

Awe and Wonder – Science, Maths and the Outdoors

Section 1



Section 2

Feature 1 – Pebbles

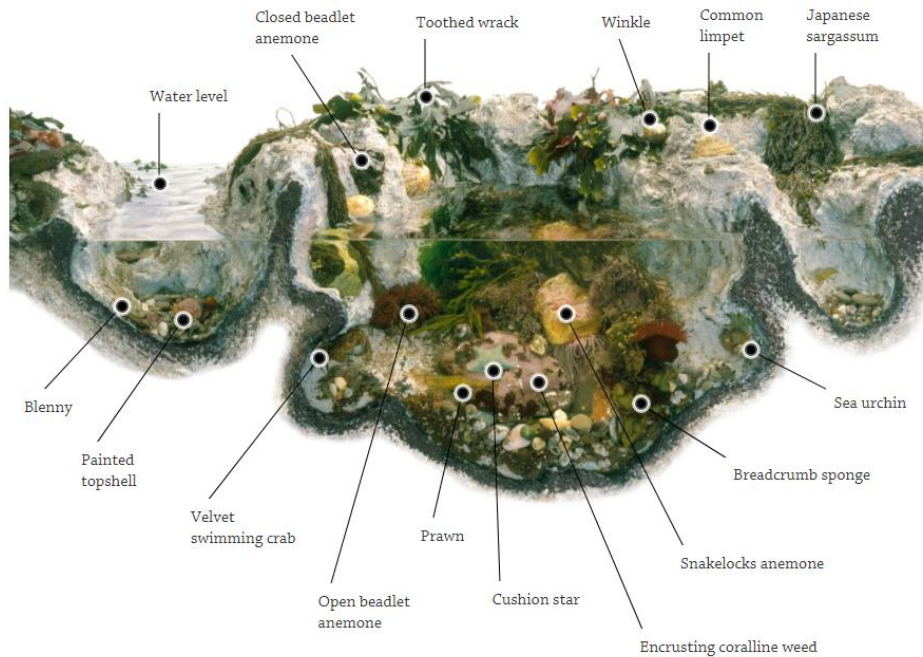
Pebbles are perfect to be used as loose parts, there are many different sized pebbles in the picture which could be used to develop a variety of maths concepts. Examples can be seen in the table below.

Activity	Concepts/skills developed	Link to curriculum
Collecting pebbles in a bucket.	Size and weight - when picking them up and carrying them. Talk about how big and heavy they are.	.
Sort into groups according to size	Grouping	Maths – statistics – step 1 I can group sets into categories
Placing pebbles in a line from smallest to biggest.	Ordering according to size	Science – matter – step 1 I can identify, follow and begin to create sequences and patterns in everyday activities
Count the pebbles	Counting using one to one correspondence	Maths – number system–step 1 Experience and explore numbers in outdoor environment

Use pebbles to form numbers.	Recognising and writing numbers.	Maths – number system–step 1 Write numbers using a multisensory approach
Estimate how many pebbles are in each bucket.	Estimation	Maths – number system – step 1 I can use mathematical language to describe quantities, and to make estimates and comparisons such as ‘more than’, ‘less than’ and ‘equal to’.
Write numbers on the pebbles	Number recognition	Maths – number system–step 1 Experience and explore numbers in outdoor environment

Focusing on exploring cardinal numbers and number recognition an activity that could be done with this feature is for the adult to provide children with a bucket which has a number, and maybe dots to represent that number drawn on the outside. Then ask them to collect and put the correct number of pebbles into that bucket. The adult could talk to the children and introduce vocabulary such as larger, smaller, heavier, lighter, full, and also encourage the children to count out loud the number of pebbles. They could expand they activity by discussing the number of pebbles and talk about how much space is left in the bucket and how many pebbles they think would fill it, encouraging the children to estimate.

Feature 2 – Rock pools



(Source: DK findout!, 2021)



(Source: Matthews, 2021)

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The second identified feature is rock pools. These give many opportunities for exploring and learning about living things and their habitats and open up opportunity for lots of discussion around the natural environment, the tides of the sea and how the rocks were formed. Simply climbing and walking over the rocks helps develop balance and vestibular sense.

