

Student number: 2512177

Module code: ECEY5005

Word count:

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.

Awe and Wonder – Science, Mathematics and the Outdoors.

Portfolio.

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Awe and Wonder – Science, Mathematics and Outdoors.

Part 1 – Photograph of Aberavon beach



Source: Personal image, 2026a

Part 2 - Learning story

A visit to Aberavon Beach.

We arrived at Aberavon beach on a dry sunny summer afternoon. Looking down from the promenade the children were in awe as they gazed down at the sight of the beach. There were seagulls gliding through the air and children flying kites. Child A and child C were jumping up and down with excitement. Child B said, "I can't wait to play in the sand". You could hear the waves as they gently rolled on the shoreline as the water glistened in the sun. As we walked down the steps onto the sand, the children started counting their steps aloud "1,2,3,4,5,6,7,8,9,10". Once we reached the sand child C turned to me and said, "Miss I can see giant letters on the wall." I replied "Wow! Yes, you are right, what letters can you see?". Child C replied, "A for apple."

I gathered the children for a safety talk and to explain the importance of staying safe on the beach and around water. I asked the children if they could tell me what they already knew about the beach and what wildlife lived there. The children were able to acknowledge that there are fish, crabs, starfish, dolphins, sharks and seagulls, that lived in the sea. The children were encouraged to explore the environment while I observed, allowing them to use their curiosity and experience the stimulating environment.

I emptied a bag of buckets and spades onto the sand, and it was not long before child A scooped up some dry sand in a small bucket and was trying to build a sandcastle. The other children all wanted to build their own sandcastles. Child D said, "Miss, why is my castle falling down?" I replied, "It is because the sand is dry, but what do you think would happen if you were to add water to the sand?". The children paused to think about my question and child C replied, "I don't know". I encouraged them to see what would happen when water was mixed



Source: Personal
image, 2026b

with dry sand. Child C and child A went to collect some water from a nearby rock pool. Child A started to pour the water on top of the dry sand in the bucket.

The children noticed that the sand had changed colour and looked different from dry sand. Child A tipped up their bucket and tapped out the sand and said, "I did it, I built a sandcastle and it did not fall over." The children had noticed that wet sand became more solid when water was added. The children continued to build sandcastles, adding different amounts of water which gave the children the opportunity to explore and experiment the difference in the changes of materials when water was added to the sand. The children used maths when building their sandcastles as they were counting how many scoops of sand it would take to fill their buckets. The children discussed the different shapes and sizes of the buckets and how much sand it would take to fill each bucket. The children were using vocabulary such as, more, less, empty, full, light, heavy, round and square when describing the buckets. The children were counting who could build the most sandcastles, they used a stick to write numbers in the sand to keep a tally. Child B was finding this task challenging, child D noticed this and said, "shall I help you?". Child B replied, "no thank you!". Child B persevered and after several attempts successfully built their own sandcastle. This showed that child B had resilience, determination, focus and problem-solving skills.

After the children had built their sandcastles, they drew squares to outline a moat, while learning shape recognition. The children suggested that they wanted to decorate the sandcastles with some shells and little pebbles from the beach. There was a wide variety of different shapes and sizes of shells and pebbles all around us.

Source: Personal
image 2026c



I reminded the children to only pick up items that were needed and not anything that they were unsure of. Child A collected some small shells, while child B collected bigger shells. Child C could see that some of the shells were white and some darker in colour, child D collected small pebbles and feathers. Before the children began to decorate their sandcastles, I asked the children if they could line the shells up from smallest to biggest.

The children worked cooperatively in groups of two to work out the order and placement of each shell. Child D then made a repeating pattern, starting with a big shell followed by a little shell and so on. Child D, then paused for a short time and then started to look at lots of different size shells. I asked, “what do you think comes next?”, Child D selected three different shells and chose the correct size shell next in the sequence. I said “bendigedig, good job!”. I asked the children if they could do the same with the pebbles. The children then made a different pattern with coloured pebbles and stones.

This activity helped the children to gain an understanding of size, order, colour, counting and repeating patterns.

