

Awe and Wonder-Science and Mathematics in the outdoors.



(French, 2023)

Today, the year one class have visited Broad Haven Beach as part of our outdoor play experience, it is a short walk from the school, however, before leaving, the weather forecast for the day was sunshine and we ensured that each child had sun cream applied and appropriate footwear and clothing, including high visibility vests. The children were partnered up and held hands whilst we walked to the beach. The children are familiar with the route and even though the time it takes to walk to the beach is short, we had the opportunity to discuss the different shapes of the houses we passed, were they bigger or smaller, how many windows they each had and the beautiful seaside colours they have been painted, we also counted how many street lights we passed on the walk, thereby taking a small window of opportunity to introduce mathematical concepts of bigger than, smaller than in accordance with the new curriculum in Wales (Welsh Government A, 2020).

Upon reaching the beach we sat on the steps against the wall which, again, is part of a familiar routine for the children. Shoes are kept on or removed as the children

wish and they are placed on the steps. The beach itself accommodates outdoor play in many forms. The curriculum for Wales states that the six areas of learning are linked and that planning and learning should allow for a cross curricular approach to developing a child's learning journey (Welsh Government, 2021). Broad Haven beach allows for every aspect of the curriculum to be met. The sound and motion of the waves, the sensory experience of the sand and water and the sounds of seabirds all contribute to our well-being, the freedom to run, dance, sing or shout out, lay down and relax whilst looking out to sea or up to the sky for some cloud watching, picking out shapes they make encouraging creativity and storytelling to develop a child's language, literacy and communication skills. The different habitats the seaside includes from land, sea and the countryside surrounding the populated village of Broad Haven invite questions on what animals and plants live where and why? What features or characteristics they may need to survive on land or underwater. It opens discussions on how we can better care for our planet and play our part within our immediate and wider environment linking science, mathematics and humanities.

Before leaving school, the children have been made aware that we are staying within the stream area today. We break the beach up into different sections, the stream, the rockpools and the sea. We denote the area that the children must stay within using football corner flags that we stick into the sand and run bunting around, denoting their safe play area for the visit.

There is a small stream that runs under the coast road onto the beach. The area is surrounded by rocks, sand and the area we play within is the along the mean high tide level, therefore, we are at the strandline that brings in all sorts of surprises. The equipment we have today includes buckets, spades, litter pickers and rubbish bags, magnifying glasses and assorted toys, such as small boats and balls. The stream is very cold today, even with the warmer weather, and several children comment on the fact. One child says that he was swimming in the sea yesterday and it was warm but "the river is freezing!" so we discuss the warming effects the sun has on the sea and how the sea can hold that energy thereby creating the warmer sea temperatures we experience in August and September. We also discuss how this affects the plants and animals that live in the sea, we look at how we cope in the warmer weather, for example, wearing lighter clothing, applying sunscreen, eating ice cream and how animals and plants can't always cope with the change in sea temperatures, even small changes. One child says "We can help by not leaving rubbish on the beach" so the conversation moves onto how we can look after our planet. When asked how we can look after our planet, one child answers "By putting rubbish in the bin" and another child answers "My mammy has an electric car" so we discuss how electric cars can help our planet to which another child answers "I'm going to fly a rocket when I'm older", I reply "Will you do your shopping in your rocket too?" and he replies "No, my mammy does the shopping".

The children are free to play as they choose. A number of children choose to use the buckets and spades to create sandcastles that they decorate using loose parts they collect from the beach, another group chooses to collect stones and decorate them

with the felt tip pens we've brought, one child digs a hole in the sand and creates a vehicle to sit in, using sticks to drive it, he also creates a picnic shelf for all his snacks, created with seashells and loose parts found around him. These activities develop the children's social skills and their creativity in an environment that will benefit their well-being (Welsh Government C, 2020).