Activity	Concepts/skills developed	Link to curriculum
Investigate the rock pools and look closely and carefully at the creatures and plants living there.	Life Cylcles – living things – habitats Being Curious	Science – living things – step 1 I can recognise that plants and animals are living things which grow. Science – living things – step 2 I can explore relationships between living things, their habitats and their life cycles. Science – being Curious – step 1 I can show curiosity and question how things work. I can explore the environment, make observations and communicate my ideas.
Walking over and around the rock pools on uneven and unlevel slippery surfaces	Forces Encourages balance and vestibular sense	Science – forces – step 2 I can communicate the effect forces have on myself and on objects.
Using a camera to take photos of what they find	Digital technology	Science – computation/digital – step 1 I can experiment with and identify uses of

		a range of computing technology in the world around me.
Look on the rocks for limpets and count how many you can find on one rock. Compare with other rocks.	Habitats, living things, counting, Comparing quantity, more, less.	<i>Science – living things – step 1</i> I can recognise that plants and animals are living things which grow. <i>Science – living things – step 2</i> I can explore relationships between living things, their habitats and their life cycles. <i>Maths – number system–step 1</i> Experience and explore numbers in outdoor environment Maths – number system – step 1 I can use mathematical language to describe quantities, and to make estimates and comparisons such as ‘more than’, ‘less than’ and ‘equal to’.

Feature 3 Sand/beach

The beach offers lots of opportunities for learning and holistic development. Pebbles (as mentioned above), sticks, shells and other natural loose parts can all be used alongside the sand, for example to make marks, build and count. Children can use buckets and make sandcastles or dig a whole with a spade to discover the wet sand and water below. There are further examples in the table below.

Activity	Concept / skills	Link to curriculum
Dig holes in the sand, compare wet and dry sand. Mix water with sand.	Being curious, compare materials	Science – Matter – step 2 I can observe and describe ways in which materials change when they are mixed together.
Mark making using fingers/sticks	Number recognition/formation	Maths – number – step 1 I can notice, recognise and write numbers in a range of media, through a multisensory approach, from 0 to 10 and beyond.
Making sandcastles using buckets, counting them, and adding shells to decorate.	Capacity, Full, empty, coordination, physical, counting	Maths – number system – step 1 I have explored forming a quantity in different ways, using combinations of objects or quantities.

Metal detecting	Curiosity, energy,	Science – forces & energy – step 2 I can explore and communicate the basic properties of light, sound, electricity and magnetism.
Watching the tide and talking about how it wets the sand – covering the beach and washing away sandcastles.	Curiosity, force, gravity	<i>Science – forces – step 2</i> I can communicate the effect forces have on myself and on objects.

RISK BENEFIT ASSESSMENT

Location / Activity:	Pebble Beach	Date:	17/09/2021
Assessor:	Kelly Matthews	Review date:	17/03/2022

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
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ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Collecting Pebbles in buckets	Experience different surfaces such as wet/uneven which is good for developing balance and developing vestibular sense. Physical Development - Lifting and carrying different sizes and weights. Improve hand eye coordination Can support schemas such as transporting. Sensory experience – from feeling the different textures and surfaces of pebbles which may be rough, smooth, or wet	Heavier pebbles could cause loss of balance and cause children to become unsteady and fall. Walking over an uneven surface could result in injury from slips and falls.	Adults and Children	Discuss the different surfaces they may come across and the importance of taking your time and treading carefully over uneven or slippery surfaces. Ensure the children are wearing suitable clothing and footwear, such as trainers. Discuss and practice lifting heavy objects, talk about balance and standing steady and safely before lifting.	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Climbing over rocks and exploring the rock pools	Develop awareness of other living things, explore different habitats and learn to be considerate of other living things - become ethical citizens. Climbing develops balance and awareness of different surfaces/ children may have to climb onto higher rocks or jump down off a rock onto the sand. Children become aware of their own bodies and develop proprioception.	Slippery, uneven surface may cause children to slip and injure themselves, resulting in cuts, bruises or sprains. Living things may bite or sting, some children may experience a reaction. Water – children may slip into the water, could get water onto face or in mouth.	Adults and Children	Ensure children are wearing suitable footwear and clothing such as trainers and long trousers. Discuss how we should be careful around other living things and not to touch them as they may bite/sting. Talk about the types of creatures they may come across and the importance of respecting them. Reinforce the importance of nothing goes in your mouth and washing hands afterwards and keeping hands away from face and mouth. Make children aware of the boundaries, how far they are allowed to go and to know when to ask for help from an adult. Ensure correct supervision	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Metal detecting on beach	Encourage curiosity and inquiry – children will be excited to find treasures and possible research to find out what they are. Social and language development - Children will ask many questions as they often want to know how the metal detector works. Physical development – coordination will be improved carrying the detector around and holding it steady.	Sharp/dangerous objects which may be found	Adults and Children	Wear gloves for picking up any objects found. Call an adult when something is detected for guidance. Discuss the possibility of finding dangerous objects and the importance of being careful. Take an appropriate bag/box to safely dispose of any dangerous object without putting them back onto the beach. Ensure children are suitably supervised	L

