

Awe and Wonder- Science, Mathematics and the Outdoors

Part One



(Source: Rachael's Playhouse, 2025).

Part Two

I have chosen a photograph of the ecological area in my setting, as the image shows the area is an open space in a natural environment with many natural resources for open ended play. The mud kitchen, water play area, easel, natural resources and cable wheel provide endless opportunities for children to engage in imaginative play while using scientific concepts and mathematical thinking while also developing their physical skills, social skills and taking care of their well-being. The children visit here daily and use the area in the ways they choose. The area includes a mud kitchen, where the children can explore materials in variations. These being solid, liquids, creating potions and mixtures and learning about textures and furthering their understanding of measures. For example, pouring and transferring liquids with the use of different containers and apparatus introduces mathematical language such as 'more than', 'less than', 'half full', 'full', 'empty'. During a potions activity a child mixed coloured water together filling a jug right up to the top, before it could overflow another child stepped in and said "stop its going to fall" pointing to the water right at the top of the jug, together they problem solved and were able to carefully pick up the jug and empty some into another container stopping any spillages. They used communication skills to discuss what had happened and how to solve the problem, after this they talked about the colours of the water the one child said 'red' and the

other child replied 'I like red' then she called over some of the other children to come and look at the potion they had created. Another engaging activity that the children have independently done many of times is water flow experiments, including guttering, pipes, funnels and different sized containers to experiment with directing water. This activity enables the use of scientific concepts, problem solving and teamwork. It develops the children's curiosity, experimentation and understanding of natural resources.

The outdoor area promotes health and well-being, the children having access to fresh air daily, space to move about freely and the calming effects of nature itself this falls in line with the Curriculum for Wales' four purposes; ambitious, capable learners (through their explorations and problem-solving), enterprising, creative contributors (through their imaginative play in the mud kitchen and with the natural resources and materials), ethical, informed citizens (through them learning about nature and caring for plants and respecting living things) and healthy, confident individuals (through their physical outdoor play, staying active and perseverance growing their confidence).

In the ecological environment is the best time for children to explore and have opportunities to develop their understanding of living things and insects. For example, the grass, soil and plants naturally attract insects such as worms, ants, slugs, snails and spiders offering the children first hand encounters with living creatures in their natural habitats. This will support early biology learning as children can notice the differences between living and non-living things, compare similarities and differences between insects and understand the basic needs creatures have for survival while also learning to be gentle and caring when it comes to living things fostering empathy and ethical understanding in line with Ethical, informed citizens. Observing insects such as butterflies, ladybirds etc can highlight life cycle stages, children can use many ways to record their findings such as drawing, using digital items to take photographs and communication. Life cycles can also be explored through planting herbs or flowers in soil, then looking after them by watering them daily and observing their growth over the weeks ahead this reinforces the children's knowledge of living things, their growth and change and this ties in with the key elements of Knowledge and Understanding of the World in the Non-Maintained settings curriculum. In our setting we have a sustainable garden and allotments where we grow our own fruit and vegetables along with herbs and plants, the children water these daily and when they are ready, we pick and wash them to have for our healthy snack in setting. We also provide families with our fresh produce to take home; we have had amazing reviews from parents and the children themselves, they love to receive photos and videos of the children helping us look after the garden and are so proud when the children have some fresh produce to take home with them to show off their hard work. We have recently won Hirwaun and Penderyn

Community Allotment Garden competition under the section Best Children's Community Group Garden. By engaging in these hands-on explorations and experiences children develop curiosity, observation skills and a scientific understanding of how living things change and grow and depend on one another for survival. We recently learnt first-hand about the life cycle of butterflies in our setting with our very own caterpillars to butterflies growing kit, the children watched as we all cared for the caterpillars and watched them change into chrysalides and then emerge into butterflies before releasing them in our ecological area to be free. One child as we released the butterflies said to me "will they come back?" showing empathy and care for the butterflies that they spent weeks watching grow from little caterpillars. We then spoke about the importance of letting the butterflies go for their own survival.