The group of three children that I have been observing choose to fill up a bucket with water from the stream and collect stones to put in the water, but one of the children does not like the fact that they all sink to the bottom and asks, "Why can't they float?". I pick up a small piece of driftwood and place it in the water which floats, and I ask if that is better? The child replies, "Yes but, can you find a stone that won't sink?" I suggest that we have a look at why the stones sunk and why the driftwood floated, so we discuss the shape and texture of the stones and the driftwood, the children want to feel both and I ask, "Why do you think the stones sink and the wood floats?" I do this whilst pretending to pick up a very heavy stone and a very light piece of wood. The group laughs at me struggling to pick up the stone and one child says, "The stone is really massive", I reply, "Yes, you're right. It is massive, do you think it's heavy or light?" And they all shout out "HEAVY!". I ask, "What is different about the driftwood that makes it float do you think?". One child answer excitedly, "The stone is really heavy, but the driftwood is light. I could carry a million hundred of them."

One member of the group suggests that we collect other heavy things to sink, displaying a need to understand the concept further and I suggest we each try to find two heavy items to sink and two light to float in our buckets, this encourages the children to think about the properties we've discussed and choose carefully from the items they find. Another child joins in the play and one member of the group explains what we are doing, sharing their knowledge and demonstrating their scientific understanding of the concept of float and sink. We come together again, and we have a variety of items including plastic, a length of fishing net, seaweed, stones and wood, we each take it turn to say which of our items we think will sink and float and then put our theories to the test. Each child takes it in turn to put their items into the bucket of water, demonstrating good listening skills, respect and co-operation. They are thrilled to see that the items they thought would sink did sink and the items they thought would float did float. Their game was an opportunity to develop their scientific and mathematical learning, looking at the concept of float and sink, exploring heavy and light, looking at whether texture may affect the outcome but also shared in their delight when their predictions were successful building their self-esteem and confidence in their abilities.

Today has been a very positive outdoor play session that has helped develop the children holistically, covering each of the six areas of learning and experience.

RISK BENEFIT ASSESSMENT

Location / Activity:	Broad Haven Beach	Date:	25/09/23
Assessor:	Sarah French	Review date:	23/09/23

The boxes in the table below will expand as you type into them; pre-entered text is simply for illustration. You should delete irrelevant items and replace with text relevant to your circumstances.

Your overall risk rating – Low, medium or high – is based on your judgement about whether the BENEFITS of the activity or opportunity outweigh the RISKS.

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Uneven Surface/Loose ground/Pebbles	Gross motor skills Balance skills Improved Freedom of movement and opportunity to explore vestibular and proprioception systems	Trips and falls Broken bones	Everyone	I will ensure that everyone is aware of the hazards, highlighting any areas of loose ground, for example, the pebbles piled up at the sea wall, dips in the sand where children may have been digging previously. I will ensure that everyone is wearing the appropriate footwear or understand the hazards of not wearing any shoes, model walking with arms out to aid balance over uneven ground and maybe play a quick game of following the leader, with arms outstretched over uneven ground.	Low

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Stream/Water/Sea	Water play is a sensory activity to promote health and wellbeing. It promotes mathematics, for example, measuring and estimating. Promotes science concepts, for example, filling and emptying, sink and float and hypothesising what they think may happen.	Falls and slips on slippery stones or pebbles at the bottom of the stream. Children becoming cold if water is cold and clothes are wet. Risk of drowning.	Everyone	I will ensure children are aware that the green/brown stones are slippery which may increase their risk of falling, seaweed that is on the rocks or washed in on the tide can be slippery. I will model stepping carefully whilst in the stream, looking down into the water before manoeuvring. I will ensure that children know to tell an adult if they have a fall straight away and to call out to an adult if they see anybody else slip whilst in water.	Medium
Loose parts	Affords creativity, ignites imagination, promotes exploration and how to overcome challenges through problem solving, social interactions and individual determination	Choking. Throwing may result in injury to others, sharp edges causing cuts and scrapes, items such as sea stones may be heavy and could be dropped, causing bruising	Everyone	I will remind the children not to put loose parts into their mouth, I could model placing a pebble in my mouth and asking "Do we do this?", "No". Do we remind our friends if we see them putting items into their mouths?" "Yes"	Low
Walk to the beach	The opportunity to learn about the environment around they live in. Learn the beginning of crossing the road safely.	Walking alongside the roadside and the risk of a road traffic accident. Children stepping into the road.	Everyone	I will remind the children of stranger danger and not to speak with anyone they do not recognise. I will run through the green cross code again, something we do before any trip to the beach. I will also ensure children know not to speak with dog walkers or touch their dogs.	Medium

