



Awe and Wonder - Science, Mathematics and the Outdoors.

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Part One



1 - Source: Author's Own

Part Two

The above area was chosen as it provides a wide range of opportunities for outdoor learning for the Early years. The area with a wide range of natural resources, including a multitude of plants, trees and foliage, a pond, and man-made features such as the bridge provides multiple opportunities for science, technology, and mathematical lessons such as investigating texture, size, weight, pattern, and shape, sorting into Man Made and Natural Materials, investigating objects that float or sink and looking at the habitats and life cycles of wildlife. There are opportunities to discuss electricity with the windfarm in the landscape and the weather due to the cloud formation in the background.

In this instance the Science based lesson chosen in this area will be to observe lifecycles of the wildlife that live in the area. Extra resources will be provided such as fishing nets, petri dishes, buckets, magnifying glasses, dental mirrors, tweezers, identification and classification sheet and a plain white fabric sheet. A cross curricular approach will be taken in this lesson and children will also be encouraged

to record their findings in the form of a tally chart to transfer and record on a pictogram using digital technology. Welsh Government (2021b) states that to develop a broad and balanced curriculum drawn on children's prior knowledge and experience and following their current fascination, making cross curricular links in learning is essential.

Welsh Government (2020) explain when discussing the New Curriculum for Wales Framework that learning must be based on Stage or Progression step, there are expected outcomes for each progressions step and each step provides a basis for the next one where knowledge is increased as the stages progress. This follows Piaget's constructivist cognitive development learning theory as discussed by Aubrey and Riley (2016) where new knowledge is built on the foundations of previous knowledge learnt. The curriculum is designed by individual schools, using Statements of What Matters as a guide to curriculum design. This lesson on lifecycles will cover the Statement of What Matters for Science and Technology statement "2.6.1 Being curious and searching for answers is essential to understanding and predicting phenomena" where the children are expected to explore the relationships between living things and observe and explore their habitats and lifecycles and "2.6.3 The world around us are full of living things which depend on each other for survival, where as part of Progression step two children are required to know that a habitat is a place where a living thing lives and that a microhabitat is a small habitat.

Children will be shown examples of difference lifecycles such as how Frogspawn becomes a Frog, a Cocoon to a Butterfly using pre-printed resources.

Children will be encouraged and asked to think of questions they would like to know the answer too in relation to lifecycles and habitats. Previous lessons questions have included, Why Does Frog Spawn need to be in Water? What other mini beasts or animals live in the pond or the area around it? Why do woodlice like to live under stones? They will be encouraged to use the equipment provided, using nets to sweep in ponds or puddles, they can use the dental mirrors to explore crevices and holes and use the tweezers to collect the minibeast for further investigations with a magnifying glass or pot. They can use the white sheet to place underneath a tree, shake the tree, and see if anything lands on the sheet. Specimens can be collected in buckets or in petri dishes for investigation with a magnifying glass. Children will be able to extract frogspawn, tadpoles, and frogs from the pond to enable them to view each stage of the lifecycle. Welsh Government (2021b) suggest that pupils should be given authentic life experiences using real tools. Other pondlife and mini beast can also be observed and discussed.

Scientific language will be used to build the pupils vocabulary. Children will be encouraged to describe the minibeasts or wildlife that are found, to discuss why they think that minibeast was living where it was found. For example, is it a safe place from others creature that may eat it? Does it have what the minibeast needs to survive? Does it need light etc? This may link onto discussion about food chains. For example, the woodlouse is safer living under a stone as it is a food source for the hedgehog. The woodlouse eats bark and tree roots.

A child led approach will be used for this lesson. Whilst the lesson will have a habitat and life cycle focus. If a child has a question arising from a curiosity that will further their knowledge of the outdoors and the area a practitioner will support this learning.

As the cross curricular Mathematical element of this lesson pupils will be required to record and sort their findings.

Using a classification sheet pupil as shown below pupils can identify their minibeast and then using two minibeasts use a Venn diagram technique to record.