Children can enhance their play area however they may wish, adding objects and materials from the setting or surrounding area. Adding obstacle items such as balance beams, tyres, planks, stepping stones to this area would provide the children with endless opportunities to further their physical skills and their confidence supporting their holistic development. For example, the children love to independently create their own obstacle courses and help one another complete them, they use tyres and planks to make balance beams while communicating amongst one another if they need a hand to help them across. These movements support's coordination and balance along with developing their communication and social skills and making friendships that can last a lifetime. They cheer one another on, negotiate turn taking and work as a team. Obstacle challenges nurture resilience, perseverance and confidence, while the children also learn how to assess risks, solve problems and adapt to situations. Furthermore, obstacle courses provide opportunities for mathematical and scientific concepts such as measuring length, distance, comparing heights and forces such as pull, push and gravity. Overall, incorporating obstacle items and physical challenges supports and enhances children both physically and cognitively, supporting all four purposes of the Curriculum for Wales.

The ecological environment offers rich opportunities for many play schemas to be supported and extended, for example the trajectory schema can be explored through pouring and tipping water, dropping objects into different containers or stirring mixtures and potions in the mud kitchen allowing the children to investigate movement, direction and gravity. In addition, the transporting schema can be supported by the inclusion of buckets, baskets and wheelbarrows for children to move natural items between areas this will also support their physical development along with their hand-eye coordination and balance. The enveloping and enclosure schemas can be extended with the use of filling containers with mud, covering objects with leaves and natural resources, enclosing items inside pots and pans and

creating dens, these play skills help the children develop spacial awareness and object permanence. Furthermore, the connecting schema can be supported in this environment through joining sticks to create paths or trails, hanging utensils allowing children to problem solve, become creative, and learn more about natural resources and how they can be used. By recognising and supporting these play schemas practitioners can provide open-ended resources that allow children to follow their interest while also developing key skills in line with the Curriculum for Wales' emphasis on child-led exploration and learning through their play.

Part Three- Risk Assessment

Activity/Hazard	Benefits	Risks	Who is at risk?	Children's Voice	Precautions	Risk after precautions
Mud kitchen	Open ended materials and experiences. Home life experience Sensory inclusive.	Contact with soil or mud could expose germs leading to illness. Mud and water on the ground causing slippery surfaces leading to slips and falls. Utensil misuse could lead to serious injury of another person or themselves	Child or practitioner	'it's dirty' 'let's make pies' 'mix' 'I make castle' 'look what got'	Practitioners to inspect utensils frequently and discard of any broken or worn down, Practitioners to ensure floor is kept safe. Area kept to a low children amount at one time to prevent accidents , practitioners to model correct use of utensils to reduce serious injury.	LOW

Water	Changes the form of ingredients. Sensory. Adds scientific awareness	Risk of drowning resulting in serious fatality even death.	Child or practitioner	'washing dishes' 'mummy house' 'help me this' 'its cold'	Water to be clean and fresh daily, practitioners supervising children in water play at all times, water emptied as soon as areas left unattended.	MED
Obstacle course	Supports physical development and coordination. Aids healthy lifestyle. Grows confidence and self-esteem.	Risk of fall from height causing serious injury. If equipment is too heavy this can result in accidents to feet or strain causing hernias.	Child or practitioner	'hand' 'Its high' 'jump' 'me help'	Practitioners to promote and model correct and safe way to use obstacle course, children to be always supervised on obstacle courses. Practitioner to remove any broken or faulty apparatus immediately. Setting to	LOW

					supply only lightweight appropriate items.	
Plants	Supports children's learning about life cycles and experiences nature and other living things. Develops their empathy and learning for taking care of things.	Poisonous plants, Sharp nettles. Causing rashes, sickness, seizures or death.	Everyone present	'look' 'water plants' 'me help'	Practitioners to check plants daily to ensure no sharp edges and ensure no unusual or poisonous plants are growing and if they are these are to be removed by professionals.	LOW
Weather	Supports children's learning of the environment and the different weather types. Supports their well-being and holistic development.	If it is sunny or high uv there is risk of sunburn, dehydration and heat exhaustion If it is stormy or windy there is risk of harm or injury for anyone	Everyone present	'raining' 'Bwrw Glaw' 'me hot' 'suncream'	Practitioners to check for weather warnings before heading out, check all areas to ensure the floors are safe. During sunny and warm summer	LOW

		outside in yellow or red weather warnings. If it is very cold and wet or snowy there is risk for slips and falls causing injuries including broken bones, head injuries, bruising or fractures. There is also risk for frost bite.			months apply sunscreen morning and afternoon of no less than 50spf and ensure correct and appropriate clothing is always worn. Ensure water is provided and accessible throughout the day and refilled with fresh cold water regularly.	
Field	Supports their mental health and well-being. Promotes healthy active lifestyle. Enhances physical skills and gross motor	Faeces or deceased rodents, Uneven ground Risk of slips, trips falls resulting in cuts, bumps and bruises, poison, sickness, death.	Everyone present	'come on' 'stomp stomp' 'Run, jump' 'grass'	Practitioners to risk assess all areas before children are taken over, looking for anything that can cause harm and removing it.	LOW

	developm ent.				Practition ers to model walking feet when heading over and on uneven ground, any sights/evidence of rodents or dead rodents' children not to attend and specialist s to be called for area to be checked and certified clear by pest control.	
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Part Four

