, intrinsic motivation, and deliberate action. Cohen and Waite-Stupiansky (2019) highlights how science is an interdisciplinary endeavour. Moreso, while children engage in areas of scientific inquiry and related practises through play, curiosity of the world is motivated by an innate need to know and satisfaction in knowing. Ernst, (2013) emphasises how the use of the outdoors in education is not a new concept. Educational philosophers Froebel, Dewey, Montessori, Steiner and Malaguzzi all emphasised the relevance of outdoor experiences for children's development. Furthermore, the outdoor environment provides children with distinct stimuli that attract their attention and interests. Therefore, Bento and Dias (2017) and Louisa Penfold (2018) discuss the importance of loose parts and natural materials such as sticks, rocks, leaves, mud, and water. They are investigated with interest and a desire to learn, as they provide many opportunities for play. As a result, as stated by White (2013) and Penfold (2018) natural components are open-ended resources that respond to children's imagination and needs, this is supported by the Nicholson's, 1972 theory. Furthermore, through the act of reinvention and giving

new meaning to objects, such as a stick can be a sword or a gun, it can mobilise abilities associated with divergent thinking, creativity, and problem solving (White, 2013). Therefore, the benefits of natural elements are they are inexpensive and do not have the limited alternatives that commercial toys have (White, 2013). Moreso, it is feasible to enhance education in its broadest meaning through outdoor play and exploration of natural components. Furthermore, White (2013) argues how activities involving mud and water can serve as examples of learning opportunities in which concepts from mathematics, science, and language are promoted in an integrated manner. According to research from Ernst and Tornabene (2012) when children play in natural settings, their play is more diverse, and they are more likely to participate in creative play that promotes the development of language. In relation to this, practitioners who are knowledgeable and enthusiastic about the outdoors are important to realising its full potential (White, n.d.). Therefore, the outdoor space must be considered a necessary component of an early year's environment, well thought out and well organised to maximise its value and usability by children and adults and planning must support developmentally appropriate practise, driven by children's interests and their needs. Although, children require practitioners who appreciate and enjoy the outdoors, recognise the possibilities and implications it has for children's well-being and development, and the desire to go outside (White, n.d: Richardson, 2013). Therefore, practitioners need a clear awareness of the important underlying science principles of the chosen emphasis that encourages children's scientific inquiry (Cohen and Waite-Stupiansky, 2019). Moreso, adult engagement will influence the types of experiences that children have access to as well as how they assimilate new knowledge (Bento and Dias, 2017). It is important to remember that the adult's role in the outdoors includes interacting with the children and extending their learning (Skinner and Stevens, 2012: Welsh Government, 2021). Although one of the biggest challenges for practitioners is to ensure that outdoor learning is integrated into the curriculum and becomes a reality for children (Welsh Government, 2021). Therefore, practitioners will need to consider their own childhood experiences when planning mathematics and science outdoors and consider the children's indoor experiences and seek ways to expand them outdoors (Skinner and Stevens, 2012: Welsh Government, 2021). However, this can be a limitation for practitioners if their early exploration of natural outdoor surroundings was limited, they may lack of experiences required to see the affordances in the outdoor settings (Ernst, 2013). Furthermore, Oxfordshire County council (2021) argues how outdoor learning opportunities should not be regarded in isolation from other curriculum activities but should be used wisely so that they deepen and contextualise children's understanding and knowledge. Moreso, practitioners must plan to introduce, model, and promote the use of specialised language, enabling statements, and open-ended questions regarding all elements of mathematics and scientific learning (Skinner and Stevens, 2012). In relation to this, effective practitioners must be able to recognise, capture, and share children's outdoor learning with parents and others working with the children for them to become interested. This is an important aspect of the Reggio approach (Thornton and Brunton, 2014: White, n.d). In accordance with this Froebel, 1782 he emphasises the importance of practitioners providing children with what they require, some children may require autonomy to make choices and decisions, as well as to use their abilities and strategies, whilst others may not be ready (Early Education, 2021). Froebel, 1782 emphasises the need of children learning without being subjected to external demands from practitioners (Early Education, 2021). Skinner and Stevens (2012) and White (n.d) argues how young children thrive and develop when they have unrestricted access to stimulating outdoor environments for learning through play and real-world experiences (White, n.d.). In according to this child can have the flexibility to discover other ways of 'being', feeling, behaving, and interacting in the outdoors, they have space, physical, mental, and emotional, they have room and permission to be energetic, interactive, messy, noisy, and work on a wide scale and they may feel less restricted by adults. Morse, the concepts of Froebel's approach about learning via nature and the significance of play have extended throughout the world (Early Education, 2021). Furthermore, with the use of natural materials, young children learn numerous scientific ideas in the outdoors which can consist of investigating solids, solvents, and solutions;

