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Module – ECEY5005

Awe and Wonder – science, mathematics and the outdoors

Part 1

(Source: Instagram, 2018)

Part 2

The outdoor environment in the image shown allows children the opportunity to explore independently through play using natural elements and loose parts. The image was chosen because the environment shown offers children a large range of learning opportunities in a natural environment with raw materials to explore and manipulate.

The area looks warm, inviting, and exciting, with a range of colour, shapes, and textures in a natural environment to draw children's interest and curiosity. A safe space enabling children to use their imagination freely building confidence, a sense of wellbeing and improving social and emotional development.

The sheer nature of the environment allows children to develop gross and fine motor skill, problem solving, teamwork, creativity, physical development, maths and science in a range of ways using natural materials and enhanced by enabling adults supporting engaging environments and providing materials to expand learning experiences.

There is an area which represents a kitchen or home corner surrounded in a natural woodland environment rich with natural elements to encourage curiosity, wonder and exploration.

The Welsh Government's Science and Technology area of learning says Children being inquisitive and curious about their environment is vital for the development of understanding of scientific concepts.

The environment itself allows children to awaken their senses with various sights, sounds, smells, and elements to touch. It is a rich environment to explore and learn about living things. Creating a bug hotel paves the way for many learning experiences. Children can use sticks, twigs, leaves, pebbles, stones and may be enhanced through adults by adding different thickness cardboard, paper and straw for insects to inhabit allowing children to investigate learn facts about these interesting creatures. This particular activity allows children to take ownership by designing and constructing their bug hotels with peers, finding out what works and what does not, problem solving and making changes where needed. Children can observe them by using magnifying glasses learning about growth, movement, what they eat, how many legs they have or if they have any. Magnifying glasses to examine insects close up enhances experiences for children, encouraging them to learn more about their environment.

Exploring mini beasts brings opportunities to learn about the habitats of living things, life cycles, and what benefits insects bring to the environment, bees and butterflies for example which pollinate flowers. These activities encourage an appreciation and love of nature and a desire to learn how to care for the natural environment.

There is space which can be utilised for planting. This gives the opportunity for children to develop new skills whilst learning about living things. Exposing children to different textures, smells, and colours such as soil, seeds, vegetables, plants, and flowers supports sensory development and builds upon motor skills. Lavender and buddleia plants are excellent and child friendly, attracting bees and butterflies to pollinate flowers. The children

will also benefit from physical movements through engaging exercise by carrying, digging, raking, and watering the soil. This will allow children to learn how to take care of the plants by watering, ensuring enough sunlight and to observe the life cycle of the plants and changes.

When thinking about maths the environment illustrated gives children many opportunities to explore, problem solve and make connections. One engaging activity is to develop the skill of measurement by investigating measures using stones, sticks, or leaves and comparing objects shortest to longest, thin to thick, big, bigger, biggest. Another activity is to collect and sort natural objects such as pebbles, leaves, twigs, stones, chippings, and sort by appearance, rough/smooth, heavy, or light, big and small. Exploring empty and full using containers or jugs and natural objects such as earth, mud, pebbles, and twigs.

The kitchen area can be enhanced with enabling adults providing pots and pans, scales, spoons, and trays with numbers on. Loose parts can be used to awaken children's curiosity by weighing and balancing using the scales, using number trays to count objects, and looking at shape and sizes of different natural objects. Muddy welly footprints is a fun activity children can engage in and examine the patterns made and measure who has the biggest footprint.

These activities link to the Curriculum for Wales maths and numeracy area of learning by allowing children to be creative through experimentation and taking risks by experiencing mathematical concepts and making connections.

When creating an enabling environment, enabling adults are in a unique position to provide additional resources and build upon the area to support and enhance children's experiences and promote independence in line with the Welsh Government enabling pathways guidance. Loose parts are a range of materials which allow children the freedom to use however they choose sparking imagination and creativity. The following is a list of loose parts practitioners can introduce to the outdoor learning environment to enhance children's experiences.