Outdoor play is a vital part of a child's development as well as their well-being, and it is important practitioners can support children in their outdoor play by providing enabling environments that enhance their scientific and mathematical conceptual understanding. According to the Curriculum of Wales (2022) learning through play and exploration enables children to develop as ambitious, capable learners that are curious about the world they live in and their environment. Effective outdoor learning begins with thoughtful planning; educators should set up activities and environments that integrate mathematical and scientific concepts ensuring that the learning objectives align with the curriculum's Areas of Learning and Experience.

Adults play a vital role in scaffolding their learning by providing an enabling environment with open-ended materials, modelling behaviours and language and

extending their thinking and vocabulary through open ended questions (Vygotsky, 1978). Similarly, Piaget's (1952) constructivist theory suggests that children build understanding and knowledge through exploration, when adults and practitioners allow children freedom and child-led play to test, fail and adapt their own ideas they promote critical thinking and resilience. These skills are important for both scientific and mathematical development. Children's thinking skills develop from hands on experiences, for early years children outdoor play is important because it provides sensory and physical experiences allowing the children to build knowledge through direct interaction with their environment. This approach also reflects the Curriculum for Wales (2022) which values play, exploration and problem solving as pathways to ambitious, capable learners. By practitioners applying Piaget's theory to their everyday practice ensures outdoor play is not just entertaining for the children but ensures it encourages and enhances scientific and mathematical learning.

Practitioners should recognise that their role is not to direct learning but to observe, question and gently scaffold the children's understanding as they explore. (Bruce, 2015). For example, if a child is transferring and filling containers an adult might ask "which pot holds more?" enhancing the child's play and inviting them to think about measurement and capacity while experimenting. Goldenburg (2021) supports this by stating it is important practitioners do not overstep children's play, looking out for children's cues that indicate they want the adult's involvement. By carefully observing a children's verbal or non-verbal signals practitioners can learn when it is appropriate to step in to scaffold learning without interrupting the child-led play. This approach respects the children's space, while ensures adult support is meaningful rather than intrusive and interruptive. Maintaining this balance with the children will develop deeper bonds and trust and develop the children's confidence in their own play abilities and promotes mathematical, scientific and social concepts during play. Reid (2018) also states practitioners adopting a non-intrusive role during children's explorations is of upmost importance, Reid suggests that practitioners should "resist the urge to step in too soon" and instead to just sit back observe, listen and wait for the children to give a cue for inclusion. By knowing the children and having them close relationships it is easy to provide the correct support from their verbal or non-verbal cues. Bruce (2015) also states that adults extend children's learning most effectively when they engage in sustained shared thinking, by wondering, predicting and problem solving with the child. This reflective dialogue allows children to explain their reasoning and understand the connections between their actions and outcomes supporting their development. White and Woolley (2019) state that practitioners should also be observing children's play closely to understand their current schemas, interests and any support they may or may not need. Observing and learning about each individual child helps adapt provocations and environment for their specific needs and interests while ensure their development is supported and enhanced through the materials and items on offer.

Bilton (2010) emphasises that the outdoor environment should include mathematical and scientific exploration naturally through movement, sensory engagement and curiosity. Mathematical concepts such as distance, shapes, and quantity happen naturally as children climb, transport materials, build with items and explore and manipulate objects. However, scientific concepts and understanding develop through direct interaction with nature such as the weather, water, soil and mud and living things. Adults can ensure these are provided by setting up the outdoor areas daily, and ensuring things are relocated after the children leave for the day if they remove items that are important to that area. Practitioners must keep records and documentation of the children's exploration not only to support the children but to also support them when setting up provocations or when revisiting an area and being able to enhance it.