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Plants on or around the beach	Touching and exploring life cycles, understanding the living world, the sensory benefits of smell, touch and possibly tasting foraged plants, for example, some seaweeds.	Allergic reactions to poisonous or toxic plants.	Everyone	I will remind children not to touch plants they do not know. I will ensure they do not touch or pull plants from the sea wall for risk of stones becoming loose. I will model safe behaviours such as foraging for plants with an adult. Collecting plants in a basket to examine more closely with a magnifying glass.	Low
Climbing rocks/Rock pooling	Improved gross and fine motor skills. Learning the bodies limitations and how far to reach, jump or stretch for a hold. Risky play. Proprioception and vestibular system.	Falls, scraps, cuts and bruising. Broken bones. Drowning if they fall into water.	Everyone	The children understand through the rules of the beach not to approach rockpools without adult supervision. I will remind them to stay within our designated area for any given visit. Hold hands with an adult if possible whilst climbing over rockpools. I will model safe climbing techniques, for example, always having three points of contact, however, today isn't a rock pooling session but it is good to remind the children the rules of the beach..	Low

Experience exploring outdoor space in photograph	How will young people BENEFIT from this activity?	Hazards and associated risks	Who is at risk?	PRECAUTIONS in place to reduce the risk of injury	Overall risk after precautions RATING: L/M/H
Open area, unfenced	Sensory benefits of being outdoors. Freedom of movement. Sense of space, improving mental health and wellbeing.	Children may wander onto the rock pooling area, or into the sea or onto the road.	Everyone	I will ensure the children know the boundaries. Remind them not to cross the boundaries. I can model playing inside the boundaries and getting a thumbs up from the children, and then playing outside the boundaries and getting a thumbs down from the children. I remind the children to alert an adult if a child is outside of the boundary immediately and not to follow them. All children must wear a hi-visibility vest whilst on our trip.	Low

Articles 28 and 31 of the United Nations Convention on the Rights of the Child states that every child has the right to play and the right to an education (United Nations Children's Fund, no date). Welsh Government (2014) reflects these measures in its play policy which sets out the responsibilities of local authorities to ensure that there is sufficient, good quality, play opportunities for their residents within their areas to allow children the freedom to play outdoors, including spaces such as woodlands, parks, village greens and school grounds. Waller *et al.* (2010) similarly suggest that outdoor play is accessible to all and allows for an element of risky play.

The new curriculum in Wales lays out the six areas of learning and experience including Mathematics and Numeracy which highlights the need for play to form the basis of problem-solving skills, exploring ideas and working with others within the early years (Welsh Government A, 2020). Science and Technology underpins the need for children to learn how the world around them works and to question information that they are given allowing them to become informed, ethical citizens (Welsh Government B, 2020).

The curriculum also sets out the need for schools to design their own curriculum drawing on knowledgeable practitioners to tailor learning experiences and activities

to best support their learners (Welsh Government, 2021). The early years focuses on learning through play supported by a framework of enabling adults, effective environments and engaging experiences and it suggests that adults are fundamental for learning for children, they should model a joyful approach to learning and allow the child to lead the play, taking opportunities to teach whilst observing and engaging in their chosen activities (Welsh Government, 2022).