The children were surprised to see that there were so many different types of shells, pebbles and stones on the beach. The children choose to explore the pebbles and stones and I asked them, “Can you describe how your pebble or stone feels?” Child C said, “Mine feels smooth”, child A said, “Mine feels rough”, child B said, “Mine feel smooth too, but it is different to yours”. While looking for pebbles and stones child D noticed a shadow on the sand of myself. Child D picked up a stick and started to draw around the outline of my shadow.

Source: Personal
image 2026d

I asked the children if they could find stones that were small, big, light, heavy, flat, round or square. Once these were collected, I said, “I wonder what we could do with them?”. Child B replied, “We can build a house or a wall.” I replied, “Yes you could, well done!” Child C says, “We could build a tower!” I replied, “What a good idea, shall we see who can build the tallest tower?” The children began to stack the pebbles on top of each other while I stood back and observed from a short distance. Through trial and error, the children noticed that they needed to have the largest on the bottom and the smallest on top. The children were carefully counting each pebble and stone to see who had built the tallest tower. They also watched to see which tower balanced for the longest before falling over.



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The children selected different options when trying to build their towers, this helped to develop the children's awareness of balance, height, size, counting, spatial awareness and problem solving.

The children knocked down their towers and child A decided to drop a pebble into a nearby rockpool. Child B copied this action and said, "Mine made a bigger splash." I could see that the children were interested in the rockpools so I gathered a variety of objects that would float or sink and asked the children to predict what would happen to each object when they dropped them into the rockpool.



Source: Personal
image 2026e

It was interesting to see that the children formed their own opinions on what the result would be and whether the items would float or sink. By doing this the children were learning about the basic concepts around density.

After exploring the rockpool, it was almost time for us to leave the beach. I gathered the children and we sat down for circle time and I asked what they had enjoyed, ensuring to give the children time to reflect before answering. Each child shared what they had enjoyed and what they had learnt during the visit. These included building sandcastles of different sizes, collecting different shape and size shells, hearing the waves and smelling salty air. This showed that the children were exploring their senses during their visit to the beach.

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Part 3 - RISK BENEFIT ASSESSMENT

Location / Activity:	Aberavon Beach Visit	Date:	10th September 2026
Assessor:		Review date:	27th September 2027

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**.

Activity	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 and exploring with sand,	Develop an understanding of how materials change when they are wet or dry. Exploring different weights of objects. Develop fine and gross motor skills through scooping, carrying, pouring, pressing and lifting. Develop creativity, making patterns and building in the sand, supporting mathematical and science development.	Slips, trips, trips and falls Sand could get into eyes or mouths. Hazardous object buried within the sand. Lifting buckets that are full of wet sand. Wet sand is heavier than dry sand.	Children and staff.	Staff to always supervise children effectively. Appropriate clothing and footwear to be worn. Staff to check the sand area before allowing the children to use it and remove any sharp objects, rubbish or animal fesses. Provide suitable and age-appropriate buckets and spades. Staff to explain that sand must not be thrown and must not be put in their mouths. Encourage children to walk around the area and wash hands after the activity.	M

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Activity	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 and exploring shells and other natural objects found in the outdoor space.	Develop mathematical concepts by counting, matching, sorting shells, pebbled and stones. Compare objects using words such as more, less, many, big, small, long and short. Explore different textures, shapes, colours and patterns. Develop scientific thinking by asking questions about where the objects come from and how they have changed. Develop curiosity about the natural environment by using their senses.	Shells, stones, sticks and other objects may have sharp edges and cause cuts and splinters. Choking risk from small objects. Litter, broken glass, or other unsafe objects. Biological waste.	Children and staff.	Staff to check the area before the activity and remove any visible dangerous objects. Children should be reminded that they must inform a member of staff before touching anything they are unsure about. Only suitable, safe objects should be collected. Explain that nothing is to be put into mouths.	L

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Activity	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
Exploring water and rockpools at the beach.	Develop an understanding of water through pouring, splashing and how the tide moves. Investigate reflections, ripples and patterns in water. Support early scientific concepts such as floating and sinking. Encourage children to ask questions about where water comes from. Support physical development through reaching, bending, carrying and pouring.	Water can be deeper than expected. Children could fall or lose their balance. Wet surfaces can be slippery and cause falls. Close to water edge waves and changing tides could create a serious risk of drowning. Cold water and wet clothing could also cause serious health risks.	Children and staff.	Staff to check the water area and weather conditions before starting the activity. Children to stay within the clearly agreed boundary and to be closely supervised near any open water. Shallow water should only be used for child led exploration. Children to wear appropriate clothing and footwear. Staff should check rockpools for depth and uneven surfaces. Children should regularly sanitise or wash their hands after contact with water.	M

