

Awe and Wonder – Science, Mathematics and the Outdoors

Portfolio



(Image: Cecen, 2024)

According to White (2014), children can engage in a wide variety of authentic experiences when playing outside that are important, relevant, and meaningful. For young children, the beach provides a rich, immersive educational environment where they can investigate basic science and maths ideas in a fun, natural setting. The beach transforms into a dynamic classroom where science and maths skills are learnt by firsthand experience, observation, and play by letting children explore these ideas in a concrete, physical way.

Children aged 4 and 5 will be visiting the beach as part as a trip linked to their topic work where children are able to explore concepts such as counting and sorting shells, measuring height of sandcastles in which they have built, and water play where the children are able to grasp an understanding of how water interacts with sand and how it flows.

To begin, children will be allowed to explore the nature of counting in a real-life context. Within the Curriculum for Wales (2020a), one of the main components of the Mathematics and Numeracy Area of Learning and Experience (AoLE) for children in the early years is counting. Through play-based learning and discovery, the emphasis is on building a solid foundation in understanding numbers. At the beach, children will be given the opportunity to collect shells and collaborate with peers, discussing the shapes of the shells, counting the shells and furthermore, sorting the shells into categories of their choice. During this activity, children can start to identify numbers and relate them to amounts. It is encouraged for them to recognise and comprehend the numbers that are present in real-life contexts. Children may count up to 10 shells at first, but as their confidence increases, they can move on to bigger numbers, which connects with the curriculum's objective of helping children develop number sense (Welsh Government, 2020).

Collecting shells also gives children the opportunity to explore the Science and Technology Area of Learning and Experience (AoLE) within the Curriculum for Wales (Welsh Government, 2020b) which has an emphasis on curiosity, problem-solving, and understanding the natural world. Exploring shells gives children the opportunity to discover how shells are the remains of living organisms and allows them to learn how living things have different types of shell coverings on their bodies for protection. In line with the Curriculum for Wales (2020), children start to understand the basic concepts of biodiversity and biological processes, which are essential to early science learning. When children come to sorting their shells, they are exploring scientific aspects such as comparison in terms of size or shape for example. In doing so, the basic scientific ability of classification is introduced. Based on identifiable characteristics, children can start to organise and compare shells, gaining an early awareness of how scientists categorise materials and living things. Through observation, classification, and description of the natural world, children are encouraged to think like scientists as part of Curriculum for Wales, which fosters understanding via investigation and comparison. Also, when collecting and exploring shells, children are being exposed to the concept of ecosystems where the beach supports different forms of life. Children benefit from awareness of habitats and the interactions between living things and their surroundings. Through collaboration with their peers, exploring shells may encourage conversation and questioning such as

"where did this shell come from?" and "what lived inside it?" which contributes to children becoming ethical, informed citizens (Welsh Government, 2020).

Secondly, whilst at the beach, children have the opportunity to build sandcastles. Not only does this promote holistic development such as communication skills and gross motor skills, it also gives children the opportunity to explore science and maths skills. Within this activity, children are given the opportunity to measure sandcastles. Loose parts will be added to this activity such as small building blocks to use as a standard measurement unit. Measurement activities are enhanced by the sensory and visual attraction of loose parts, such as stones, blocks, or natural materials. Measurement plays an important part in the Mathematics Area of Learning and Experience (AoLE) in the Welsh curriculum (Welsh Government, 2020). The curriculum has a strong emphasis on practical activities where children measure objects with loose parts and materials. This is in accordance with the AoLE's emphasis on applying mathematical ideas in practical contexts. Children are frequently faced with challenges in measurement tasks that call for critical thinking and problem-solving skills. This supports the AoLE's objective of developing mathematical thinking and strengthening reasoning abilities.

As well as measuring their sandcastles, children will apply scientific skills such as force and stability which allows young children to experiment with the structure of their sandcastles and exploring what shapes can form best in the sand. Young children will be applying these concepts without being conscience that they are using them. This activity promotes curiosity, critical thinking, and observation. Children can develop an understanding of science by asking questions, formulating hypotheses, and testing their theories. When digging to create their sandcastles, children will also have the opportunity to discuss and experiment depth and volume. They can compare the quantities of various shapes and sizes as they fill containers with sand or water. They might discover that a deeper, narrower hole retains more than a wider, shallower one, which could start a conversation about the relationship between volume and depth.

