

Awe and Wonder: mathematics, science and the outdoors.

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Part 1



(Source: Wemyss, 2025, personal photograph)

Part 2

A Day to Learn New Things at a Rocky Beach

A group of excited children ages 4 to 7 came to the rocky beach with their teachers on a school trip on a cloudy but dry morning. The tide was out which left a large open beach for the children to explore. There were tide pools, pebbles, shells and sand for them investigate, we also brought buckets and spades with us. The adventure began as soon as they stepped onto the sand.

9.30am: Rolling down the sandbanks

A small sandbank covered in soft sand was the first thing the children were interested in. They ran towards it as fast as they could without thinking and laughed as they climbed to the top.

Tia yelled, "Let's all roll down!" Her eyes were filled with joy and excitement.

The children took turns rolling down the hill giggling all the way down. When they got to the bottom, they were excited and full of energy.

"When we roll, why do we go faster?" Leo asked as he brushed the sand off his clothes.

I smiled and kneeled next to him. "What a great question!" I said, "It has to do with weight and gravity, if you roll down a hill it will pull you down. It's faster when the hill is steep!"

Ashleigh asked as he looked around for other things, "Can we try rolling different things?" he said, I replied "of course we can, let's see what we can collect together". The children then searched around them and started to gather small rocks and a beachball they found in the sand. They then went to the top of the hill and started to roll down each thing and discovered the ball rolled the fastest, which made them wonder more about its shape and weight. We then discussed that we could not roll the rocks or beach ball back up the hill without a lot of force and energy, to this Leo replied "it that because of the gravity" I was amazed how fast the children were absorbing the information through curiosity and play.

The sandbank activity supports the Curriculum for Wales because it encourages the children to ask questions and learn more about science. Through curiosity and investigation, the children are learning about basic ideas like gravity and motion as they roll down the hill, which makes them wonder why they go faster. By trying out different things, like rocks and a beach ball, they can see how fast something rolls and compare how shape and weight might affect it the results. This child led activity gives children the freedom to think critically and solve problems, which are important skills for learning science. The activity grows children's interest in the natural world and helps them understand basic scientific ideas. The children also complete progression step one: Being curious and searching for answers is essential to understanding and predicting phenomena (Welsh Gov, 2020).

10am: Getting to Know the Tide Pools

After a while, the children went to the rocky area where there were tide pools. They got on their knees and looked into the clear water; they were interested in the small creatures that lived in there. Leo pointed out a small crab skittering across the rocks and said, "Look at this little crab!" "But why does it hide in the water?" Tia asked with her head tilted full of wonder. I encouraged them to explore and explained they hide to stay safe from being eaten and to also look for food themselves. While they were still looking in the tide pool Lola saw a starfish stuck to a rock. She asked out loud, "Why does it have those little bumps?"

"That's a very good point!" I responded. "They're called tubercles, and they help the starfish move and stick to things." The children took turns gently touching the starfish and were amazed by its colour and feel. They started talking about what they might find in other tide pools, which led to talks about ecosystems and sea life.

Children can learn about ecosystems and marine life by investigating in the tidal pool. By encouraging inquiry, observation, and scientific thinking we follow the Welsh Curriculum. When Leo and Tia see a crab, it makes them wonder how animals adapt and thrive. Lola also asks about the starfish's tubercles, teaching the children animal anatomy and biodiversity. By allowing the children to explore and investigate in the different tidal pools, they can learn about biodiversity, food systems, and interdependence. All these discussions promote curiosity, teamwork, and environmental awareness. The children also complete progression step one: The world around us is full of living things which depend on each other for survival (Welsh Gov, 2020).

11am: Make sandcastles and measure them.

The children then chose to go back to the beach area and build sandcastles there. They got their buckets and spades together and got ready build. "How big can we make our castle before it falls down?" Leo asked, the children then worked together to build the biggest castle possible. The children filled their sand buckets but when they turned the buckets over the sand tipped out dry and flat, Ashleigh asked "What if we add water to the sand? Will it be stronger?" I replied, "That's a good idea, Let's give it a try and see if it works better." By adding water to the sand allowed them to experience change in texture, density and texture. After adding water to the sand Ashleigh then tried turning the bucket of sand over again but this time the sand poured out fast and soggy. "Aww no" Ashleigh cried. "I wonder why that happened" I said watching Ashleigh think about it for a moment. "it is too wet now" he said "we need to put more dry sand in the bucket" he suggested, "great plan, let's try again" I said to him. He added more sand to the bucket and this time it worked perfectly. "Yay!" he yelled, I could see how proud of himself he was. They learnt about structure and support by playing around with different amounts of sand and water, they also learned trial and error and teamwork. Tia then grabbed a stick to use it to measure how tall the castle was, and all the children decided that it would be great fun to see how big their castles were too. This led to the children talking about who has the biggest castle and who has the smallest castle.

