Student Number: 1001407
Word count: 4400 Module: ECEY5005/C

ECEY5005/C

Awe and wonder - science, mathematics and the outdoors.

Source: Green Schoolyards America (2013-2023)

The environment within the photograph chosen, has several dedicated areas the practitioner can utilise to promote and encourage a variety of activities and opportunities to support children in line with the Welsh Curriculum (2022). Providing children with this space offers growth of ideas, curiosity and inquisition. There are planting boxes for growing both vegetables and plants depending on the subject matter, seating area to have circle time to promote discussions, a shaded area to protect children and work from the elements, workstation for projects and experiments as well as under storage facilities to keep planting equipment, trellis for plants to grow up to show children how big plants and how they travel, colourful paintings to encourage creativity and provide a welcoming, bright and happy space for learning. All areas will be risk assessed prior to activities and outdoor play in line with the attached risk benefit assessment form. The topics could be based on eating what we grow as well as healthy eating or as I will discuss further the growth of plant life and basic principles of photosynthesis, dependent on the age of the group. The

Welsh Government (2022) statement of what matters suggests that Learners can gain knowledge of how living things have evolved by observing diversity and how they interact with their surroundings.
To exist, all living creatures need a certain set of circumstances and materials to survive. This outdoor area provides the children with provisions to explore, question and enhance curiosity for science and the outdoors.
Supporting learners to explore and use scientific knowledge to deepen Understandings of how our world functions by helping to foster the use of reasoning, evidence, and creativity. Welsh Government (2022).
An example of an activity that practitioners could use to discuss water absorption in plant growth is a flower colour food dye experiment. This can be done within the shaded area making use of the benches to form a platform for the containers to be placed when carrying out the experiment. This type of activity would be suited to children aged 5, progression level one and two discovering the world around us, curiosity, searching for answers and forces of energy (Welsh Curriculum 2022).

Equipment needed for colour changing flower experiment:

- **3 Plastic cups or containers**
- **3 Assorted food colouring**
- **3 Carnations or pale colour flowers**
- **Water**

Due to the limited number of containers required for the experiment, the practitioner would be wise to full each with a small amount of water prior to the lesson. This would eliminate any disagreements between children regarding who is filling the containers with water. If required however small groups could be taken to a water station and asked to full up to a certain line or number to encourage mathematics skills through measurements as well as practising fine motor skills by holding, filling and carrying the container with water in.
Containers or cups that are plastic should be used for Health and safety purposes. Different colour food dye is then put in each container with water and a white or pale coloured flower, carnations are cost effective for this experiment and show the dyes particularly well for the children to obtain the full effect. Each flower is put in its own container with the water and several drops of the food colouring.
Prior to the experiment the practitioner could ask several questions within the outdoor setting about plants and what the children think they need to survive

and grown. The practitioner explains what they will be doing and what is equipment is needed. The practitioner asks the children to watch and see what happens to the flower.

Each child could be given a worksheet with two sections, the first will be a prediction of what they think will happen to each of the flowers after the practitioner has explained the process and the second section will be completed at the end of the experiment.

Source: Fun Learning for Kids (2023)

This encourages independence, curiosity confidence, and creativity as encouraged within the four core purposes of the Curriculum for Wales (2022). These purposes aim to support learners in becoming:

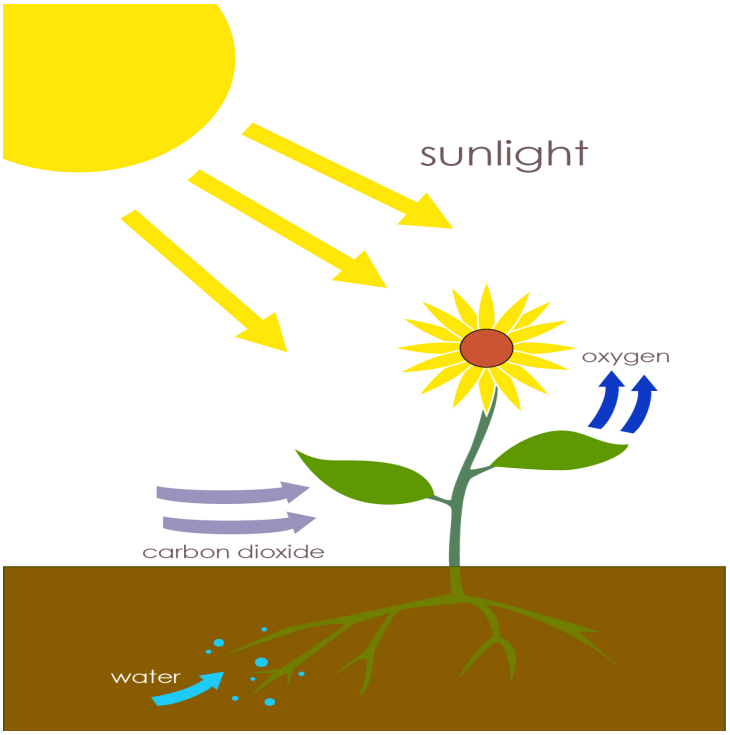
1. **Ethically Informed**
2. **Creative and enterprising in life and work.**
3. **Confident and healthy.**
4. **Ambitious and capable.**