Children learn best in environments where they feel safe to explore, surrounded by caring and responsive adults (Virtual Lab School, 2023 and Holmes, 2006), highlighting the need for enabling adults (Welsh Government, 2021) who can respond to a child's needs to support them in reaching their full potential (Aubrey and Riley, 2017). Froebel similarly believed that children should be nurtured by knowledgeable and supportive adults (Tovey, no date). In the context of an early years setting, practitioners should ensure children are fed and watered, wearing the appropriate clothing and they are happy and confident in the areas and people that surround them (Maslow). Through building and developing relationships between themselves, the child and the child's family as suggested by Bronfenbrenner (Conkbayir and Pascal, 2014) practitioners ensure the learning environment promotes the holistic learning and wellbeing of a child.

Outdoor play is critical to a child's mental health and well-being (Goodenough, 2013 and McCree, Cutting and Sherwin, 2018) and children are more motivated and happier to learn in the outdoors (GOV.UK, 2016). Froebel believed that all children are born inquisitive and curious, with a need to explore (Tovey, 2022), Piaget similarly argued that children are little scientists with a natural curiosity to learn about how the world around them works and that time in nature is beneficial to their learning (Halfpenny, 2014). The outdoor spaces available to children in settings should offer play affordance for children by inviting opportunities for play through exploration of the environment and the items available within (Early years educator eye, 2016 and Ryder-Richardson, 2013).

Community Playthings (2013) and Griig and Lewis (2016) argue that the opportunities for children to play outdoors have reduced over the last few generations and schools should provide those outdoor environments where children can play, explore and manipulate their surroundings.

This can be a barrier for many settings as outdoor space may be limited or unsuitable for risky play, such as big, tarmacked school yards or very small, grassed areas (Little and Eager, 2010 and Waite, 2011). This is where the role of the enabling adult is crucial in developing those effective environments (White, 2011).

A practitioner may introduce loose parts; Nicholson's theory of loose parts states that they need not be expensive items and that a few changes to an un-inspirational outdoor area may completely transform it in the eyes of a child allowing them to manipulate and create a world of their own whilst learning key elements (Nicholson, 1971) which is now covered by the six areas of learning and experience of the curriculum in Wales (Welsh Government, no date).

Loose parts can be anything moveable allowing play to happen anywhere (Brown, 2012 and Daly and Beloglovsky, 2016), for example, everyday household objects, logs and sticks, cones, pieces of material, anything a child can move around either independently or with help (White, 2013 and Wilson, 2018). Items such as cups, buckets or jugs could be used to learn about measuring, volume and capacity (Montague-Smith and Price, 2012). Paint brushes and water to allow for mark making allowing discussions on how quickly the water dries on a warm day and the beginnings of evaporation. Items such as wooden blocks, sticks, seeds and pinecones to discover and explore living and non-living world, construction opportunities and to encourage the open-ended play suggested by Froebel (Tovey, 2022).

Loose parts, such as those mentioned, allow for endless possibilities for a child to develop their scientific and mathematical understanding, problem solving, creativity, gross and fine motor skills, social skills and vocabulary (Rahadjo, 2019 and Department for Education, 2011). Forest schools with natural items such as stones and sticks give children greater opportunities to explore these concepts, possibilities and the limitations of the play (Moser and Martinsen, 2010).

Adults can allow for greater play affordances, the perception of play in an environment or objects within it (Scarantino, 2003) even where outdoor space or resources are limited, it can be altered to make the environment interesting and inviting to the mind of each child (Storli and Hagen, 2010), ensuring there is access to a variety of textures, differing ground conditions, for example, smooth and flat to run, slopes for rolling down or pushing item up, height challenges such as logs. All of these offer a child the opportunity to take risks, move freely and be curious (Little and Sweller, 2014).

Piaget believed that environment plays a crucial role in the development of a child's mathematical and scientific learning, however, Vygotsky placed more emphasis on the idea that children learn through social interactions with those around them, maybe peers or an enabling adult (Pound, 2014). Both Piaget and Vygotsky were constructivists, they believed that people construct their own knowledge (Lindon, 2012) which links to the Welsh curriculum for non-maintained settings where environment, experience and the supportive adult all encourage and develop child led play (Welsh Government, 2022).