Box of various materials, cardboard boxes – den building, home corner, dressing up, setting a scene

Items for kitchen/home corner – jugs, kitchen utensils, containers, sweeping brush, buckets, water, clothes pegs, blankets, pots, pans

Gardening kit – spades, shovels, rake, watering can, gloves, seeds, plant pots

Building materials – guttering, tyres, wood, crates, hammer, paint brushes, cable ties

Tyres – sand pits, planter, use in play

Sensory – foil, torches, netting, herbs, lavender, glass stones, shells, feathers, magnifying glasses, different shaped pasta, rice, lentils,

Sensory Jar/bags – add stones, twigs, pasta inside a jar with lid for sound, place soil, mud, pebbles inside a zip lock bag for touch, add lavender, herbs, or flowers in a draw string bag for smell

Nature trays – acorns, sand, twigs, feathers, leaves, mud, soil, pinecones, pebbles

The area in the image enables children to experience the natural environment and the freedom to explore the world around them, making connections, problem solving and building relationships. The health and wellbeing area of learning and experience in the curriculum for Wales signifies how important it is that children are given opportunities for outdoor learning. The core purposes of the Welsh curriculum support the development of independence though rich experiences in the natural environment, whilst developing a knowledge and appreciation of the natural world and developing empathy for living things and the natural environment in Wales and the world around them.

Part 3

RISK BENEFIT ASSESSMENT

Location / Activity:	Outdoor play in school woodland area	**Date:**	12/9/22
Assessor:	Gemma Clarke 2114097	**Review date:**	15/9/22

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.

Outdoor play in woodland area in photograph	How will young people BENEFIT from this activity?	Hazards and risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Woodland play area – free play under adult supervision. Walking, running, exploring, investigating.	Engagement with natural elements in fresh air. Develop understanding and appreciation of nature and living things through hands on experiences. Physical development – agility, balance, co-ordination, spatial awareness, strength, fine and gross motor skills. Develop awareness of one's own limits and overcome challenges and limitations. Social skills – communication, social and emotional development with peers and adults. Improved wellbeing, enjoyment and fun through freedom and exploration	Children may wonder away from group and become lost. Falling/stick out/low level branches may cause head/eye injury, cuts, or infection. Objects/debris on ground may cause trips or falls resulting in bruising, cuts, or scratches' Inclement weather conditions such as high winds, strong sun or icy cold. Uneven/slippery when wet terrain. Collision with peers during play leading to bumps, head injuries and falls, possible fractures. Insect bites or stings Injuries /stings from thorns, nettles Danger from ingesting poisonous berries	Adults and children	Correct adults/child ratio is in place and adhered to prior to and during activity. Area inspected prior to arrival and knowledge gained of terrain, low level branches, slopes, and uneven surfaces. Adults to be made aware of environment and potential hazards to users. Procedures in place for inclement weather conditions – weather to be checked prior to activity. Parents informed of appropriate clothing and footwear required. Sun cream and hat must be worn in event of hot weather. Age-appropriate safety talk with children regarding the wooded area, surface is a rough terrain, uneven in places with pebbles, stones, twigs, leaves, grass, and dirt. Talk about low level branches and objects on the ground to highlight dangers in a child friendly manner. Establish rules and discuss with children prior to activity – do not put anything inside the mouth, make them aware of things that may cause irritant/injury and do not touch, stranger danger, give a boundary line where they do not cross. Ensure this is delivered in a child friendly, age/ability appropriate manner. Staff to be aware of policies and procedures with regards to safeguarding children and make any reporting in the correct manner to the organisation.	L