This activity supports the Maths and Numeracy in the Curriculum for Wales, especially when it came to using words like bigger, smaller, taller, and shorter to compare and order numbers. Also getting to know standard and non-standard units of measurement by using the stick as a creative way to measure. It also requires reasoning and fixing problems by thinking deeply about how to make the castles stronger and more stable. During the activity children also shared tools, talked about ideas, and learning through teamwork which are all examples of working together. This activity naturally got the children to think about maths through play. It showed that maths isn't just something that happens at a table but is also a part of exploring and being curious in the real world. The children also complete progression step one: The number system is used to represent and compare relationships between numbers and quantities (Welsh Gov, 2020).

Part 3

RISK BENEFIT ASSESSMENT

Location / Activity:	Beach	Date:	12 th September 2025
Assessor:	Gemma Wemyss	Review date:	

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
Rolling down sandbanks	By rolling down sand dunes, children can learn about science and numbers. This is because it teaches children about motion and gravity, as well as how to keep track of their surroundings and stay balanced. Things like friction and acceleration change how they roll, which is a fun way for children to learn about physics early on. They use math to guess lengths, speeds, angles, and slopes, which helps them learn how to measure and solve problems. It helps the brain grow by making them more aware of their body and better able to coordinate their moves. Little children walk around to guess, do easy tests, and see how one thing changes something else. Scientists need to be able to think and reason in these ways. This is a fun way for children to use what they've learnt in science and maths in real life.	Steep or uneven sandbanks might cause children to lose control and hurt themselves which could lead to the possibility of sprains, bruising, or falls. children could get Cuts or injuries from hidden things like rocks, sticks, or broken glass. A crowded or unsupervised place may result in collisions with other children. There is a chance that sand will get into children's mouth or eyes, which could irritate them or cause choking. wet sand can become slippery, and children can slipover hurting themselves. Weather could be hot and children could get sunburned.	children	The sandbank should be checked before the children start playing, you should check for dangerous things like glass, pebbles and sharp sticks. A small slope that is safe for the children's ages should be chosen. Also, to avoid crashes, you should only let a few children roll at a time. To keep their skin safe, children should wear the right clothes. We need to make sure the children wear sunscreen and drink a lot of water when it's sunny to avoid dehydration. we need be able to rapidly respond to any incidents or injuries by keeping a close eye on the children with the correct ratio of teachers to the number of children. Also, a first aid box should be brought in case of any scrapes or cuts.	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
Exploring tide pools	Tide pools are a fun and educational way for children to learn about nature. They're not just having fun as they look for crabs, starfish, and sea anemones. They're also learning how to be curious, ask questions, and pay attention to what's going on around them. The cool water, salty air, and slippery rocks all work together to provide them a number of distinct sensory experiences that help them grow in both body and mind. It's also a chance to boost their self-esteem, balance, and coordination. A great part is also telling friends and family about these findings since it makes children care about nature and learn how to protect it for the future.	Children might easily slip or trip on slippery pebbles, which can make them fall or scrape themselves. If a child touches a crab or sea urchin with their hands, they might experience a pinch or sting. The sea can also be unexpected, if practitioners are not paying attention and checking the tide times, the tides might rise suddenly and catch them off guard which could lead to drowning. If children are not dressed correctly, the sun and cold water can injure them too by sunburn or hypothermia.	Children and practitioners	Suitable shoes with a good grip can help stop the children from slipping on damp, rocky ground and keep their feet safe from sharp shells and creatures. It is very important to keep a close eye on children, especially while they're climbing or moving around on uneven ground to try and prevent falling. Exploring tide pools should be done when the tide is low and to know when the water will come back in so that no one is caught off guard. If we teach children to look with their eyes and touch lightly, they have less chance of getting stung or pinched. It is also a good idea to have sunscreen, hats, and a small first aid kit on hand.	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
Making sandcastles and measuring them	Building and measuring sandcastles is a great way for children to learn and develop. As they determine the height and width of their castles, they are also unknowingly learning numbers. At the same time, children can demonstrate their creativity by creating a variety of original designs. In addition to strengthening and improving hand coordination, working with friends teaches children how to communicate and share. It's also pleasant to be outside in the fresh air, and children feel more confident after seeing what they've created.	Sand can be uneven or slippery at times, it's easy to trip and get a tiny scrape or bump. There could be sticks, litter or sharp shells in the sand that could scratch or cut children's hands or feet. Also, sand can get in their mouths or eyes, which can be painful or uncomfortable. If children spend too much time in the sun without a hat or sunscreen, their skin may turn red, or they may feel hot. Also, waves and tide times can make it a little dangerous to play too close to the water with a risk of drowning.	Children	Wearing shoes or sandals to protect children's feet from sharp shells and rocks that could be hiding in the sand. Practitioners should always keep a close eye on children, especially while they're near the water, so they don't wander off or slip on the wet sand. Practitioners can protect children's skin from the sun by wearing a hat and sunscreen. Children will be less likely to get wounded if practitioners teach them to be careful with the sand and watch out for sharp things. It's also a good idea to keep a first aid kit on hand in the event of small cuts or scrapes.	Low