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Activity	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
Running, Walking, jumping and moving across sand and other uneven surfaces.	Develop gross motor skills by improving coordination of balance, spatial awareness and confidence. Understanding of different surfaces and terrain. To explore how their bodies move. Support physical wellbeing and give children opportunities to take part in active outdoor play.	Trips, slips and falls on uneven ground. Hidden holes, stones, shells or other objects could cause injury. Collisions if running to fast. Wet surfaces on rocks or steps could become slippery.	Children and staff.	Staff to check the area before the children enter it and identify any spaces which should be out of bounds. Children should be reminded to walk until they are familiar and comfortable with the area. Clear boundaries should be used so children know where they can play. Staff should position themselves so the whole group can be observed. Children should wear suitable clothing and footwear with good grip.	L

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Activity	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
Child led exploration of the beach.	Children can follow their own interests and ideas while exploring. Supports independence, confidence, communication and problem solving. Staff can offer open ended questions and promote children's learning through simple conversations. encourage scientific and mathematical thinking by investigating, comparing, counting, sorting and making predictions.	Getting separated from the main group and become lost. Children may approach the sea or another unsafe area. Picking up unsafe objects or eat something they find. Barbeque and hot coals. Fishing lines and hooks. There could be conflict if several children want the same natural materials or equipment.	Children and staff.	Staff to agree clear boundaries before the activity and use coned off areas. Staff should make sure children are always within sight. Regular head counts should be completed. Minimum of 2 competent adults will be required on the visit Children should be reminded that they must ask an adult if they find something unfamiliar. Staff should be close enough to support children while still allowing independence. The area should be checked before and after the activity. Suitably trained first aider and first aid kit to be brought on visit. List of any children with medical conditions and that all staff are aware. Medications are to be carried by staff.	L

Part 4 - Adults supporting science and mathematics outdoors.

Introduction

Learning outdoors allows young children to learn about science and mathematics through real life experiences. Children can use the outdoor environment to explore what they can see, touch, hear and smell, rather than only learn numbers, shapes, measurement and scientific ideas indoors. The role of the practitioner in supporting science and mathematics outdoors, and how they can provide experiences to develop children's curiosity, problem-solving, communication and independence is discussed in this essay (White, 2020). This essay will discuss and explore how children learn through play, relationships, nature and use of different materials using Froebel, Vygotsky and Nicholson's theory of loose parts. The role of the practitioners will also be covered including the importance of observation, listening, asking open ended questions and knowing when to step back. Alison Clark's recent work on slow pedagogy will be linked to the need for practitioner to allow children time to explore and revisit ideas (Clark, 2023). International approaches such as, Reggio Emilia will also be looked at because they view the environment as an important part of learning (Edwards, Gandini and Forman, 2012). There are many outdoor STEM opportunities that can support maths with counting, sorting, shape, size, pattern, measurement and problem solving. Science can be supported through an exploration of living things, materials, weather, movement, water, light and change (Murray, 2019; Waite-Stupiansky and Cohen, 2020). Outdoor learning is important as children can link learning to real life and develop skills that can be used in different situations. In Wales this also aligns to the Curriculum for Wales and its four purposes, enabling children to become ambitious, capable learners, enterprising, creative contributors, ethical, informed citizens and healthy, confident individuals (Welsh Government, 2022).

The Role of the adult supporting mathematic and scientific concept outdoors.

The outdoor environment can be used to support and offer different learning environment as children are able to move, investigate and use their senses. Grigg (2016) states that learning outside offers authentic experiences linked to life in the real world.