Outdoor play in woodland area in photograph	How will young people BENEFIT from this activity?	Hazards and risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Exploring natural materials and loose parts play	Freedom to discover and explore in the natural environment. Develop fine and gross motor skills. Use imagination to build upon creative and problem-solving skills. Investigate different properties of a range of materials – natural or man-made. Develop language and communication skills. Work collaboratively with peers developing teamwork skills. Develop a curiosity for how things feel/grow or created. Develop sense of freedom using imagination through unstructured free play. Experience various sensory stimuli	Uneven/slippery surfaces causing trips or falls resulting in cuts/grazes or head/facial injuries, bruising. Objects/materials being thrown causing head/eye injury. Swallowing small parts resulting in injury/choking/death. Failure of man-made equipment – snapping, breaking causing falls, impact, or cuts/scratches/bruising. Wooden object/natural materials causing splinters. Heavy tyres may cause strains when lifted or moved, danger of toppling, build-up of speed when rolling on uneven ground.	Adults and children	Clothing and footwear are suitable for the terrain of woodland area and appropriate for weather conditions. Adults to have in place first aid kit to tend to minor injuries at the scene Rules/safety talk age/ability appropriate with children prior to activity to ensure they have understanding of the dangers of throwing objects with lots of people in the area, and do not put any objects in the mouth. Staff to monitor behaviour during visit and intervene where needed e.g., throwing objects. Area to be inspected prior to visit to assess any damage to equipment and gain knowledge of area for low lying branches, uneven surfaces, protruding tree roots. Adults to use own judgement on weight/size of tyres and assist in the movement where needed. Caution /judgement must be taken when rolling tyres e.g., speed and momentum on uneven ground	L

Outdoor play in woodland area in photograph	How will young people BENEFIT from this activity?	Hazards and risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Mud Kitchen	Ability to incorporate routines home/school. Build confidence and independence. Promote imaginative and creative play. Discover/explore changing states – adding different amounts of water to soil. How solids and liquids react when mixed together. Experience sensory stimuli. Encourages communication and language development. Hands on experience with natural elements, supports developing understanding of nature. Physical development using tools to mix, pour, press, and mould materials.	Contaminated soil – animal faeces, stagnant water etc transfer bacteria causing illness. Ingesting dirt/mud, stagnant water, pretend 'food' made in mud kitchen made from water/dirt, pebbles, Ingestion of leaves, berries or plants resulting in sickness, choking and allergy. Wet or dirty clothing or footwear causing a feeling of cold or being uncomfortable. Puddles from using water may cause slippery surfaces resulting in falls causing bruising, cuts, or scrapes. Moving/carrying objects around may cause bumps and injuries in the process.	Adults and children	Rules established prior to visit and children aware of possible risks. Children encouraged to tell an adult, when possible, dangers are found in the soil and for adults to remove. Age/ability appropriate discussion with children around pretend play in the mud kitchen and not putting anything inside their mouths – practise this in home corner before visit. A talk about stagnant water and the dangers and this must not be put in the mouth. Area checked by staff prior to visit for any soil contamination in area of use. Equipment to be checked for algae, mould, or stagnant water. Children are aware of hand washing routines and provision is made to clean hands through visit. Children are aware of the hazards of nettles, berries, and other poisonous plants – strict no eating rule. Small amount of water will be used, equipment is small so children will not fall inside. Children to be supervised by an adult when using water. Any equipment used with water to be emptied at end of session to avoid build-up of stagnant water. Parents made aware of area visiting, activities undertaken and the high possibility of children getting dirty. Advised of possible messy, wet play and so clothing appropriate for the occasion and a change of clothing is essential. Wellies, long trousers, and other clothing appropriate for weather. Appropriate footwear is essential for slippery/uneven surfaces – no sandals or open toe shoes.	L

Part 4

Children are naturally curious inquisitive beings who flourish when given opportunities to play outside in natural environments (Bruce, 2012). Theorist Friedrich Froebel believed play is the process of children learning, allowing them to build a knowledge and understanding through freedom of exploration making connections as they experience the natural environment (Tovey, no date; Bruce, 2012).

The Welsh Government (2021) Enabling Pathways document states the early years period is an important time in terms of setting the foundations for children's development, furthermore children will blossom in accordance with their own developmental stages with the outdoor environment playing a key part in purposeful learning experiences (Welsh Government, no date), created by enabling adults around the principles of the four purposes of the Welsh Curriculum, (Welsh Government, 2022).

According to Piaget (Halpenny, 2014) children will learn and develop through active participation and independent learning experiences enabling them to build upon their own knowledge and understanding. While Vygotsky also believed children learn through experiences, he focused on children's social interactions and surroundings being that which shape their cognitive development (Pound, 2006) and therefore, practitioners in early years settings are in a unique position to support children's development and taking both theories into account by facilitating engaging learning environments, being positive role models and valuing children's individuality, moreover, providing children with rich learning opportunities enabling the development of creative thinking, problem solving and reasoning skills (Hughes, 2009).