As discussed by Welsh Government (2021) this will cover the Mathematical Statement of What Matters those states “statistics represent data, probability models chance, and both support informed inferences and decisions” with the learning descriptors for Progression Step Two as needing to sort and classify data using more than one criterion, which also includes the use of Venn and Carroll Diagrams. For younger learners Welsh Government (2021b) explains that children should be provided with effective experience such as the opportunity to compare, sort and classify living and non-living things and that this supports their cognitive development.

Again, as this is child led, previous lessons have included discussions regarding wingspan size in relation to body size and how things can still fly. A discussion on the length of the tails of tadpoles and frogs looking at longer/shorter, thinner/thicker.

Children are also able to record their findings using camera or a video on an iPad again meeting the Digital Competency Framework as discussed by Welsh Government (2022) who state that by 2022 information technology should be integrated into all subjects of the curriculum. This task covers the Digital Competence Framework of being able to collect and organise data which is an expectation by Year 2. Welsh Government (2021b) also states that Children must be provided with the opportunity to explore and experiment with digital technology for a range of purposes.

Part Three

RISK BENEFIT ASSESSMENT

Location / Activity:	Dare Valley Country Park / Pond Dipping and Mini Beast Hunt	Date:	30/09/2022
Assessor:	Hayley Griffiths	Review date:	30/12/2022

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 risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Bridge over stream leading from pond	- Children can drop things from the bridge to explore the float or sink concept. - Children could drop objects into the water to see which one lands first to investigate heavy and light. - Pupils can view and discuss the flow of water, the speed in which it is flowing, finding out where it came from first, where it is going. - Pupils learn to discuss man-made and natural features or natural and manufactured materials as the bridge is made from both.	- Whilst the bridge floor has a manufactured non-slip coating some of this has worn away leaving the surface slippery in the wet weather and leaving some ground uneven which is a trip hazard. - Despite the drop being low, the bridge could pose a serious risk if children were to climb on the rings on the side of the bridge and fall onto the rocks or into the water below. The bridge is safe if children are standing on ground as the ring barrier is quite high.	Pupils and Educators	- Pupils and Educators will be asked to wear suitable footwear for the lesson. - Pupils will be reminded to walk slowly and carefully on the bridge. - Dangers of climbing up on the sides bridge will be discussed beforehand. Rules will be given to the pupils not to climb on the bridge and an educator will supervise to make sure these rules are adhered to.	Low Risk Medium Risk
Mud area next to the pond	- Children will be able to explore texture and consistency as some of the mud in the area is dry and some is wet and boggy. - Children will be able to use this area to pond dip and explore wildlife living in the area such as the ducks, plants, pondlife and minibeasts. - Children will be able to view the lifecycle of a frog. - Clothes and shoes could become wet.	- Some of the mud is slippery and there is a risk shoes could become stuck in the mud. - There is a risk of drowning if a child falls into the pond, the pond is very shallow in the area which is why the area has been chosen. - The area risks the ducks living in the pond that they may become distressed during the visit. - Children could ingest or absorb contaminated soil.	Pupils, Educators and Wildlife	- Suitable footwear should be worn for this activity. - Pupils will be provided with suitable waterproof clothing. - The dangers and risk of falling in the pond will be discussed. - Group numbers participating in this area at one time will be limited to allow maximum supervision from an adult. - Children will be asked to put their hands in their mouths and to wash hands immediately after the activity. - Children will be asked to be respectful to the wildlife that we are observing.	Medium
Log on floor	- Walk on top using it to balance. - Use the magnifying glass to view minibeasts living in the log. - Discuss the shape of the log and look at how different the texture of the wood is from the log seat to the picnic bench and why they are different.	- Potential trip hazard. - Pupils could fall off whilst balancing. - Splinters from uneven wood.	Pupils	- Children could be made aware of the risks. - Educators could be at hand to provide support to children if required and requested to balance on the log.	Low Risk
Geese on the pond	Pupils can observe the geese and their features. Looking at wingspan in comparison to their body. Their features that allow them to float on the pond.	Geese bites.	Pupils and Educators	- The geese will be observed from a distance. - Pupils will be reminded to respect the Geese space if they walk on land and not to offer food or try to touch them at all.	Medium
Grossed verge area around the rest of the pond away from the mud area.	Children can view the pond and pond dip looking for pondlife.	The pond is much deeper in these areas increased drowning risk.	Pupils and Educators	- Children will be asked not to walk to the waters edge in these areas and only to pond dip from the supervised muddied area. - Educators will supervise to ensure that children are not going too close to the water's edge.	High
Surrounding Trees	- Pupils can view the leaves and bark on the trees exploring shape, colour, pattern, and texture. - Pupils can climb some of the branches on the trees, which helps develop confidence, develop spatial awareness, concentration, working memory and knowledge of nature. - Pupils can observe and find wildlife that live in the trees.	Children could fall and injure themselves.	Pupils and Educators	- During wet weather explain to children that branches will be slippery, and the tree may be more difficult to climb. - Number of children climbing tree at any one time will be limited. - Ground underneath tree will be checked first for any sharp rocks, roots, or branches. - Children will not be supported to climb up and will only climb to where they feel confident to climb no more than 3 x their height as suggested by Forestschool.org (No Date). - Teach children how to recognise a dead branch such as having lack of foliage or change in colour to limit any chances of a branch falling. - Educator to climb the tree first to assess any dead branches and assess if the tree is safe to climb.	Medium