However, Bilton, (2016) refers to the outdoors as an important environment for active learning. Likewise, White, (2020) explains that outdoor space offers chances for children to explore, experiment and make decisions. Sisson and Lash, (2017) also describe outdoor

activities as a way of developing stronger connections with nature. This is also connected to Froebel as he believed children learn through direct experiences, play and relationships with the natural world. Froebelian practice describes the practitioner as offering 'freedom with guidance' rather than managing every part of the activity (Tovey, 2017). Practitioners can set up an engaging environment, allowing them to watch the children and decide when to offer support. The outdoor environment is therefore able to be used in teaching, rather than being seen as a break from learning. An example of this could be, a child building a tower of stones is learning about size, height, balance, counting and problem solving as they investigate gravity and stability. This also supports the Froebelian view that children learn as whole individuals and physical, social and cognitive learning should not always be separated (Tovey, 2020).

Vygotsky's theory helps explain why practitioners have an important role when outside. Vygotsky, (1978) suggested that children have the potential of achieving higher standards with proper support from others. When a child experiences difficulty, the adult can offer open ended questions, language, modelling or encouragement. For example, if children construct a bridge with sticks, the practitioner could ask, "What might make it stronger?" instead of providing the answer. This encourages children to think about possibilities and learn from trial and error. Adult support that helps children move toward greater independence was similarly described by Bruner, (1966). Play can provide opportunities to explore new ideas, communicate and develop understanding through experience (Waters Davies, 2022). Science, maths and technology naturally show through children's play and interests, according to Campbell *et al*, (2018). additionally, children can often learn from each other, as well. One child may be counting using sticks, while another is testing which is the strongest structure. The adult can listen and introduce vocabulary such as longer, shorter, heavier, lighter, balanced and stable. Piaget's work also supports the importance of children being active in how they engage with materials so that they can develop their own understanding (Piaget, 1952). This shows that adults should support children without taking over the learning.

The practitioner's role in supporting mathematics outdoors should not limit the number of activities. Mathematics is everywhere... counting steps, comparing leaves, finding shapes, making patterns, measuring puddles, filling containers and estimating distances. Murray, (2019) proposes that early exposure to Science, Technology, engineering and Maths (STEM) may assist children to develop an interest in STEM. Furthermore, Waite-

Stupiansky and Cohen, (2020) explain how STEM experiences can connect different areas of learning. Therefore, mathematics may help develop children's interests and questions. This can make learning mathematics more meaningful as children can see why the knowledge is useful.

Another important aspect on the role of the practitioner is the work of Alison Clark on slow pedagogy. Clark, (2023) proposes that children need time to explore, listen, revisit ideas and become deeply involved. This is great for outdoor exploration because nature does not always go by an adult's schedule. A child might get interested in an insect, notice a change in the weather, or spend a long time moving water from one container to another. As an adult rushing the child on to the next activity may lose an important learning opportunity. Slow pedagogy, however, does not mean doing nothing by practitioner. They still observe, listen and recognise where a question, resource or new vocabulary could improve the child's learning. Froebelian principles also refer to knowledgeable practitioners who facilitate and guide, respecting children's ownership of play (Tovey, 2017). Similarly, Reggio Emilia considers the environment to be an important part of learning and encourages adults to observe children's ideas (Rinaldi, 2006). So, the adult is a partner in the process of learning, not simply a source of instructions. This is especially important for children who need more time to explore before they can explain what they have found out.

Nicholson's, (1971) loose parts theory can be linked to Froebel and Reggio Emilia. Environments with have a lot of different objects can offer children more opportunities to be creative, discover and inventive. Loose parts for the outdoors can include sticks, stones, leaves, cardboard, fabric, logs and containers. These items can be moved, joined, sorted, counted, measured and used for construction. For example, children may create a den using sticks. They could count the sticks, compare their length, pick which materials are the strongest and see if the structure stands up. Similarly, to the Reggio Emilia idea of the environment as a 'third teacher' as materials and spaces encourage active learning (Edwards, Gandini and Forman, 2012). However loose parts require planning, practitioners need to consider the safety, accessibility, inclusion and developmental needs of the children. Nicholson's theory supports creativity, but adults need to be careful with materials. The adult must therefore provide enough choice and not make an environment that can be confusing or unsafe.