investigating changes caused by freezing and melting, measuring, solving problems and testing hypotheses (Jensen and Bullard, 2012). Moreso, the natural environment also aids mathematical growth in the following ways. First, the stimulation provided by being outside, known as the psychosocial plane, may be employed in learning about mathematics, and their capacity to touch and manipulate will enhance their learning. While involving children in everyday situations might help them acquire a mathematical disposition towards the world, a sense that they are always on the lookout for mathematics and strategies to utilise, this is referred to as the socio-cultural plane (Waite, 2017). In relation to this, to acquire profound mathematical comprehension and secure numerical abilities, children must engage with maths in relevant concepts where abstract mathematical concepts can be applied to real-life circumstances. Waite, 2017 argues how mathematics in the outdoors is an excellent vehicle for this strategy. When children are in the outdoors, they play with and explore a wide range of mathematical and scientific concepts and skills (Skinner and Stevens, 2012). This can be evident as children fill and empty containers, investigate concepts such as weight, volume, and time, and talk about living things and their experiences and as they learn new vocabulary. Furthermore, similar findings were observed in other studies, demonstrating the children's ability to learn and apply mathematical products and procedures while playing outdoors by utilising their bodies as a learning tool (Bilton, Dias and Bento, 2017; Sumpter and Hedefalk, 2015). Therefore, children benefit from learning mathematics in the outdoors since they have access to an infinite number of mathematical resources. In addition to this the outdoors provides a wealth of chances for sorting, matching, collecting information, problem solving, recognising patterns and applying positional language (Oxfordshire County council, 2021). This then leads to young children asking more questions, thinking deeper, and generating creative solutions to challenges they encounter while exploring (Keith, 2017). Furthermore, the outdoors allows young children to discover mathematical and scientific solutions to problems that would be more difficult to solve using other approaches. Moreso, everyday materials and experiences can be utilised to generate mathematical and scientific concepts, but the goal is to abstract the ideas rather than leaving them buried in the experience (Waite, 2017). To summarise learning in the outdoors is an important strand that feeds through all areas of learning in the new curriculum (Welsh Government, 2021). Outdoor learning has long been recognised in the early childhood sector. Froebel (2005), Dewey (1998), Bilton (2004), and Knight (2009) all emphasise the benefits of being outdoors for children's holistic development (Tinny and Hirst, 2017). Furthermore, outdoor learning is becoming increasingly valued, not only in geography or scientific field studies, but also in children's overall personal development and academic accomplishment (Welsh Assembly Government, 2007). The outdoors provides opportunities to aid in the development of children becoming competent learners (Welsh Government, 2021). Richardson (2013) emphasises how important it is for children to spend time outdoors and for them to share their curiosity with an interested, observant, and attentive adult. Therefore, children require purposeful and engaging outdoor activities that allow them to develop in various curriculum areas at the same time in a natural way that draws on their own patterns of behaviour and learning. The outdoors is proven to be an excellent environment for teaching early mathematics and science (Sargent, 2016; Welsh Government, 2021).

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