Part 4:

According to Gov (2019) when children are outside, they can play and learn about maths and science in a fun natural way. Adults can really help children get involved in this way by using methods that encourage them to explore, ask questions, and think critically. This assignment looks at how adults help and encourage children to learn these things outside and how their actions are linked to significant ideas, studies, and government plans, such as the Curriculum for Wales 2022. Williford et al., (2013) states that adults engaged with young children are not merely observers; they are educators who actively involve the children in their own learning processes. Vygotsky's sociocultural theory, which emphasises the significance of social interactions for cognitive development, supports this position. Adults may facilitate children's learning by providing age-appropriate support and promoting exploration and inquiry. Adults are very important in making sure that children may explore and learn via hands-on experiences without getting hurt. This means looking around attentively for any possible threats while still letting them explore and interact with the environment around them. Vygotsky's theory of scaffolding (Berk and Winsler, 1995) and Bruce's approach to learning via play (Bruce, 2011) both support the idea of giving children "freedom with guidance."

It's also important to encourage curiosity. The role of practitioners and care givers is to help a child be naturally curious by asking questions that don't have a clear answer and encouraging a culture of inquiry. For instance, asking children what they think will happen when dirt and water are mixed might help them learn more about materials and how they work (Kozulin, 2024).

Adults can also teach children basic maths and science while they play outside. Children can learn about balance, symmetry, and measurement by doing things like building with sticks, stones, or leaves. When adults are involved in these activities, they not only assist children learning, but they also help them become more independent and think critically, this links to Bruner's theory that children learn best by doing, he believed hands on experiences that he called the "enactive" stage of learning is vital for children to learn the world around them (Bruner, 1966). There are many excellent contexts for mathematical research that can be found in outdoor situations. This engagement can be facilitated in several different ways by adults. To begin, they have the potential to generate opportunities for numbers and measurements. Mathematical principles can be included into play through activities such as counting the number of steps to a tree or measuring the height of plants using non-standard units (such as hands or feet). The findings of a study conducted by Clements and Sarama (2007) highlight the fact that children's comprehension of mathematics is improved when they are exposed to real-world contexts and manipulatives. Developing mathematical thinking through interactive activities is something that adults can do. For instance, children are encouraged to count, sort, and categorise natural objects using nature scavenger hunts, which include

mathematical thinking into the play experience. According to Miller and Almon (2009), adults can present children with checklists that challenge them to locate and quantify items, thereby strengthening their ability to count and properly categorise items.

Another method that is beneficial is the construction of buildings. It is possible for adults to encourage children to design structures using natural materials, which can then lead to conversations about the concepts of assessment and equilibrium.

According to Bruner's theory of representation, infants learn through action and the manipulation of objects (Bruner, 1966). This hands-on method is consistent with this theory. Children should talk to each other about maths when they're young so they can learn the language and get better at it. The role of the adults can help with this by utilising maths language while they do things outside. Children learn maths better when they use words like "more," "less," "taller," and "shorter" in their lessons.

According to Gibson's (1979) affordance hypothesis, the way children interact with their environment affords them chances to learn. Adults can also help children learn how to solve issues by assigning them tasks, such finding out how many sticks they need to make a fort. Practitioners can do this by displaying it to children. Duncan et al (2007) say that doing things like this helps children use maths in real life. The outdoors is also a great place for inquiry-based learning, where children may learn about science by doing things. The role of adult to help with this inquiry would be to encouraging the children to look around. Helping children pay close attention to their surroundings and notice changes in vegetation, weather, and animal behaviour helps them learn more about the natural world.