Questions that link with the four core purposes of the Welsh Curriculum (2022) such as what they each think will happen to the flower, encourages the children to use hypothesise or make a prediction of what they think may happen to the flower. It also promotes the expression of ideas as creative and enterprising contributors, connecting and applying knowledge, and learning to explain and communicate what they have learnt. The Welsh Government (2022).

Throughout the experiment process questions can be asked by the practitioner to get the children thinking about the process of how plants drink water to grow.

Questions to ask:

1. How do plants drink water?
2. Why do they drink water?
3. Parts of the flower (stem, leaves, petals).



Source: Easy Science for kids (No Date).

The children are then asked to observe and return every few hours along with the practitioner to see if there are any changes. This experiment allows the basic principles of scientific experiments to be conducted by the children. These are to; Question, hypothesis, test, observe, analyse and discuss the findings. The Welsh Curriculum (2022) suggests that ambitious and capable learners should be supported to challenge themselves, question and problem solve as well as being able to explain the findings. The practitioner can encourage keeping track of the progress by using a whole class approach of monitoring and recording. This promotes teamwork and effective working with others as suggested in the Welsh Curriculum (2022). This could be done using a large sheet of paper or white board with coloured ticks representing each coloured flower, the more ticks would indicate the flower colour is changing. This is however open to interpretation and each child may view it differently.

The practitioner may opt for a more general class discussion every few hours around the experiment area in more of circle time approach.

Following the experiment, the practitioner may use questions such as:

1. **What have we seen happen to the flowers?**
2. **Was it quick or did it take some time to happen?**
3. **How do you think the water has changed the colour of the flowers?**
4. **What other things do you think plants may need to grow?**

Source: Montessori (No Date)

This can lead onto explanations from the practitioner such as:

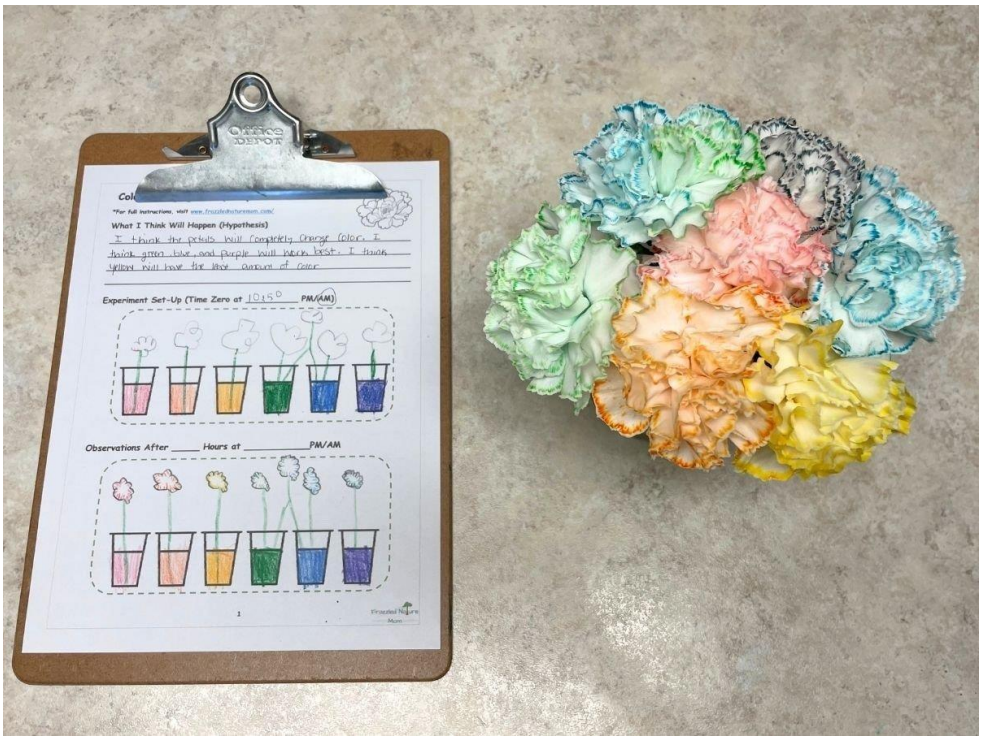
'Flowers need water to live, just like we do, but unlike people, flowers get their water from the ground by pulling it up through their stems. The coloured water we used shows how the flower sucks up the coloured water all the way to the top of the petals and changes their colour'.