Part Four

Welsh Government (2021) explains that the role of the adult is integral to children's learning, they explain that the enabling adult is responsible for ensuring that there are many opportunities for the

child to learn and explore a range of different experiences and environments both indoor and out. They suggest that the enabling adult should support the learner in actively solving problems and to encourage learners to observe and discuss their immediate environments and surroundings. Gibson (1986) affordance theory suggests that a potential use of an object or feature of the environment can be perceived by an individual through sensory input and is immediate, an action possibility formed between a person, their capabilities, and the environment. Gray and Burrell (2015) supports this and suggests that outdoor learning environments provide a rich stimulus for creative thinking and learning and that this provides opportunities for critical thinking, inquiry, and reflection. Malone and Tranter (2010) also agree and explain that not only does outdoor learning provide a multi-sensory experience it also helps pupils retain knowledge more effectively.

Early Years Educator (2016) suggest that practitioners are required to understand Gibson's affordance concept to enable them to plan rich environments and provide enriched free-play provisions. White (2020) somewhat agrees and explains that children use play to experiment, process and practise their feelings and understanding of new experiences and that children need a multi-sensory environment with time every day to experience interactions with the living world around them.

Bruce (1991) suggests whilst free flow play is without the confines of external expectation children have control of their play by making decisions and predilections, showing curiosity, experimenting with strategies, and taking risks to develop their skills. Whilst Tucker (2017) agrees that free flow play has a positive impact on the teaching of mathematics and that many of the processes integral to free flow play require the same skills needed as mathematical processes and critical thinking, there is a contradiction when Tucker (2017) also suggests that to fully support mathematical Development, playful activity requires adult involvement. Furthermore, Welsh Assembly Government (2008) states that the play that best supports learning is a mixture of child initiated, adult supported play as Fisher (2013) agrees and explains that practitioner led focus activity supports the teaching of systematic skills, child-initiated play without adult intervention enables children to become self-regulated capable learners.

Donaldson (2015) when discussing the New Curriculum for Wales Four Core Purposes describes an education where Wales produce ambitious, capable learners where schools design their own curriculum which is child initiated by listening to pupil voice. Bronson (2000) also suggesting that how a child learns has a greater impact on their school achievement than what they learn. However, Bliton (2010) discusses the learning limitations of child-initiated activity and suggests for the learning to be worthwhile children need to be challenged, try new things, and build on their skills. Therefore, a child choosing to do the same outdoor activity such as riding a bike outside every day is not effective once a child knows how to ride a bike.

