

Portfolio – Awe and wonder – Science, mathematics and the outdoors

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I have not used any AI.

Part one – Photograph of outside area.



Part two – How this environment could be used by young children to develop specific scientific or mathematical concepts or ideas.

As part of the children's holistic learning, we considered it important to take them to an environment that allowed them to take risks and promotes creativity while also creating links between mathematical and scientific learning. We would have a group of ten, three-year-olds attending with three practitioners to the local beach pictured. The beach provides an excellent environment for the children to explore and investigate in a natural environment. It provides rich opportunities for the children to explore scientific and mathematical concepts and encourages them to learn about the world around them, teaching them about forces, living things and a range of different materials.

The Curriculum for Wales (2022) states that ambitious, capable learners, ready to learn throughout their lives should engage with scientific change and in the early years, play forms an important part in the development of mathematics, numeracy and science. Enabling learners to solve problems, explore ideas, establish connections and collaborate with others. The application of mathematics to solve problems, play a critical part in everyday lives and is therefore imperative that experiences are engaging, exciting and accessible for learners.

The type of environment in this photograph is ideal for supporting the children's understanding of scientific concepts as it contains uneven ground and slopes such as the sand and the rock pools which will allow the children to investigate the concepts of gravity and friction. This type of environment encourages the children to be curious and provides a wide, open area for them to explore. As practitioners, we would encourage the children to take part in activities such as climbing and exploring the textures on the different surfaces. We would also provide extra resources to create activities such as rolling objects down slopes, dropping objects from heights, digging and mark making. Loose parts will be considered important resources for the children to use when taking part in these activities because these objects are open ended and allow the children to use their imagination as they use them in endless ways. For example, due to the environment containing lots of different textured surfaces and slopes such as the rock pools and sand, the children could take advantage of this to explore forces such as friction and gravity. They could roll objects such as balls, rocks or even toy cars down these slopes and surfaces and observe how they move and stop. These types of learning experiences allow children to develop a foundation for scientific

thinking. This learning activity can be extended by practitioners providing resources such as planks of wood and ramps and encouraging the children to observe and compare the different speeds of the objects when they are rolling down the planks of wood compared to when they are rolling down the sand and rock pools. It will also be encouraged for the children to observe whether different objects move faster than others do. Open ended questions that help scaffold the children's learning and still emphasise child led play, and learning will be asked by the practitioners including 'Which one moves faster?' or 'What happens when we roll the ball down a plank of wood instead of on the sand?' These types of questions can help children to begin to make observations and gradually introduces them to scientific and mathematical skills. This type of activity also encourages the children to test different ideas and be creative.

A second activity that also focuses on the concept of gravity while also exploring different objects sizes and weights would include the children dropping different sized objects and materials such as pebbles, shells, sticks, seaweed and sand into the water in the rock pools in order to observe if they float or sink and how big of a splash they make in the water. This type of activity encourages the children to make predictions about what they think could happen and then test different ideas. In order to support the children's curiosity, practitioners would provide other resources and materials including small nets and magnifying glasses so that they can take a closer look at the object under the water once they have dropped it in, and observe whether the object changes underwater and if it floats or sinks, then they can use the small nets to fish the object out of the rock pool. While providing them with a variety of resources and materials, we will also be supporting their scientific and mathematical learning by encouraging them to use descriptive language introduce them to new vocabulary such as heavy, light, float, sink, deep and shallow. The children will also be encouraged to expand their thinking and develop their critical thinking skills, this will be done by the practitioners asking open ended questions including 'Why did this object sink to the bottom of the rock pool but that one didn't?' 'Can you find an object that is lighter than this pebble?' and 'What do you think will happen to the seaweed when you drop it in the water?' While the practitioners will not be interrupting the children's learning experience or taking the lead in their activity, we will still be encouraging turn taking and teamwork. We will suggest that the children take turns when dropping the objects into the water so that each child has the opportunity to experience dropping an object in. we will also encourage them to work as part of a team so that they can share their ideas and listen to each other's opinions and ideas. This will be an opportunity for the children to develop their social and communication skills as well as learning about scientific and mathematical concepts. As practitioners we want to make sure

that the children are fully engaged in this experience and are in a safe learning environment, guided by thinking and questioning.