A book to accompany the class discussions that may be used is Plant a Tiny Seed by Christie Matheson. This is also available on You Tube as a read aloud Storytime. The book allows the children to engage and take part in the story, encouraging them to use their hand to wiggle the rain to water the plant, clap their hands to make the sunshine and press down to plant the seed. This in line with the Welsh Curriculum (2022) supports creative and imaginative learning with expression through different media.

Plant a Tiny Seed | Read Aloud Storytime

Source: You Tube (2020)

To conclude the activity and after a class discussion about what the findings of the experiment were the practitioner can ask each child to complete the remaining section of the worksheet to draw the flowers and their colours from what they have observed.



Source: Frazzled Nature Mom (2021).

Limitations to the experiment: it can take several hours to fully see any change in the flowers colour, having adequate space to facilitate the experiment, and funding for equipment.

Having funding for the appropriate materials within which to offer an outdoor garden is also a limitation as many schools may be unable to provide not only an adequate space to utilise but also the provisions to accompany having a garden such as the plants, vegetables, planters, and other equipment required to sustain such a space. Time is also a concern as practitioners have limited time to spend ensuring the garden area is fit for purpose and is maintained.

Part 3.

RISK BENEFIT ASSESSMENT

Location / Activity:	School Garden	**Date:**	16th September 2023
Assessor:	Natalie Richardson	**Review date:**	16th March 2024

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 associated risks**	**Who is at risk?**	**PRECAUTIONS in place to reduce the risk of injury**	**Overall risk after precautions RATING: L/M/H**
Wooden planters	Provides appropriate space for planting and observing plant and vegetable growth.	Broken or splintered wood. Falling off them if climbed on. Injury.	Children and adults.	Regular checks before and after the activity to ensure no planters are unsuitable and could cause harm. Signs and conversation to state no climbing allowed on the planters.	L
Wooden benches and workstations	Provides children and adults with seating facilities so discussions outdoors and in circle time can be comfortable and relaxed. Appropriate seating also offers space off the floor. Workstations available for conducting work and outdoor experiments, that can be assessed by all involved.	Broken or splintered wood. Falling if climbed on. Injury. Falling off seating benches.	Children and adults.	Regular maintenance checks for breakage. Removal of items if they are deemed unsuitable or dangerous. Signs to state the benches and workstations are to be used in the intended manner. Verbal confirmation from the practitioner prior to going into the area that if anyone notices anything broken to report to the practitioner or Teaching assistant and that the benches and workstations are to be sat on and used for work.	L
Soil	Provides children the with the appropriate material to grow plants and vegetables. Enables sensory learning touching and smelling the	Allergies to soil or adverse reaction on skin. Eating the soil.	Children and adults.	Ensuring the excess soil is swept up from pathways and seating areas. Verbal communication to learners that the soil doesn't go in mouths and to wash hands after touching because of germs.	L