Finally, the children will have the opportunity to experiment how water interacts with sand. This is an engaging activity which allows children to explore properties such as how the behaviour of sand changes when it changes from dry to wet, and applying

scientific skills such as making a hypothesis. This also links to the activity where they build sandcastles. Through experimentation, the children will discover that it is almost impossible to form a sandcastle of their chosen shape with dry sand, but will find that they can mould and form better shapes when water is added to the sand as water fills the gaps between the sand grains. Children will explore the properties of water and sand and see how they alter when combined. This relates to Curriculum for Wales where there is an emphasis on understanding the properties of various materials within the Science and Technology AoLE. Holistically, this also allows development such as language and communication skills where children will ask questions, make predictions, and test their theories about how water affects sand with this activity. It also promotes fine motor skills. Without overly interrupting, adults will scaffold the activity further by making comments such as, "I wonder what will happen if I add more/less water to my sand..." This will allow further understanding and embedding of the new concepts and skills that the children have learnt.

Also, within this activity, children will have the opportunity to create concrete experiences with movement linked to maths and science. They will discover how their footprints change in wet sand compared to dry sand. They will also experience what happens after a wave covers their footprint which should spark further conversation. Children will experiment with water at the beach and discover the flow of water. Children will get an in-depth understanding of the behaviour of water under various conditions, including tides, waves, and currents. Children can predict what will happen when they make changes to the variables, such as adding things to the water or adjusting the sand's angle or depth.

Overall, the beach is an inviting outdoor space for children to explore, be curious and experiment. Also, when connected to affordance and loose parts, Piaget's (1936) theory of cognitive development emphasises how children engage with their surroundings to discover, gain, and develop knowledge. These ideas are important to both Piaget's stages of development and the theories of loose parts and affordance in play, and they help us understand how children participate in active, hands-on play and discovery-based learning.

RISK-BENEFIT ASSESSMENT

Location / Activity:	Visit to the beach – shell collecting, building sandcastles, experimenting with water	Date:	21.09.24
Assessor:	C.Cecen	Review date:	27.09.24

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
Collecting shells	Young children can improve their mathematical skills in a fun and engaging way by collecting shells. By sorting the shells according to size, shape, or colour, children can practise counting and sorting as they collect them. By organising their collections, children will be able to comprehend fundamental ideas like amount and classification. Talking about concepts such as symmetry and patterns present in shell designs additionally develops critical thinking and problem-solving abilities. Shell collection combines learning with play, giving young learners a more tactile and engaging understanding of maths concepts.	- Broken shells: Certain shells or broken shells have a sharp edge that might cut or injure a child/adult. - Allergies: Certain types of shells, saltwater, or sand may cause allergies in some children. - Children could have the tendency to wander when looking for shells.	- Children - Adults	- Children should wear protective shoes. - Before letting children handle shells, adults should examine them. - If necessary, provide gloves for handling. - Keep the adult-to-child ratio high. - To make it easier to identify children, they should dress in bright colours. - Decide on a meeting spot in advance. - Adults should always keep children close by and maintain eye contact on the children.	High

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
Building Sandcastles	For young children, building sandcastles at the beach has several developmental advantages, including promoting creativity, motor skill development, and problem-solving abilities. Children improve their hand-eye coordination and fine motor skills as they dig, shape, and mould the sand. This activity will also allow children to explore measuring and estimation. When undertaken with peers, this exercise also promotes communication, collaboration and teamwork.	-Sand in eyes/mouth: Children may be tempted to throw sand, put sandy fingers in their mouths or rub their eyes with sandy fingers -Broken objects in sand: see above -Digging deep holes: children may dig holes that cause accidents such as tripping over or falling in. -Not using shovels correctly: children may hurt themselves/their peers with shovels when digging the sand	• Children • Adults	- Remind children not to throw sand. - Monitor play to prevent rough behaviour and actions. - Always have water and wet wipes available for cleaning. - Before the children begin digging, make sure the area is free of any sharp objects. - Encourage footwear while walking along the sand. -Remind children of rules when using the shovels. -Demonstrate and model expected behaviour when building a sandcastle.	Medium
Experiment how water interacts with sand	By exploring how water alters the texture and behaviour of sand, turning it from dry to wet, children can gain an understanding of fundamental physics and earth science concepts. Through observing density, evaporation, and absorption, they discover how various materials react to water. Children engage in early hypothesis testing and observation by making predictions (e.g., how sandcastles form better with wet sand), which helps them develop their scientific thinking abilities.	-Children could get swept away by powerful currents, fall into deeper water, or be knocked over by waves. -Safe play spaces can be rapidly reduced by rising tides, which may also catch children or carry them out to sea. -Seaweed, rubbish, and broken glass can injure children. -Cold sea temperatures can cause hypothermia, especially if children stay in the water for too long.	Children Adults	-Always have an adult nearby, keep to shallow water, and be mindful of the tides and water depth. -Keep an eye on the tide schedule and make sure children are playing far from the shore during high tide. Define clearly the boundaries that children can and cannot cross. -Make sure children wear safety shoes and keep them away from areas with sharp rocks or debris. -Limit the amount of time children spend in the water, make sure they're wearing correct swimwear, and make sure they have towels and warm clothes on hand. -Ensure an appropriate adult to child ratio.	High