The environment that we have chosen provides the children with a large space that is filled with natural resources that allow for the children to explore mathematical and scientific concepts. By creating simple activities that encourage the children to learn about these concepts through play, they are also able to test their ideas, develop their understanding of real-life experiences and use their curiosity to experiment. With us practitioners providing the children with extra resources and loose parts however also still encouraging child led play and learning, we are helping to scaffold the children's learning and providing them with a meaningful experience and supporting their scientific and mathematical learning journey.

Part three – A risk-benefit assessment for the outdoor space

Risk Benefit Assessment

Location/Activity:	Beach	Date:	15/09/2025
Assessor:	Louise Baker	Review date:	

Experience exploring outdoor space	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 risks after precautions rating
Walking on uneven ground	Children become aware of uneven ground of slopes and different textured ground. Supports children's balance. Strengthens their muscles and bones.	Increased risk of slips, trips and falls which can lead to cuts, bruises and sprains. More physically demanding which can lead to faster muscle fatigue.	Children and adults.	Show the children the uneven ground and explain to them that we need to walk slowly and carefully as it is a new experience and will help to avoid injuries. Ensure that children and adults are wearing the appropriate clothing and shoes.	Medium Risk
Different weather conditions	Children can learn new vocabulary such as hot and cold. Children will become aware of different types of weather conditions and temperatures. Helps to build resilience and adaptability. Improves motor skills.	Strong winds can cause strong currents and waves and could blow sand into the children/adults' eyes. High tides could potentially prevent access to the beach. Paddling in cold sea water or rock pools or temperature drops could lead to shock or hypothermia. Slippery rocks and seaweed, falling debris from nearby cliffs and floating debris from the sea may be sharp or dangerous. Visibility may be affected and fewer lifeguards available. Increased noise makes it more difficult for children to hear instructions.	Children and adults.	Check the weather apps a few days before and the day off to ensure that we are prepared for any type of weather and if needed cancel/rearrange if the weather is causing too much of a hazard. Ensure that the children and adults are wearing appropriate clothing and shoes depending on what the weather is like on the day and bring spare clothes and shoes to change into if needed.	Low risk
Washing up and storage of equipment and resources	the children can learn to take ownership and help build up their independence. Helps to teach them life skills. Helps to develop muscle control and their motor skills.	Could cause potential injuries as they will be moving and cleaning different objects and resources that could be heavy or have sharp edges.	Children and adults.	Encourage the children to use teamwork to clean and move objects and materials that may be too heavy to lift on their own. Raise awareness of manual handling with the children. Use trollies or a cart to help make it easier and safer for heavy resources to be transported down to the beach and back. If necessary, ensure the adults take part in manual handling training before. When the children are taking part in the moving and cleaning process, make sure and adult is present and observing them while still letting them complete the task independently to help prevent injuries.	Medium risk