	soil, expressing and communicating what they think it feels and smells like. Encourages conversations with practitioner and learners about what is needed to support plant and vegetable growth. Discussions regarding washing hands after using the soil to promote good hygiene.			Being aware of any children or adults with allergies to the soil prior to using it. Kept in a locked storage facility.	
Planting equipment	Helps facilitate both children and adults when planting, digging up and watering plants and vegetables. Discussions of what each it is used for. What the equipment is made from.	Injury, putting in mouth-choking. Sticking items in eyes. Hitting other children with equipment.	Children and adults.	Ensure items are locked away. Used under supervision. Place equipment that is deemed safe for the children's use in an appropriate area for them to access. Maintenance check of equipment encase an item is broken. Discussions regarding the appropriate use of equipment and what each item can be used for to educate and inform.	L
Plants and vegetables	Promoting growth of both plants and vegetables, discussions about healthy eating, how to care for plants and vegetables.	Food allergies if eaten by a child or adult. Pollen allergy.	Children and adults.	Ensuring the practitioner is aware of any allergies prior to activities. Verbally explaining what can or cannot be eaten. Educate and inform. Encourage questions. Promoting hand washing for good hygiene practice.	L
Food colouring	Sensory, exploration of colours, creativity. Supporting understanding of the use of food colourings to change colours.	Allergy or reaction to the dye product.	Children and adults.	Practitioner to be aware of any allergies prior to activities using the product. Use of gloves when handling. Washing of hand after use. Cleaning of equipment after use. Kept in a locked storage facility.	L
Water	Scientific and mathematical learning experience using measurement, water usage, flow, float or sink, splashing. Enhancing fine motor skills, creativity and discussions based on healthy drinking. Properties of water.	Wet clothes – cold. Drowning if unaccompanied by an adult, Change of clothes not provided. Dirty water – risk of putting in child's mouth. Staff ratio.	Children.	Spare charge of clothes available. Verbal conversation about why we need to be careful around water and what we use water for. Hygiene discussion. Ensuring staffing ratio meets minimum requirement for outdoor activities.	L

Containers	Using containers to carry items such as water or soil. Measurements to promote mathematics. Full or empty discussions. Forces – how much can be carried in each container.	Breakage causing broken skin. Injury	Children and adults.	Use of plastic containers/cups only. Ensuring maintenance of these is regularly adhered to.	L
Weather conditions	Lessons relating to seasons, weather types, countries and the weather they have, what's needed with certain weather (umbrella, sun cream), weather in Welsh.	Wet clothes and hair, catching a cold, sunburn, heatstroke, dehydration. Change of clothes not provided.	Children and adults.	Change of clothing if participating in outdoor activities. Sun hats. Letting parents know that there will be outdoor play and to apply sun cream before school. Water availability for children and staff. Discuss weather and what we need for the different types of weather to be safe and warm.	L
Gates to outside of school.	Push and pull (forces) for scientific discussions. Materials used to make gates. What gates help us do. Heavy or light gate material.	Safeguarding – children getting outside of school premises. Catching fingers in the gate,	Children and adults.	Making sure the gates are securely locked. Maintenance of the gates to ensure there are no broken elements. Signs on gates reminding staff to keep the gates closed and to check them regularly.	L
Uneven ground	Helps develop fine motor skills, balance, coordination, builds core muscles. listening skills when explained by practitioner that the ground is uneven.	Falling, tripping, cutting and injury.	Children and adults.	Active communication with children about any uneven ground with stones or change in heights between areas. Visual signs to show children to be careful. Ensuring a first day kit and a first aid trained member of staff is available.	L
Wooden balk	Sensory, how it feels, colour, what we use it for. Hard or soft.	Eating the balk, dirty clothes, falling or tripping over.	Children and adults.	Discussion with class about hygiene and hand washing. Communication regarding tripping over the balk and to watch around you.	L

Part 4.

The Welsh Curriculum (2022) states that's under the four core purposes learners should be provided with the space and environment to support and promote creativity and innovation fostering curiosity and the generation of ideas, learners should be encouraged to question and evaluate. Skinner (2005) suggests that providing an outdoor learning environment offers an opportunity and powerful platform for the formation of new ideas, imagination and creativity

on a wider scale. Mathematic skills can be promoted via thinking, doing and playing. Children should remain engaged and able to use meaningful representations within their own creative confines. This may include movement, imagery, and exploration using their senses. The practitioner's role as stated in Shirley (2007) is to scaffold and support, by observing and actively listening and therefore making decisions to interject only if it promotes the learning experience. This theory is supported by Vygotsky's zone of proximal development whereby the strategies suggested such as questioning, feedback, instructing, modelling and cognitive structuring provide the framework to scaffold. This form of internalisation which is deemed the goal of development and fulfilment can be achieved by learning from others with a higher knowledge base. Sanders and Welk (2005). Hammond (2007) concludes by stating that parents and practitioners that provide an outdoor environment that is intrinsically rich in natural materials and dynamic, alongside the freedom to ask questions, have space for thoughts, feelings and exploration provide the children with enjoyable engagement with the learning experience holistically. This according to Hammond (2007) can be seen in various research. Furthermore Skinner (2005) suggests that for children to benefit from the outdoor environment provided the adult should ensure it is visually engaging and exciting. This in turn promotes curiosity and forms a basis to challenge children's ideas and understanding. Pacey (No Date) states that effective scaffolding involves the practitioner being aware of the capabilities of the child, using positive communication, enhancing resources or an environment and planning and observing to support the child. Children's development is underpinned by the role of the adult and is crucial for learning in the early years. An enabling adult makes use of children's prior knowledge, experiences, and current interests. Professional association for childcare and early years (No Date).