The Role of the Adult

Williams (2022) emphasises how the Welsh Government (2020) states that “the outdoors provides opportunities to inspire awe and wonder, and allows learners to be themselves in open, relaxed and stimulating spaces.” The role of the adult in an early years setting is to engage with and encourage the children with mathematical and scientific concepts in an outdoor environment. According to White (2014), an important “ingredient” to a child’s experience outdoors is the adult role being “thoughtful, complex, skilled and sensitively managed” (White, 2014, pg 7). Tucker (2014) agrees, and states that a certain amount of adult interaction is necessary for engaging activities to completely enhance mathematical development. The UK's early childhood curricula promote that play that combines child-initiated and adult-supported play is the type that best assists learning.

‘Enabling learning’ is a section provided by the Welsh Government (2023) within the Curriculum for Wales which states that enabling adults are a fundamental key principle to ‘holistic and meaningful development’. According to the Welsh Government (2023), adults must observe, recognise, and react to learners with sensitivity if they are to gain a deeper knowledge of their developmental requirements. To assist children in creating meaning, they must decide when and how to intervene. When children start to collaborate to solve challenges, they should be supported and encouraged to do so. This links to Bruner’s (1976) scaffolding theory where the adult gives a child limited support with completing activities, they wouldn't be able to do on their own. As the child develops confidence and skills, this help is progressively decreased. In outdoor education, scaffolding is recognised as an important teaching strategy. In line with Bruner’s (1976) theory, they believe that scaffolding involves providing children structured support when they work on unfamiliar or difficult activities, especially in hands-on and outdoor environments.

The enabling adults also has the responsibility of creating an enabling environment providing loose parts and curiosity when supporting mathematics and science in the outdoor environment (Welsh Government, 2023). According to Mackley *et al.* (2022) loose parts are natural loose parts materials that can be found outdoors, such as pinecones, leaves, and sticks. Ropes, tires, buckets, and wood planks are examples of synthetic loose parts which are usually created by humans. Mackley *et al.* (2022)

states that the educational goal of loose parts is that they don't have a single, clear play function, therefore, children have more opportunity to solve problems creatively and socially when they use objects that have no clear purpose. Mackley *et al.* (2022) discusses how Nicholson (1971) suggested that using loose parts instead of fixed-object play equipment may provide children with more chances to express their imagination and creativity. According to Nicholson (1971), providing children with loose parts materials in their play areas would enable them to engage in play activities that serve many purposes. Similarly, he argued that since these materials are easily transportable and reasonably priced, with natural resources being free, they could be easily made available outside of the classroom in the outdoor environment.

According to Early Science Matters (2021), children experiment with science as they play with loose parts. They can perform experiments by combining different components to observe what happens and look at the properties of materials such as its weight, size and texture. Through direct connection with their surroundings, children can ask questions and seek answers through this form of play that supports inquiry-based learning.

According to Lipp (2018), maths skill development is naturally encouraged in a setting with lots of loose parts. Playing with loose parts is a fantastic method to introduce early maths concepts while encouraging the kinds of inquiry and critical thinking required for more complex computation. Lipp (2018) claims that many mathematical concepts can be explored using loose parts including counting, sorting and creating patterns. However, Lipp (2018) makes the point that play with loose parts is fundamentally child-led, so striking a balance between adult participation and this can be challenging. Lipp (2018) states the want to encourage the development of new skills while providing time and space for self-discovery.

According to Sandseter, Storlie and Sando (2020), typically, the role of the adult in the outdoors is to watch and observe the play from a distance, ready to join in and follow the children's cues while the children take the lead. Sandseter, Storlie and Sando (2020), also makes the point that playing with objects promotes the use of hands-on skills, whereas pretend play and play with adults and peers demand and improve cognitive abilities and encourage social engagement which is paramount to

developing mathematics and scientific skills. The predictability of children's perceptions and actualisations of affordances should be essential understanding for professionals supporting children's outside play. However, practitioners and facilitators need to understand that each child should be able to use his or her own experiences, thoughts, perceptions, and imagination to develop the play in unique and dynamic ways. (Sandseter, Storlie and Sando, 2020).

This supports Froebel's (1826) play theory. Bruce (2021) explores Froebel's theory on how the role of the adult is facilitating play rather than being direct instructors. Bruce (2021) discusses how children see adults as guides who encourage their curiosity and desire to learn about the world. Adults should follow children's interests rather than dictating activities and, especially when they are outdoors, offer resources or subtly suggestive guidance to enhance their learning. Bruce (2021) also explores how Froebel (1826) believed that allowing children to make their own decisions during play is the greatest way to support their learning. Adults should create spaces that encourage children's independence so they can explore, take risks, and be creative. According to Froebel, the adult's role is to nurture the "whole child"—that is, their mental, social, emotional, and physical development. In this context, outdoor settings are very beneficial, and adults assist children in making connections with the natural world, encouraging movement, creativity, and social contact. (Bruce, 2021).