Water (the sea and the rockpools)	Expands play opportunities by allowing children to use different skills such as pouring, tipping and splashing. Encourages children to learn about different aspects of science and maths such as what happens to different materials when they are in the water, do bigger objects make a bigger splash and volume. Coordination and balance, motor skills. Benefits health and development. Creativity (imaginative play) Problem solving skills.	Risk of drowning High tides and strong currents Sharp objects and marine objects could be hidden within the rockpools and might not be visible to the adults or children causing injuries. If there has been a lot of rain, there is a potential of flooding.	Children and adults	Adults will supervise the children when they are playing near a rockpool or the sea and will constantly be observing what they are doing. Appropriate clothing and shoes will be worn. All children will be in groups when exploring the rock pools and the adults will inspect them first before the children do to ensure their safety. First aid kits will be carried. If there is a high tide or it has been raining a lot on the lead up to the day, the children will be asked not to go near the sea for their safety however they will still be encouraged to explore the rockpools.	High risk
Slippery Surfaces	Allows children to explore different scientific concepts such as friction.	Potential injuries as the slippery surfaces could cause children and adults to slip and fall over.	Children and adults	Appropriate footwear will be worn by children and adults. If the area becomes too slippery due to the amount of water or the weather conditions, we will ask children to move from this area and find somewhere else for them. Children will be supervised by adults at all times. Depending on what is safest, children and adults may be encouraged to go bare foot instead of wearing shoes. The adults will observe each area and decide which option is best and safest.	Low risk
Natural resources, other objects and pieces of different materials (sticks, rocks, seaweed) Loose parts	The loose parts and natural materials allow children to be creative and encourage imaginative play. Connection to nature. Explore different objects and materials they may have never seen before. Children will use fine and gross motor skills.	Potential injuries if objects are heavy or sharp. Choking hazard.	Children and adults	Supervision for all children when exploring these objects as younger children may put them in their mouths. Adults will explain to children in a way that they can understand that we can explore each object, but we must be careful and not put anything in our mouths especially small objects.	High risk

Part four – How adults working with early years children support and encourage them to engage with mathematical and scientific concepts in an outdoor environment.

The adult's role is vital when supporting early years children to engage with mathematical and scientific concepts as they provide meaningful learning opportunities through play and offer them open ended resources. They scaffold the children's learning by encouraging independence and investigation in a safe and stimulating environment while still being there to support and help them if they need it (Whalley, no date).

Froebel saw children as active, curious and creative learners and that playing in an outdoor environment offers engagement with the wonder and mystery of the natural world, opportunities for adventure, risk and challenge and even engagement with scientific and mathematical concepts including gravity, speed and energy. As Froebel argued, the quality of the environment and the interactions within it are crucial (Tovey, 2012). Educators who enjoy being outside, who interact sensitively and take a positive approach to adventurous play are crucial. Educators who act this way within the setting create a positive enabling environment and help children to assess risks themselves and can teach them safe ways of doing things. As stated by the Health and Safety Executive UK (2012)

'No Child will learn about risk if they are wrapped in cotton wool'

Froebel recognised the powerful impact that adults can have on either nurturing or crushing children's curiosity and engagement outdoors. Instead of adults focusing on mundane domestic matters or telling children to stop doing something, instead, tuning in to children's individual interests creates a richer learning environment and more meaningful conversations. Based on his theory, Froebelian educators emphasise the importance of observing, supporting and extending, tuning in to children's own play ideas, having realistically high expectations of what children can do and making links with the curriculum. This means building on children's interests, making appropriate links with areas of knowledge and extending children's learning in worthwhile ways (Tovey, 2012).

The Curriculum for Wales emphasises the importance of mathematics and science in everyday life. The curriculum integrates these concepts with other subjects to create a more holistic learning experience (Welsh Government, 2020). They focus on real life learning experiences. Experiential learning supports enhanced and deeper learning for children and by learning through real life experiences they will remember and have more meaning and impact. For example, if you wanted to teach a child about how to use money, you would take them to a shop. This is the same as educators in early years settings creating learning experiences such as sink or float experiments, plant growth exploration, building towers and counting with natural materials. These types of activities foster a child's curiosity and creates a more holistic approach to learning and play.

Froebel also recognised the value of adventurous play outdoors. He believed we should focus on the benefits of challenging activities rather than the risks. For example, climbing and balancing on trees, ropes, logs, stepping stones and bridges offers children the opportunity to learn about scientific concepts such as height and distance, but also can create positive feelings and a sense of achievement for the child. Froebel argued that children who experience increasing challenges in their play are safer than those who have been protected from them. Enabling adults creating a safe yet stimulating environment where children can take risks and test their limits is increasingly important as early years settings may be one of the few places where children are able to do this (Tovey, 2012).