Key early childhood theorist Friedrich Frobel was an advocate of the outdoors and used the word kindergarten meaning a garden for children. Bilton (2010). The Froebelian principle according to The Frobel Partnership (No Date) is to nurture children's curiosity in nature, educate them to become reflective and knowledgeable, provide them with first hand experiences, promoting freedom with guidance. Bradbury and Swailes (2022) state that Frobel designed an environment that was ever changing and organic inspiring and engaging children. He recognised that the children should lead their play and the role of the adult is to scaffold that learning experience. Bradbury and Swailes (2022). They also state that evidence suggests that children engage with the outdoors in an interactive environment with its opportunities providing them with expression and creativity. Promoting this connection with the outdoors and learning first hand supports holistic development through the activities

themselves." Freedom for the child to act according to his ability and inclination' is based on the idea that children must be given the right kind of environment and this includes the element of freedom, which allows them to see relationships and draw inferences and to make decisions. This concept includes guidance, order and careful planning". Liebschner 1992 cited in The Scottish Government (2019). Activities that can support child led learning could include, allowing the children to choose their play type based upon their interests, promote freedom but also include the class and community. The Scottish Government (2019). The use of Froebel's principles in early years science and mathematics can be seen in activities such as the growing of plants, the elements, and transformations prompting critical thinking and problem-solving skills. Tovey (No Date). These skills are also present when engaging in mathematics outdoors, through counting of sticks, measuring the rainfall or length of a plank of wood.

An approach with a similar ethos is that of Maria Montessori. Montessori agreed with Froebel's school theory that the garden provides open access, freedom of choice and self-direction. She also stated that the environment should be child sized, encouraging independent movement, materials have real life value and do not include fantasy toys. However, unlike Froebel, Montessori believed the outdoors was not a place for play or imagination, and natural materials were not educational. Montessori's guiding principle was that science provided knowledge and the ability to transform. Tovey (2007). Montessori's principles such as providing a favourable environment (Bradbury and Swailes, 2022) can be linked to the current Welsh Curriculum (2023) identifying an enabling environment as key for meaningful and holistic learning. She also determined each child as being unique, this can also be seen through the Welsh curriculum (2023) ethos that all learners have individual needs and practitioners should explore these.

Having discussed the role of the practitioner in promoting exploration and positive learning experiences outdoors, further information can be gathered on the methods and applications a practitioner can solidify when incorporating Mathematics and Science in the outdoors. White (2007) states that implementing repeated experiences and drawing on everyday explorations can involve Mathematics and Science. For example, investigating how much soil can be carried across the outdoor environment in various methods of transport. This includes investigating, weight, volume, and distance. White also suggests that by making the activities enjoyable and understandable it in turn fosters confidence and the applied ability to tackling problem-solving and ideas within mathematics.

Encouraging curiosity and discovery within the learning experience according to a study by Shah *et al* (2018) children that have had curiosity encouraged have shown to have higher levels of academic achievement. Shah (2018) also noted that these levels of achievement were more pronounced in those children from a lower socio- economic background. These children however are less likely to have access to reading materials and less stimulating environments. This may in turn provide the child with the drive and ambition for achievements academically motivating their curiosity. Therefore, interventions to support curiosity and discovery within early years is invaluable to the learning experience.

Learning Journals (No date) states that providing natural curiosity involves child-led learning. The child makes the choices promoting problem solving skills, confidence, and critical thinking. These ideas also follow approaches based on the likes of Reggio Emilia and Montessori, where the learner becomes the thinker in charge of their development instead of being led to do things, they may not be interested in.

Piaget (1926) cited in Jirout (2020) suggests that the learning of the child is driven by investigation of the world around them. This exploration can be the backbone of curiosity and promote engagement in the learning process. Saylor and Ganea (2018). It is also interesting to note that part of investigating the world around children involves testing of theories they have discovered and repetition of these patterns. This is called a schema. The term schema was coined by Jean Piaget and determined the repetition of patterns of behaviour to be integral to the child's cognitive development. Schema's according to early impact learning (No date) provides children with the tools to express ideas. Astley (2007) cited in Bilton (2010) suggests that through movement, space, and objects, children learn to make sense of the world and learning. One such schema is transformation. This schema can be linked to science and the transformation of substances. Snow melting, the manipulation of food to change its consistency or puddles drying up in the sun. Children within this schema are exploring to understand and question cause-and-effect. Bilton (2010) and Early impact learning (No Date).