Science support children's outdoor learning and allows them to explore real things as compared to just hearing about them. Children can look at plants, study mini beasts, look at shadows, test if objects float or sink, notice changes in the weather and observe how water moves. Sisson and Lash, (2017) describe outdoor learning as a means of developing children's relationship with the natural world around them. Murray, (2019) discusses the importance of scientific investigation from an early age. Outdoor learning may encourage a child's, wellbeing and social development, but also identified challenges. (Kiviranta *et al*, 2024) Curiosity is essential, because when a child asks, "Why is the puddle bigger today?" they are thinking about science. The practitioner may respond with, "What do you think happened?" and assist the child to look for evidence. Children can watch, predict, test and discuss what they find. The practitioner should not always correct children immediately as their first ideas can be useful starting points. Science outdoors can therefore aid and develop skills of observation, prediction, classification, communication, reasoning and problem solving. Similarly, Johnston, (2005) emphasises the importance of practitioners, peers, the environment and time when young children are exploring outdoors. Children's curiosity may also guide them into wider areas of learning. Children can develop better communication skills by engaging in talking about what they discover, mathematical abilities through counting and measuring, physical growth by climbing and carrying objects, artistic expression by drawing and modelling, and social skills by engaging in teamwork as they explore the natural environment. STEM should not be considered as four separate subjects because these areas can be linked together (Murray, 2019). Similarly, Campbell *et al*. (2018) found that integrated STEM can develop from children's play and interests. Waite-Stupiansky and Cohen, (2020) states that STEM experiences may improve learning by linking science and mathematics to problem solving and exploration. The Curriculum for Wales also promotes learning which links knowledge and skills across various settings (Welsh Government, 2022). Children building a stable tower are learning more than balance. They are talking, they are working together, calculating, matching, guessing, planning and selecting. This can help children become ambitious and capable learners and enterprising and creative contributors. Exploring nature can also create ethical, informed citizens and outdoor movement and independence can create healthy, confident individuals.

International approaches show that outdoor learning can be organised differently. Reggio Emilia values children's ideas, relationships, documentation and environment. International

approaches can offer useful ideas but should not be simply copied without considering local culture and curriculum. Local parks, beaches, gardens, woodland and community spaces can be used by Welsh settings, while also drawing on wider international concepts. There are also issues for adult to consider with outdoor learning such as the weather, clothing, staffing, time, access to suitable spaces, safety issues and adult confidence, these can all have impact. Settings need practitioners who know and can use the environment well. There is also the risk that adults become overly involved and turn child led exploration into an adult directed task. However, adults who always step back may miss opportunities to extend learning. Balance is everything. practitioner should watch, listen, evaluate, ask questions, and provide resources, but give children enough time to explore. Planning session should allow for risk instead of trying to remove it. Outdoor experiences can be seasonal and offer different learning opportunities (Watts, 2020). Adults can set limits, watch the environment, and provide the right resources, while still allowing for manageable challenge. This can help with independence, confidence and problem solving.

Conclusion.

Outdoor learning can offer children real life experiences where science and mathematics can be integrated into everyday play. practitioners play an important role in creating the environment, providing resources, observing children and deciding how to extend learning. However, the practitioner should not take control of every aspect of the experience as children need time and freedom to explore their own ideas. Froebel's ideas show the benefits of nature, play and freedom with guidance, and Vygotsky shows how nurturing relationships help children develop beyond what they may achieve alone. Nicholson's theory of loose parts, illustrates how open-ended materials can enable creativity, discovery and problem solving. Clark's slow pedagogy also demonstrates why children need time to stop, look, listen and revisit their learning. Another useful approach is Reggio Emilia as it values environment, relationships and ideas of children.

Counting, sorting, comparing, measuring, patterns, shapes, position and problem solving can support mathematics outdoors. From this science can be developed by the observation of living things, materials, weather, motion, water, light, and change. Curiosity is important because children's questions can be the starting point for investigations and new learning. These experiences can support communication, physical development,

social skills, creativity, confidence and reasoning as well as science and maths. Outdoor STEM promotes a holistic approach to learning, rather than the separation of learning into different subjects. This links in with Curriculum for Wales as children may develop as ambitious, capable learners, enterprising, creative contributors, ethical, informed citizens and healthy, confident individuals. Ultimately, effective adult support outdoors is a balance of intentional teaching and child led discovery. Practitioners can watch children closely, listen to children, provide appropriate challenges and allow children time to explore, solve problems, ask questions and make sense of the world around them in the outdoor environment.

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Thorne. R. (2026a Personal image) [Photograph]

Thorne. R. (2026b Personal image) [Photograph]

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