The role of the adult is to provide the opportunity and guidance for the child to explore a stimulating environment where children can learn new skills. Cambell and Neill (1992) suggest that not only should children not be interrupted time should not be wasted on non-worthy activities. Bilton (2010) explains that the approach of adults in play need to be interaction not interference. These views support the theory by Vygotsky (1978) of the zone of proximal development which is the zone where children learn skills that are too difficult to master independently but they can do with the support and encouragement of others. Children need to be left in an environment which supports the zone of proximal development which is stretching and intriguing but where an adult is there to support them when required.

Welsh Government (2021b) suggest that in the correct environment with the adults attuned to their needs, can increase pupils' knowledge and skills providing chance and opportunity supporting mathematical and scientific language encouraging it in play and purpose. The experiences should encourage children to notice and discuss their environment and local surroundings again using Bandura's Social Learning Theory as discussed by Bates (2019) practitioners can model scientific language and the activity and then allow the pupils to work independently then using Vygotsky's scaffolding approach to help and build confidence when the pupils ask. Dowdell et al (2011) support this with the suggestion that when children play outside children tend to be less inhibited in their use of language and that studies have shown that children have been known to make five times as many more utterances outdoors as they do inside. Smith (2015) suggests that learning outdoors can be beneficial for all pupils, as pupils may behave differently outdoors with those who are quiet and reluctant to participate speaking more and other pupils remaining calmer and more focused. This may be because as Maynard and Waters (2014) suggest that when children are outside engaged in child-initiated activity, they do not have to wait their turn as often as focussed indoor activities. Ouvry (2003) somewhat supports this as suggests that the outdoor environment provides increased space for the child, giving the child space to remove themselves from confrontation and conflict and making the child feel less frustrated and demonstrating frustration.

Welsh Government (2021b) suggest children have a natural curiosity about their environment which means they are naturally curious problem solvers, who enjoy investigation and exploration individually and in a group. In the Non-Maintained Curriculum, they encourage practitioners to provide outdoor opportunities to experiment and play with a range of varied materials, using authentic real resources such as tools to exploring properties and textures of materials and to find out about man made and natural environments, to give opportunity for the child to use their senses to explore the world around them and to develop an understanding of how things work, to solve problems Williams-Siegfriedsen (2012) when discussing the Danish forest school approach explain that children are natural learners and observers, who learn from real life experiences and situations. They explain that the Danish Forest school approach works on many theories one being Rousseau who explains that children construct their understanding and knowledge from the world around them, and another being Dewey or suggested that children by doing particularly in the outdoor environment when they are active participants in their own learning. Williams-Siegfriedsen (2012) give an example as where children will learn more about being the seasons in nature by spending time actively outdoors throughout the year than hearing a story about the seasons.

The Froebel Trust (no date) state that children should learn in a holistic way that is non compartmentalised as children are whole beings whose thoughts, feelings and actions are interrelated. Tovey (2007) when discussing Froebel identified the educational potential of natural materials, where children could learn about cause and effect and physical processes. Tovey (2007) explains that whilst Montessori believed in the idea of direct access to indoors and outdoors areas, it differentiates from the Froebel approach as Montessori did not believe that natural materials were educative and argued that structured materials and apparatus were more effective in learning. She believed that children did not learn from just nature but from the scientific pedagogy. For example: Scientific knowledge can not only be used to have knowledge of what plants are but how to transform them. Woods (2007) discusses the Te Wahriki approach that uses Māori epistemology to influence the early years curriculum in New

Zealand the Mana Aotara is the desire to explore and understand all aspects of the world and to use the environment to develop curiosity and to seek answers again showing that natural materials are important to a child's learning. The child needs to develop their "mana" (Their enabling and empowering tool) This is nurtured in the child knowing they are nurtured respected and loved by the adults around them. This almost follows Maslow's Hierarchy of Needs as discussed by Bates (2019) where a child needs to have all their needs met to reach self-actualisation and the Bronfenbrenner's ecological systems theory also discussed by Bates (2019) where the child is affected by the adults and environment around them. Showing again that the child requires an enabling adult to reach their full potential.