Providing children with opportunities to move freely indoors and outdoors and encouraging them to face challenging situations for themselves is not always enough. Froebel's theory suggests that self-activity on its own is not enough and that children should also become more aware of their own learning and feelings, so that they can know something in a deeper, more reflective way. Allowing children to think for themselves and asking more open-ended questions will encourage them to think deeply about what activity they are doing, what they are learning and why it is important. Helping children to reflect and become more self-aware was a key feature of Froebel's approach (Tovey, 2017).

Early childhood is a critical period for cognitive and social development and experiences during this time can shape future learning and interests. Having nature-based environments as a source of diverse opportunities for experiential learning, can promote children's curiosity, problem solving and creativity through direct interaction with natural elements (Trina et al., 2024). Such direct, hands-on experiences are more impactful than stimulated ones, as they allow children to fully engage with their senses and interact directly with the natural world. Items like trees, plants, water features and various landscape can not only impact their behaviour but also the paths that link these elements to each child's home emphasise the importance of the small-scale environmental aspects in a child's interaction with the environment. The environmental aspect of learning is now acknowledged as a key factor in delivering high quality early years education and care. The importance of the physical environment in early years education and care was first emphasised by Loris Malaguzzi who founded the Reggio Emilia approach. He suggested that in addition to family and educators, the design and organisation of educational spaces are crucial in developing early childhood developmental trajectories and that an environment with an abundance of diverse affordances for exploration is essential for maximising a child's behaviour, learning and attitudes (Trina et al., 2024).

Understanding the impact of nature-based outdoor environments on the formation of STEAM, or science, technology, engineering and maths is crucial as it can lead to future interests for children. STEAM opportunities in early childhood take learning to the next level and every child deserves STEAM learning environments that are wonderful, stimulating, innovative and that value their curiosities. Exploring the

natural world is a core element of childhood (Trina et al., 2024) it is important for early years educators to encourage this and help scaffold each child learning by bringing in natural resources and loose parts. Loose parts are open-ended materials that children can move, construct and transform in their play including sticks, stones, leaves, recycled items, ropes and pinecones. Loose parts invite children to use their imagination and problem-solving skills to create their own activities and structure. Forest schools, often in natural or woodland environments, emphasise experiential learning where children learn through hands on activities and real-world experiences with the use of loose parts. Loose parts also naturally incorporate elements from the environment making them a great tool for activities where children can learn about mathematical and scientific concepts. For example, learning about cause and effect by rolling pebbles down ramps, or counting and sorting different materials such as leaves (Muir, 2024). Simon Nicholson developed the loose parts theory and suggested that by incorporating loose parts into play, early years educators can create a dynamic context for exploration, discovery and invention, promoting intellectual and cognitive development (Play Scotland, 2018).

Outdoor play allows children to explore and take in the world around them. early years educators should be maximising this and providing children with the choice to go outside no matter the weather. Piaget's theory suggests that play should encourage further psychological development as children mature. Outdoor play provides children with the opportunity to develop in all areas and develop a range of skills (Boulton and Thomas, 2023). With early years educators providing temporary support, children can be guided through their Zone of Proximal Development (ZPD) which is the gap between what they can do independently and what they can do with assistance. Scaffolding is a crucial aspect and by doing things as simple as modelling a task, asking open-ended questions, fading support as children gain confidence and providing them with natural materials and resources, early years educators are guiding children through this stage and promoting their holistic development. Outdoor learning environments are often more engaging and dynamic and by providing children with the opportunity to learn in a naturally environment and observing, providing support if needed, allowing activities to be child-led and asking open ended questions, children gain confidence and independence, learn life skills and mathematical and scientific concepts (First Discoverers, no date).

Through exploration, questioning and encouragement, early years educators are able to help children to engage in play that teaches them mathematical and scientific concepts while also teaching them new skills through real life experiences. The meaningful and hands-on experiences that children have the opportunity to engage in an outdoor environment promote the children's holistic development and encourages them to develop their critical thinking and problem solving skills as well as supporting their confidence and independence. In summary, with the support of early years educators and opportunities provided in a stimulating and enabling

outdoor environment, children are able to learn and understand new mathematical and scientific concepts.

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