Supporting this schema can involve the promotion of the outdoors and science by providing activities such as watching the change in snow as the day goes on and with the sun out, walking in snow and the sound it makes, squashing of flowers to see the colours and change in texture. These observations made by the child provide inquiry and curiosity. A study by Howard-Jones and Demetriou (2009) cited in Jirout (2020) demonstrates that higher engagement, further information seeking and exploration is more prevalent when there is uncertainty and observation. The prevalence of schemas within the context of science, mathematics and the outdoors can also be seen within the theory of sustained shared thinking.

This process according to Siraj-Blatchford *et al* (2002) is when shared thinking between two or more people contributes to working together to problem solve. This shared thinking provides engagement from both parties and a learned experience. Sustained shared thinking can be undertaken by either children or between children and adults. The Researching Effective Pedagogy in the Early Years (2002) also suggests that studies conducted identified the most productive and effective forms of sustained shared thinking was communication between that of an adult and one or two children. The study also stated that child-initiated play provided the richest environment for sustained shared thinking. Siraj- Blatchford *et al* (2002). Vygotsky (1978) cited in Brodie (No Date) states that sustained shared thinking is when one child/adult has more knowledge than the other. Sustained shared thinking is a two-way process with exchange of information, an example of this could include a science activity to determine how many bricks a tower needs or how much the earth weighs. This involves extended learning and conversations between parties that are genuine and transfer to other situations. Sustained shared thinking creates deep level learning and in turn promotes critical thinking and working together. The Welsh Curriculum (2022) states that through active communication within both science and mathematics teaching supports thinking skills as well as delivering ideas to others. Working together to solve problems can be encouraged within an outdoor environment in various ways. Den building, discussing the hazards outside and how to balance on an unstable plank all of these promote discussions and exploration of possibilities. Practitioners should provide teaching opportunities that arise naturally and through observing play, supporting and encouraging their natural curiosity communicating and sharing thoughts and ideas with each other. Welsh Curriculum (2022).

Practitioners can assist in further developing and enabling a child's critical thinking skills, fine motor skills and sustained shared thinking by adding loose parts to the environment. The term loose parts originated from Nicholson (1971). Nicholson encouraged engagement with children's curiosity, imagination, and interest in learning about the world by giving them the freedom to create with materials or variables that can be playable. Keyte- Hartland (2022).

According to Rahardjo (2019) loose parts are objects or materials that can be used in various ways and combined with other objects and moved around. Loose parts can be available anywhere, particularly in the outdoors. Providing loose parts or encouraging finding them provides opportunities for children to explore the natural world around them, collaborate with others, communicate and use critical thinking skills. Rahardjo also states that loose parts improve scientific and mathematical thinking. Combining loose parts and mathematics introduces experimentation and participation while removing the isolation of formal instruction from the maths environment. This can be created using visuals alongside the

numeral, the number six written down with six sticks found in the outdoor environment for example. Lipp (No Date). Keyte- Hartland (2022) also states that science related learning using loose parts can be incorporated using sunlight on certain objects, gravity when heavy or light items fall or sound being heard through tubes. A study of primary school children by Gibson *et a*l (2017) state that significant evidence could not provide quantitative evidence to suggests that social, emotional or cognitive development had been impacted through loose part play.

There can be several barriers and challenges when enabling mathematics and science within the outdoors. These can vary from insufficient space, unsuitable terrain, or safety elements such as building works. Another barrier or challenge is the lack of outdoor weather specific clothing, such as waterproof all-in ones or wellies. Not all families can afford these items and many schools do not have funding. One barrier which directly has an impact on the children is the lack of confidence from the practitioner to promote the curriculum in an outdoor environment. These according to learning through landscapes (No date) can be overcome by liaising with other practitioners for advice and support, planning of lessons and managing time, understanding the other outdoors is a medium for learning, having a storage facility for spare wet weather clothes and wellies through parent teacher association communication with parents and donation. Using all areas of the outdoor environment regardless how small can have an impact. Painting on walls, and hanging wind chimes, moveable storage options. The outdoor playbook (No Date) stated that regardless of perceptions of outdoor teaching it offers opportunities for engagement and rich learning experiences.

In conclusion and reflecting on the points discussed there are numerous benefits to learning in the outdoors and thereby enhancing the developmental experiences through curiosity and discovery. Enhancing fine motor skills, cognitive development, problem solving skills, communication and working together.

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