White (2020) states that not only is water one of the most important substances on the planet, but it is therapeutic fascinating and full of potential for children's learning. That children are strongly drawn to water and that when children play indoors with water in a water tray it limits the sensory information to the child's brain. Offering outdoor water play, with children investigating natural water such as water from rain, puddles is more sensory and supports the child further to make sense of the world around them. Malaguzzi (1996) discussed a child's view of a city in the rain when it produces a different version of the city for a child to perceive and experience. Whilst the features of the street are there unmoving the rain can cause thunder, change in the colour of the sky, different noises and smells, water streaming down the streets to experience flow of the water, puddles to experience different feeling such as textures and temperature showing that water from nature is a powerful learning resource.

Natural materials such as sand, stones and wood have a high play value and can be used in a myriad of ways as discussed by White (2020) Mathematical Thinking is supported and developed throughout observing the detail, shape, pattern and sorting ordering and classifying the materials. Scientific concepts such as balance can be explored using natural materials in construction as loose parts. White (2020) suggests that adults can support children ensuring they have natural materials to explore in their environment, observing play with the natural materials, and to develop language skills by modelling play and using the correct terminology. By supporting and giving confidence such as telling children they are inventors, scientists, and mathematicians to support role play and encourage free play and independent thinking. Bruner as described by Tucker (2017) had a spiral curriculum theory where children revisited play materials and activities over time but used them differently with each encounter. This can be seen by The Curiosity Approach (2019) used in many settings in Wales today where natural materials are provided to children as an invitation to play, children may choose to sort them into colour, texture, count them, roll them therefore are experiencing different mathematical and scientific concepts each time they play.

Nicholson. S (1971) suggested that everybody was born creative, and that people could use variables, loose parts to awaken their creativity. He suggested that environments lacking in variables limited a child's curiosity, and discovery therefore limiting learning. Wherell Garbowski (2018) shows that loose parts can be used to explore science, technology and mathematics using parts to make items that roll, weighing objects, looking at shape, colour and pattern and using them to see cause and effect whilst constructing and transforming objects using their imaginations, the possibilities are endless. However, Armitage (No Date) explains that loose parts are sometimes presented as small pretty objects such as shells and jewels in wicker baskets in settings and that interpretations of loose parts have changed over time, limiting the learning opportunities. Nicholson's loose parts theory included large planks of woods, stones, brick and other larger variables and that children should have the opportunity to discover all

these variables. It is the practitioner's role to ensure that there are invitations to explore a wide range of loose parts in various environments.

Rosen (2019) points out that the world has all the items that should be included in education for example: bodies machines mountains liquids and more but argues that not enough is done to include practical activities in teaching. He suggests that practitioners should not only make learning fun but for the practitioner to learn alongside children. Geist (2010) explains that negative attitudes towards mathematics in adulthood that are often developed in early childhood have an effect not only on learning mathematics but on the ability to teach it. Montague-Smith (2002), agree and suggest that if mathematics is to be taught effectively teachers own attitudes towards the subject should be addressed, they suggest that the traditional methods of teaching mathematics such as being told how to do a task is not an effective method of teaching for every child.

Maynard and Waters (2007) When discussing their study on outdoor learning environments in four primary schools in the south Wales area they found that many schools have highly managed risk-free tarmacked school playgrounds, they explain that learning would be extended in there were opportunities to play in natural outdoor environments Maynard and Waters (2007b) also explain that to create powerful pedagogical outdoor environments and ensure maximum positive experience for childrens learning, play and wellbeing that. Waller (2005) discusses risk-taking as being a positive influence in children's learning supported by Stephenson (2003) who explains that risk taking in the outdoor environment provides children with potential to build confidence and learn to manage risk. White (2021) explains that practitioners should eliminate hazards in the environment rather than remove all risk to ensure a child can reach their full potential. This is supported by HSE (2012) who state that the goal is not to eliminate risk but to weigh up the risks and benefits.

To allow a child to benefit fully from the outdoors, the enabling adult should provide a risk-managed, curiosity evoking, challenging, engaging environment, they should observe the child, provide support, and reassure the child until can master the task and confidently complete it themselves.

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