ACTIVITY	How will young people BENEFIT from this activity?	Possible hazards	Who is at risk	PRECAUTIONS in place to reduce the risk of injury	Overall risk RATING: L/M/H
Digging	Gross manipulative skills will be developed through digging with large movements, and physical strength will be improved. Children will develop their sense of balance and proprioception as the stand and lean over the hole to dig and be careful not to fall in. Curiosity and discovery – children will be excited to see the wet sand and water below the sand.	Children could lose their balance when leaning over to dig deeper and may fall in the hole. This could result in injury. Water – the tide may come in and fill the hole with water. May find dangerous objects such as glass or sharp cans which could result in cuts and even infections.	Adults and children	Remind children to have an awareness of their surroundings and to be careful. Discuss the possibility of digging and finding dangerous objects and the importance of not picking anything up without gloves. Explain the importance of calling an adult for help where needed. Ensure appropriate supervision. Discuss boundaries and not to dig too close to the water.	L

Section 4

There are many ways that adults can support and encourage children to engage with mathematical and scientific concepts. Choosing a suitable environment for the children to learn in is an important part of this. Outdoor natural environments such as the pebble beach in the picture provide many opportunities for exploration, creativity and investigation which are closely linked to learning of science. According to Wisbey (2018) we should just look outside to recognise the potential of the outdoors to provide opportunities for mathematical learning through a wealth of natural mathematical resources. Similarly, Tovey (2021) talks of the importance of the outdoor play environment and the potential it has to promote curiosity, imagination and creativity. Froebel believed that the quality of the environment and interactions it enables are vital. Adults should allow children space and time to explore and learn at their own pace. Children often respond better to learning experiences offered outdoors where they can have freedom to explore and to behave and interact differently to how they would indoors. Outdoor provisions should not be seen as an option or as an extension of indoor provision, it is an essential part of daily life for children. It is important that the adult shows awareness and flexibility as children behave and react differently to spaces available and created outdoors. Young children should be enabled to spend as much time outdoors as indoors White (no date). Wisbey (2018) and White (no date) echo this view, Wisbey (2018) states that outdoor and indoor favourable environments are equally important and work together as natural extensions of each other while Jan White (no date) suggests the role of the adult in outdoors environments should be given as much thought and consideration as it would be indoors.

According to White (no date) outdoor play allows children to satisfy their intense desire to experiment and explore and become aware of their environment and other living things. Children become fascinated and curious outdoors and experience awe, wonder and joy. However, this type of high-quality play and experience can only happen where children are not rushed and have the time

to become deeply involved. Brunton and Thornton (2013) suggest that where children are exploring and investigating, the most challenging decision for adults is to know when to intervene and when to stand back.

Children are able to make sense of abstract maths ideas by discovering maths outside it can make it feel real to children and less disconnected from daily life (Robertson, 2017). Similarly, Tovey (2021) states Froebelian educators allow children the opportunity to have rich real-life experiences and through offering 'freedom with guidance' they encourage and expand their interests. This approach is not to instruct but rather to guide and enable.

Mathematical thinking is naturally used by children as part of their outdoor experiences, and creative play. Measuring, estimating, counting and exploring shapes and colour is all part of nature's maths that the outdoor environment brings. (Wisbey, 2018).

"Everyday learning is a foundation for scientific learning" (Vygotsky, 1986) cited in Campbella and Speldewinde, 2020) There are many opportunities for learning science and developing skill-based learning in the outdoor environment. Learning in science is not only about conceptual understanding. (Campbella and Speldewinde, 2020). This is supported by Thornton and Brunton (2013) who state that young children should be encouraged to develop a love for science and focus on activities which they find interesting and exciting, their experience of science should not be mainly focussed on the development of conceptual knowledge. (Thornton and Brunton, 2013).