According to Play Scotland (no date), theorist Simon Nicholson believed that materials or objects that can be handled, moved, manipulated and used in a number of ways allowing children to interact with however they choose which allows children to experiment and explore through play. Daly *et al.* (2015) believes that ensuring loose parts are plentiful in learning environments enable children to explore through curiosity and draws on imagination (Play Scotland, no date) also, loose parts play had a positive impact on children cognitive, social and emotional development (Gibson, Cornell, and Gill, 2017).

Examples of loose parts are any objects can be moved, manipulated and changed through play such as stones, pebbles, feathers, material, beads, leaves, cotton reels, tyres, cardboard, boxes, shells, pinecones, pots, pans and jugs, basically anything children can utilise to expand on their learning experiences and change by using their imagination (Daly, *et al.* 2015).

One study found through multiple observations that when engaging in loose parts play in the outdoors, children will choose to explore the affordances of the objects independently (Boulton and Thomas, 2022). The idea of affordance is the learning environment and its contents which can be accessed and used by children in ways which cater to their needs. An example of affordance in the outdoors would be space to run, climb, investigate, handle and feel natural elements, areas for planting, observation of various living things such as birds, insects, trees and flowers (Laakosharju, Rappe, and Kaivola, 2012).

It is important to consider how practitioners can support learners to engage in maths and science in the outdoor environment.

Previous studies have reported that enabling children to access engaging outdoor environments is beneficial for their holistic development (Rios and Brewer, 2014; James and Williams, 2017). Other studies have found evidence that children exploring outdoors through cross curricular activities improved attainment in maths and science in primary schools and developing countries (Khan, McGeown and Bell, 2020; Miller. D, 2007).

The Welsh Government (2021) enabling pathways guidance states enabling adults are central to providing warm, safe engaging environments to support children's independent learning, and facilitate enabling experiences that embrace learners own choosing through exploration of their environment (Hodgman, 2012).

Schemas allows children to actively build upon their knowledge and understanding (Boulton and Thomas, 2022). The Welsh Government (2015) Foundation Phase guidance states children's interests should be a priority when planning for the curriculum, moreover, allowing children the freedom to lead their own learning through children's schemas ensures child led holistic learning. Furthermore, the outdoors should be actively considered a learning environment enabling children to build upon and enhance learning experiences through independence, creating a desire to be at one with nature within meaningful learning

environments with a desire to discover new concepts through their own schemas to develop and understanding through child led play (Boulton and Thomas, 2022).

Observation plays a key part in the planning for children's learning opportunities (Bilton, 2014). Observation allows practitioners to see the impact of provision put in place for children's learning and enables monitoring of what is working and where changes are needed (Richardson, 2014). Broadhead, (2004) suggests allowing sufficient time to observe, pay attention and absorb how children embrace and use the learning environment, also, take time to reflect on observations made and share knowledge gained with the early years team to implement any changes needed.

According to Russell and Mcguigan (2016) for children to develop an understanding of scientific concepts it is important to nurture curiosity, imagination, and desire for exploration. With this in mind, practitioners have a responsibility to support children to develop and process scientific concepts (Waite, 2017).

Laakosoharju, Rappe and Kaivola (2017) suggest the outdoor environment is rich with natural loose parts to draw on children's curiosity to investigate and process scientific concepts through play. For example, branches, rocks, pebbles, leaves and soil to name a few are readily available naturally outdoors for children to engage in play and manipulate how they choose (Daly *et al.* 2015). That being said, practitioners can further enhance children's experiences by providing a range of loose parts in the outdoor environment, natural and man-made for children to engage in open ended play (White, 2014).

An example of this would be practitioners in the early years setting working together to create an engaging environment which enables children to experience plant life and living things (Braund and Reiss, 2004). According to Grigg and Lewis, (2016) to make learning purposeful and relevant practitioners should provide loose parts to enhance experiences, when thinking about gardening it is beneficial to have access to an area for digging earth and a range of plant pots, a box with gloves, spades, rakes, watering can, wheelbarrow, forks and a range of seeds and bulbs.