Practitioners may set up challenges for children, for example, a picture card describing how to make playdough using household ingredients and equipment (Preston, no date) introducing measuring skills, and the opportunity to observe through touch, smell or taste to ascertain when they feel the dough is ready. The adult may then extend the play through introducing loose parts such as food colouring and observing how they change when they are mixed or maybe whether the dough will roll down a slope or can be pushed through a sieve examining the properties of their creation.

Piaget's schema theory highlighted the cyclical nature of acquisition of knowledge through carrying out repetitive actions to cement their learning (Davies *et al.* 2014),

for example, filling, moving and emptying wheelbarrows to understand the force needed to push and tip up the wheelbarrow when it is full and empty. Bruner similarly argued that children learn through repetitive actions and that anyone can learn effectively if they are taught at the level that is right for them developmentally (Smidt, 2014) linking again to the enabling adult who should know the children that they support through observing their likes and interests so that they are better placed to provide the support at the right level for each child (Welsh Government, 2022). Vygotsky similarly argued that children learn within their zone of proximal development (Thomas, Evans and Crowley, 2016), for example, a practitioner should know a child's capabilities before considering items or challenges that may be presented.

McGrath (2014) suggests storytelling to teach mathematics, posing problems and challenges through the medium of a story and allowing children to explore their own interpretations or create a new scenario completely, for example, the three little pigs and which home is the most effective as a shelter and why?

Cohen and Waite-Stupiansky (2020) argue that Science, Technology, Engineering and Mathematics should be taught outside as often as possible, utilising natural loose parts, carrying out experiments such as designing and constructing a den after observing an animal shelter or maybe monitoring the seasonal or weather conditions in a regularly visited outdoor area over a longer period.

Montesori believed that practitioners should present children with hands on play opportunities that allow them to choose the direction of their learning (Bradbury and Swales, 2022), for example, filling and emptying cups of water in a water tray, and the practitioner utilising the opportunity to discuss properties of water, measurement, counting and teaching in the moment (Good Start Early Learning, 2017). Howard and McInnes (2011) suggests that children respond better to activities when they perceive them as play, Cremin *et al.* (2015) similarly suggests that providing playful learning opportunities gives children agency over their own learning which helps motivate and spark their curiosity.

Froebel believed in a free flow approach to a child's environment, where there is freedom to move from indoors to outdoors without barriers and freedom to explore in difference spaces for different lengths of time (Tovey, 2012) however, time can be an issue in some settings where snack time or lunch time are set or maybe different classes need to share the same outdoor space, this may result in an adult adulterating the play cycle and restricting the learning opportunities (Sturrock and Else, 1998).

Murray (2014) suggests that in settings some practitioners may feel daunted by teaching mathematics and scientific concepts if they have had a bad experience through their own time in education or they may not be confident in how to apply it to everyday situations, Cooke (2007) suggests approaching mathematics as a language used to problem solve and encourages practitioners to admit when they are unsure.

Some practitioners may have little knowledge of the wildlife surrounding them and, as such, may feel reluctant to partake in activities such as bug hunts for fearing of not passing on the right information (Skarstein and Skarstein, 2020).

(Siren films, no date) suggest ideas to overcome the barriers on how to utilise outdoor spaces more effectively by looking at smaller ratios of adults to children and having knowledgeable practitioners who know when to ask the right questions and when to step back and observe the play.

In conclusion, it is widely accepted that outdoor play is beneficial to a child's well-being and holistic development, unfortunately, setting may struggle with lack of suitable spaces which is where the knowledgeable, enabling adults are pivotal to the success of those areas and the benefits felt and perceived by those who use them. Science and mathematics are part of the new curriculum in Wales to ensure that children learn about and understand how the world around them works and their place within it, some practitioners may feel ill equipped to take the lead on scientific and mathematical learning which is where child led activities should be the norm for early years settings, the adult should follow where the child leads, providing guidance when needed, finding out the information together when required and keeping them from harm whilst allowing for the risky play and risk taking. Most importantly, practitioners should share in the awe and wonder that a child may experience when they are in nature and exploring the environment that surrounds them.

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