Loose parts are open ended materials that can be included in all provocations and all environments, Nicholson (1971) developed the Theory of Loose Parts. He states loose parts are items such as leaves, sticks, stones, water, sand, fabrics, crates, pipes and planks that children can move, combine, and manipulate freely. Unlike toys, these loose parts do not have a specific use allowing the children to play using their imagination while problem solving and experimenting with open ended materials. Loose parts can be objects sorted by size, shape or colour laying the foundations for mathematical concepts and pattern recognition. Nicholson's Loose Parts Theory is particularly useful in an outdoor environment as there are many natural resources already to hand offering endless opportunities for enhancing scientific and mathematical learning. Manipulating loose parts allows children to explore concepts of balance, weight and stability which are fundamental in physics. Building items with materials such as sticks and stones for example experiments with cause and effect and material properties. Adults should ensure that loose parts are an integral part of children's outdoor explorations, by intentionally providing a variety of natural resources and creating an inviting outdoor environment can encourage children to engage and lead their own play. Loose parts have a big impact on mathematical and scientific exploration in young children allowing them to work as part of a team to build, transfer and manipulate items while communicating together and using concepts they would not always think to use in other environments.

Additionally, outdoor play has a positive impact on children's mental health and emotional well-being. It supports children's confidence, self-regulation and resilience. Maslow's hierarchy of needs (1943) underlines that before higher-level learning can occur children's basic physiological and emotional needs must be met. The outdoor environment helps meet these needs by offering fresh air, physical activity and space for the feeling of release, therefore creating the foundations for positive mental health leading to effective learning and exploring. Similar to this is Bronfenbrenner's Ecological Systems Theory (1979) that highlights a child's development is shaped by

their interactions within different environments including nature. Allowing the children free access to outdoor spaces provides them with opportunities to experience movement, sensory engagement and physical activities which in future will develop their gross motor skills, develop their muscles and confidence as well as reduce any stress. Exposure to natural environments supports calmness, reduces anxiety and enhances well-being not only for the children but the practitioners too.

In addition, documenting children's progress is crucial in early childhood, it provides valuable insight into their development, interests and supports adults and practitioners in planning and facilitating experiences best suited to their individual self and builds bonds. Documentation also encourages children to revisit and reflect on their own learning helping them further develop. It also strengthens parent involvement as families/carers can reflect on the observation and support their child's learning at home with similar provocations and materials (Williams and Powers 2011). Sobel (2008) states outdoor play in particular offers rich opportunities to enable children to explore mathematical and scientific concepts and develop their learning. Documentation can include many different methods such as observation sheets, learning stories, portfolios, photographs, videos, time samples and the children's own work, capturing the learning process and offering opportunities for future activities/materials to further develop skills. Linking observation to mathematical and scientific learning ensures that explorations are both meaningful and educational.

In conclusion, from all the research and theory's it is evident that adults play a vital role in children's engagement with mathematical and scientific concepts in the outdoor environment. It requires practitioners to have a balance between providing support and allowing children to explore and experiment independently. By carefully observing children's interests and interactions along with their verbal and non-verbal cues practitioners can learn when to get involved or when to step back ensuring the involvement is meaningful and not intrusive. (Goldenburg 2021). Being responsive respects the children's needs and wants while also promoting independence, creativity and curiosity. An effective way to incorporate mathematical and scientific concepts is through loose parts play as shown from Nicholson's Theory (1971). Loose parts such as stones, planks, sticks, leaves, recycled materials, water and so on offer open ended opportunities for the children to experiment with cause and effect. Through the children exploring these items they naturally explore measurements, speed, balance, sorting, colour sorting and weight which will develop their mathematical and scientific learning. Adults can support this by providing appropriate materials, accessible storage and ensuring the environments are fully always stocked.

Outdoor environments themselves provide unique opportunities for learning, the natural resources such as weather, living creatures, plants can prompt observations,

comparisons and investigations. Practitioner's and adults can support this by asking open-ended questions, offering simple tools and encouraging the children to reflect on their findings and talk between each other about them.

Documentation and reflection are also important when it comes to supporting the children and their development, by recording observations by the many ways suggested above practitioners can gain the right information about the children and their progress to tailor future experiences and extend learning. In addition, sharing these observations with families/carers can encourage them to further their children development and give them ideas on how to do this.

Lastly, adults and practitioners must understand the importance of child led play. Children's curiosity thrives when they are given the space to explore and investigate independently allowing them to make mistakes and problem solve to overcome them. When children are given the opportunity to investigate independently, they thrive, inviting their friends to explore their explorations with them and working as a part of a team to experiment and learn more about the world around them.

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