This method is in line with Malaguzzi's philosophy, which says that observation is an important part of learning (Malaguzzi, 1996). Adults can help children learn about science by taking them on nature walks or having them work on gardening projects. Children learn about different ecosystems, plants, and animals when they go on nature walks. This makes them more scientifically literate and helps them understand biodiversity (Kahn & Kellert, 2002). Gardening and other hands-on activities helps children learn about plant biology and the life cycle. Adults may assist children, talk about how things grow, die, and depend on one other, which links science to everyday life. One way to encourage scientific thinking is to get children to ask questions about what they see. Adults could ask children questions such as, "Why do leaves change colour?" to urge them to think. Children are interested in learning more about plant biology and environmental science when they are asked questions like these (Foundations of Science literacy, no date). Children can also learn socially by working together and talking to each other when they do things like creating houses for bugs or participating on a nature scavenger hunt. This collaborative approach aligns with Vygotsky's concept that learning is naturally a social process (Gowrie, 2025). Play is a crucial aspect of early childhood development and is vital for learning to work. Froebel's Play Theory says that play is a way for children to connect with the world around them (Tovey, 2016)). Children

can learn about maths and science through many sorts of play. For example, children can learn about these principles naturally when they play freely, for instance children can learn about volume and buoyancy by playing with water. The role of the adult is also guided play, when adults give children tools and advice but let them choose how to explore, keeps a balance between freedom and direction. Nicholson's loose parts theory suggests that giving children a lot of diverse things to deal with helps them be creative and solve issues. Loose parts play is based on this. The role of the adult with the loose parts theory would be to allow children access to loose parts and to explore with them and encourage imagination, for example asking a child "what do you think we could make with is" and allowing them the freedom to be creative. Children can play with them in numerous ways, which helps them learn maths and science (Smith-Gilman, 2018). "Sustained shared thinking" occurs when children and adults work on a task together for a long time. It helps them grasp things better. Adults can ask children questions that make them think and explain their reasons while they play. This helps them think critically and reflect (Siraj-Blatchford I, 2009). The Curriculum for Wales (2022) says that learning outside and via experience is very essential. Adults may make learning entertaining by making the content engaging, encouraging children to ask questions, and motivating them to think critically. Adults may help children learn maths and science outside by making sure that the things they do fit with what they are learning in school (Hwb, 2023).

The curriculum encourages learning by doing, and it realises that being outside is a terrific way for children to learn maths and science. It emphasises the importance of overall progress, which is in line with the premise that children learn best when they can relate what they learn in different areas. The curriculum also stresses learning via play, which is crucial for young children because play is a terrific way for them to learn. Adults support children by following the curriculum (Welsh Government, 2023). Playing outside is healthy for children, but they might not want to do it as much if they're worried about safety. Adults need to establish a balance between the hazards and the need for children to learn by doing things. This includes keeping an eye on the area for prospective threats while the children play. It could also be a problem if adults don't have enough resources. Adults may need to battle for better access to natural environments for learning because access to outside places and resources might be highly diverse. This kind of action can mean working with schools, local groups, and other organisations to make outdoor learning more available (Little, 2020).

Adults may also need training to effectively integrate mathematics and scientific concepts into outdoor instruction, if they so not adults may struggle to effectively teach mathematics and science in the outdoors without the proper training. This can make children miss out on chances to learn, and for adults to provide inaccurate answers to questions the children may have. Children may also lose their curiosity and interest in learning without an adult who is also involved and interested. Adults who are not confident in themselves or maths and science could neglect outdoor

lessons altogether and just teach them in a boring way which makes it harder for children to understand and get interested in these subjects. Inconsistent teaching quality can also make learning experiences varied and make it harder to achieve curriculum goals. If adults do not keep up with their studies, they may feel unprepared or overwhelmed, which might make them less motivated and enthusiastic. Adults who keep studying feel more confident, stay up to date with relevant information, and give children excellent, useful and fun outdoor learning experiences (Perry et al, 2007).

Conclusion

Adults are highly crucial for teaching children maths and science outside. Adults can help children become more curious and think critically by offering them a lot of chances to learn, encouraging them to ask questions, and allowing them to explore their surroundings. Being outside is another great approach to keep children's interest and set the stage for lifetime learning. Adults may help children learn maths and science successfully while still letting them play outside by employing reflective practices that follow the right theories and government rules.

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Appendix

I have not used AI