Veraksa and Sheridan (2018), discuss Vygotsky's (1978) theory and how adults play the role of facilitators in outdoor play, offering children freedom to explore while also offering assistance and direction. It is recommended that adults observe how children interact with their surroundings and intervene to support learning opportunities as needed. This is consistent with Vygotsky's (1978) theory of the Zone of Proximal Development, which states that through supervised interactions, adults support children in developing their understanding. This closely links to Froebel's (1826) play theory.

On the other hand, Waters (2019) identified some key issues with outdoor learning including the how the adult may struggle to see and comprehend play, the children's abilities and the outside environment. Waters (2019) also states how children may be discouraged from conquering their fear of unfamiliar tasks if adults are risk averse or

undervalue their abilities. Furthermore, Waters (2019) concludes their article by making the point that adults who are attentive to the children's interests and who can encourage their development without taking over the activity can facilitate the child's learning when they are in the outdoor environment.

Broadhead and Burt (2012) explore the importance of the role of the adult when it comes to observing children in the outdoor environment. Broadhead and Burt (2012) discuss that in order to promote learning through play, adult observation is necessary. Adults can understand children's interests, abilities, and developmental stages by watching how they interact with one another whilst playing outside. Practitioners are able to adapt experiences that enhance opportunities for learning because of their understanding. This means that adults are able to enhance the outdoor environment to adapt the learning. For example, the need to add loose parts as a way to complete non-standard measuring. Broadhead and Burt (2012) also emphasise the importance of adults having the responsibility to respond to the conversations and behaviours of children. Adults who watch closely can intervene when necessary to direct or extend a child's play through observing how they interact with their surroundings. The social and cognitive growth of children is supported by this active interaction. Broadhead and Burt (2012) emphasise how important it is to record observations in order to monitor the development of children over time. This documentation, which can be shared with loved ones, can include notes, pictures, and videos that offer specific examples of learning. Finally, based on their observations, Broadhead and Burt (2012) propose that adults can improve children's learning by asking open-ended questions. These kinds of questions help children think critically about what they are playing with and exploring, which leads to deeper understanding and interaction with mathematical and scientific concepts.

Similarly, Dietze (2024) discusses how the core of evaluating children's learning and interests is observation. Practitioners who have the ability to observe closely can see firsthand the amazement and interest that a child sparks when they connect with the natural world. But it's more than just watching a child; it's about talking to them, sharing in their discoveries, and understanding what they are thinking.

Woods (2017) talks about how adults can scaffold children's learning experiences through observation. Adults can appropriately intervene when they observe particular

moments of curiosity or challenge, leading children towards greater exploration and understanding. This scaffolding is consistent with developmental theories such as Bruner's (1976) scaffolding theory, that emphasises the value of support in learning environments, especially those that are outdoors.

Furthermore, According to Woods (2017), children can experience mathematical ideas in authentic settings through outdoor play. Measurement, counting, and spatial awareness are taught through practical tasks such as comparing the sizes of items, counting leaves on a tree, and measuring a tree's height. Adults can facilitate observational moments by encouraging children to consider their discoveries critically. According to Woods (2017), the observant role of adults improves children's learning in science and mathematics while also strengthening their connections to their surroundings. Adults play a critical role in helping children develop an in-depth understanding of mathematics and related topics through promoting inquiry, understanding mathematical concepts, encouraging discussions, documenting learning, and providing interesting surroundings.

To conclude, when young children are in the outdoor environment, the adult's role is crucial in creating rich learning experiences, especially when it comes to the development of mathematical and scientific skills. Adults play a more active role in creating an environment that encourages inquiry, critical thinking, and exploration than just observing. According to Woods (2017), adults should actively observe how children interact with their environment so they may create learning opportunities that appeal to children's curiosity. In outdoor environments, adults are essential because they observe, encourage, and enhance the play experiences of the children. Adults may assist young children's natural curiosity and promote important maths and scientific abilities by actively engaging with them, by questioning and using loose parts. Additionally, by observing children play, the adult can evaluate the progress that children are making mathematically and scientifically and share their observations with parents and other practitioners. In addition to supporting children's learning, this reflective approach emphasises the importance that adult engagement is in recognising and encouraging each child's individual learning journey.

I confirm that I have not used any AI tools in the research and creation of this assignment. I confirm that I have not presented any AI generated materials as my own work. I confirm I have copies of my drafts, notes, and other resources I used, which I may be asked to provide in evidence

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