Childcare and educational settings having access to green spaces provides concrete learning opportunities, in addition to this the outdoor environment is rich with multi-sensory stimuli

for children to investigate and living things is one aspect of science that allows children to awaken their senses, (White. J, 2014, Braund and Reiss, 2004).

The Welsh Government (2020) maths and numeracy area of learning suggests that the early years are a fundamental part of enabling children to explore mathematical concepts through play. With this in mind, to enable children to develop mathematical skills the outdoor environment is key and should be incorporated in children's everyday learning opportunities (Welsh Government, 2014).

Pound and Lee (2011) claim that the outdoor environment is rich with mathematic opportunities to explore with nature, surrounding buildings, immediate environment and green landscapes. For example, going on a journey or walking down the road and counting cars, houses or people enables children to engage with maths through shared thinking with parents or carers along the way (Montague-Smith, 2002).

The experience and knowledge of early years practitioners is key to supporting children's purposeful learning opportunities and providing rich outdoor learning environments and communicating through sustained shared thinking support mathematical development working in partnership to problem solve (McGrath, 2010).

The role of the practitioner is to provide a rich, exciting and visual environment taking into consideration mathematical concepts through a holistic approach (Skinner, 2005). Also, practitioners need to model language appropriately to children and use descriptive vocabulary to ensure they understand the differences when using mathematical language (Robertson, 2017), for example asking I wonder which one is the biggest? What makes you think that? Shall we put these from smallest to biggest? Would you help me put these in order from shortest to longest? (Robertson, 2017; Montague smith, 2017).

Children's natural curiosity will enable them to develop mathematical knowledge by exploring objects and classifying them by appearance, size differences and shape, this also helps to develop an understanding of number, quantity and 1-1 correspondence (Ashbrook, 2017).

Loose parts play allows children to investigate mathematical ideas in several ways (Daly, *et al.* 2015) take for example exploring natural elements in the outdoors. When investigating measurements, children can observe trees, plants and bushes and compare sizes. In addition to this, ordering by size, shortest to tallest, smallest to longest, thin to thick etc using leaves, twigs, pinecones, branches, pebbles, and stones (Skinner, 2008; Ashbrook 2017).

The outdoor environment offers numerous opportunities to discover various shapes and patterns and engage in positioning and movement (Montague-Smith, 2002). An example of this would be exploring patterns on trees and leaves, using magnifying glasses to observe patterns of footprints or tracks in the mud, moving using bikes or cars, use moving toys such as cars and throwing balls and bean bags to investigate positioning (Skinner, 2005).

Blakely, Bundy and Levin (2018) believe that mud provides multiple opportunities for open ended play, gives children sensory stimuli first hand, and allows for many encounters with mathematical concepts. Reinfeld, Loutain and Mellowship, (2008) suggest enabling children to access a mud kitchen is one way to utilise this learning opportunity through loose parts play, providing pots, pans, bowls spoons, plates, scales, cups, and tins, to name a few enable children to explore maths. Counting how many scoops of mud to fill a bowl or cup, weighing and measuring using the scales, |water can be used to explore volume and capacity by using jugs or containers and investigating full, half full and empty (Robertson, 2017). In addition to this creating a mud pit to make track patterns with moving vehicles of various sizes enabling children to compare size, patterns, and shapes, (Reinfeld, Loutain and Mellowhship, 2008).

Ascoli and Hunter, (2022) suggest Froebel believed children engaging in play with nature outdoors allowed them to develop understanding and make meaningful connections by observation, measuring, investigation and wonder which enables them to become scientist and mathematicians of their own environment.

Affording children, the opportunities to explore maths (Sargent, 2015) and science (Davies, Davies, 2014) outdoors in the natural environment enables them to make sense of their encounters extending their prior knowledge and creating a desire to discover more.

The Welsh Government (2019; 2022) Science and Technology and Maths and Numeracy area of learning suggests learners must have opportunities to explore with mathematical and

scientific concepts outdoors to enable children to experiment first hand through a varied range of resources. Outdoor play is a pivotal part of learning in the United Kingdom (Pound, 2006). Nature based learning environments are a useful tool for the exploration and investigation of maths and scientific concepts and key to facilitating this learning opportunity is educators and practitioners (Lee and Ensel-Bailie, 2019).

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