Tovey (2021) states that some of Froebel's key ideas were that a child's learning could be enhanced by play which is open-ended and creative and through allowing freedom with guidance. Froebel recognised the importance of connecting with nature and all living things. The role of the adult according to Froebelian principles is to observe, support and extend the play and learning of children.

Campbella and Splendewinde (2020) suggest that the outdoor environment provides affordances for learning science through both loose parts and fixed materials which allows children to learn through play. Being outdoors allows opportunities for children to improve their understanding of science concepts, however such learning is also impacted by the scaffolding of the adult.

Close secure relationships with adults enable children to feel emotionally happy and secure and this is when they thrive. Froebel considered that children learn best when they experience things for themselves such as through gardening, and are able to solve problems, talk and play through self-activity. Children learn to appreciate the natural world and how to take of it by exploring and playing outdoors, and through activities such as gardening (Tovey, 2021). Similarly, Duglan (2015) noted that where children had opportunities for open-ended experiences in line with their interests their involvement was prolonged and they had more personalised interactions with adults

Andersson and Gullberg (2014) suggest that it is common for early years practitioners to have negative feelings regarding science. This can be due to practitioners having little subject knowledge and not being confident in answering children's questions. Tinney et al (2020) designed a professional learning program aimed at improving confidence of practitioners in supporting children with critical thinking, curiosity and science concepts. It was noted that many practitioners were afraid to get it wrong and reflected on their own experiences of 'Science' thinking back to their days at school. One of the key aspects of the program was to encourage practitioners to use 'Science talk' with children, where questions such as what do you think happens if.. and other open-ended questions. According to Thornton and Brunton (2013) Where the adult uses open questions, children are encouraged to express their ideas and opinions, investigate and explore and to use this knowledge to problem solve in other contexts.

Tinney et al 2020 suggest that children's early interests in problem solving, science concepts and critical thinking is considerably influenced by the role practitioners play in engaging them. According to Thornton and Brunton (2013) The idea of children and adults working to together as co-constructors of knowledge has come to underpin good practice in early years education in the UK

Thornton and Brunton (2013) suggest modelling is a very effective way to foster young children's scientific skills, dispositions, and attitudes. Through showing interest and being enthusiastic, thinking out loud and commenting on what the children are doing adults can model an enquiring mind and positive attitudes which the children themselves will pick up. According to Tucker (2005) quality adult involvement is needed in all play at some level if mathematical development is to be supported.

Welsh Gov (2020) states that children's development of science skills is not linear but progresses in a cyclical way through revisiting and building on existing knowledge. A holistic approach is used in the early years with children asking questions and exploring the world around them.

An important part of the adult role is to provide children with an interesting environment, this may include introducing resources to a particular space or allowing children freedom to explore natural environments. Loose parts support creative thinking, trial and error, discovery and curiosity and provide children with the opportunity to engage in scientific and mathematical learning through their usual holistic play.

Creativity, exploration and inventiveness are all inspired through loose-parts (Nicholson, 1972).

According to Rahadjo (2019) Science is linked closely to creativity and invention and can be supported using loose parts. Loose parts are in the environment around us are available in nature and do not need to be bought from shops. An example of this is the pebbles found in the image in section 1.

Unlimited possibilities are created with loose parts and children's creativity flows through the use and freedom of loose parts. They contribute to the holistic development of children and can be used to develop many skills such as Fine and gross motor

development, Mathematical and scientific thinking and social development. STEAM (Science, Technology, Engineering, Art, and Mathematics) education can potentially be supported by loose part play. (Rahardjo, 2019)

Natural objects such as shells are useful as mathematical resources, they are aesthetic and tactile, appealing to young children and can be used creatively across the curriculum. They can be used in a whole range of ways, for example counting, weighing, estimating and sorting (Tucker, 2005). This is supported by Roberts (2017) who states that there are many benefits of using natural materials and playing outside in the natural world. Provision is extended through the creative mathematical environment provided and children develop an awareness that maths is all around them.

Loose parts have an open-ended quality which is the secret to endless creativity by the children. When given the opportunity to explore and use loose parts children will immediately begin finding uses for them and investigating their qualities. (Simon, 2018) Loose parts are not toys and can be used in many ways, such as the pebbles in the picture which may be used to build a wall, to count, or to make a picture in the sand. Sticks may be used as wands, pencils or swords as well as many other things. According to Simon (2018) Playing and experimenting with loose parts helps children build a flexible mind and develop physical literacy.

