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PROJECT WEBSITE

Science Outside The Classroom

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Science Outside the Classroom: Introduction

Introduction.

Science Outside the Classroom is an Erasmus funded Research Project undertaken by University of Northampton in collaboration with the Project Lead UK primary school, a second Northamptonshire primary school, two Kindergarten schools in both Croatia and Sweden and a primary school in Spain. So much Science teaching and learning takes place indoors using teacher explanation, the internet, pictures, diagrams and textbooks. But could we do things differently? Could some aspects of our school Science curriculum be taught more effectively in other spaces and be more memorable and engaging for our learners?

The Science Outside the Classroom Project (SOtC) team wanted to explore the impact of allowing children from age 3 years -12 years, including children with SEND, to access quality outdoor learning experiences linked to the Science curriculum. Such activities would allow pupils to connect more with the real world outside the classroom helping them to develop scientific skills, knowledge, vocabulary and understanding of the world in which they live in a meaningful context. Although our Swedish and Croatian partners made greater use of the outdoors, they were keen to develop a sharper teaching focus within the context of Science. The Intellectual Outputs would include a bank of resources which could be used by teachers to foster active, hands on, experiential and inquiry-based learning in the real world. The impact of the project would be analysed by the University of Northampton with a focus on students' science related skills, their enjoyment of and academic attainment in Science and the use schools made of the outdoors. It would also look at teachers' confidence in teaching the Science curriculum before and after and their willingness to teach a curriculum subject to groups and whole classes outdoors.

This SOtC handbook provides a bank of outdoor learning ideas that can be used to enhance and enrich the children's learning In Science taught beyond the walls of their classroom. It is intended to give teachers the confidence and inspiration to take much of the Science curriculum outdoors. Throughout the project, the university asked us to only select science knowledge, concepts and skills which had the potential to be taught better outdoors in order for the children to really experience, understand and make gains in their learning. The handbook is organised into Science Units containing lessons provided by school partners for pupils aged 3 years -12 years, including lessons specifically designed for pupils with

significant learning difficulties normally taught in a specialist setting. Each activity plan outlines the scientific knowledge, vocabulary and disciplinary skills to be taught or developed, the required resources and the learning outcomes. There are even suggestions for next steps. It is further supported by a Science Pictionary written in the four partner languages with quizzes to check understanding and support recall, an inspirational photobook and a SOtC website with further information, support and additional free lesson plans and resources.

Teaching Science outside the classroom doesn't have to be expensive, complicated and it doesn't have to involve organising a " field trip." It could simply be making better use of your own school spaces or school grounds. Our research project and its related resources, seeks to explain "why" and" how" teaching Science outside the classroom can be really worthwhile. It intends to show how it can truly engage your learners in the Science curriculum and that it can be manageable for practitioners. Teaching Science outdoors in the real world seeks to teach Scientific knowledge but also key skills essential to work like a Scientist. Our lessons are knowledge rich and skills rich. We hope our resources will equip and encourage more practitioners to bring their Science curriculum to life, making it memorable, meaningful, experiential and a more multi-sensory experience.

Our project seeks to explore the belief that teaching Science outdoors will ensure children and young people are able to understand the relevance of a subject taught in school to their everyday life and everyday world. Perhaps it will persuade them to take more care of it too.

Rita Arundel (SOtC Lead Project Co-ordinator)

East Hunsbury Primary School

References

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Learning Scientific Skills Outside the Classroom.

Science Outside the Classroom: Scientific Skills

OBSERVING

Teaching children how to observe with their senses and with instruments is an essential skill for scientific work. Developing children's awareness of what they can observe and how these can be observed carefully and over time, will provide them with an understanding of physical properties and changes.

Examples

Skill	Topic	Age Group	Country
OBSERVE	Habitats	5-6	Spain
	Machines and Levers	9-11	UK
	Plants	9-10	All

MEASURE

Children need to learn how to use their senses to appreciate how things compare to each other using comparators for example larger, noisier, closer and then to measure using instruments which can be used to provide numerical comparisons. Children need to learn how to make valid measurements accurately and reliably.

Examples

Skill	Topic	Age Group	Country
MEASURE	Animals including Humans	4-5	UK
	Sound	KS1 SLD	Sweden
	Animals including Humans	8-9	UK
	Earth and Space	10-11	UK

Science Outside the Classroom: Scientific Skills

IDENTIFY, CLASSIFY AND COMPARE

Children need to be able to combine their skills in observation and measurement to name and group living and non-living things and use these to compare their features and changes.

Examples

Skill	Topic	Age Group	Country
IDENTIFY, CLASSIFY and COMPARE	Plants	7-9	UK
	Habitats	11-12	Spain
	Habitats	10-11	UK
	Rocks	3-6	Sweden
	Light	7-8	UK

RECORD DATA

Children need to learn how to say, write and draw their observations, measurements and record their thoughts. These can be presented as diagrams , pictures , tables and graphs.

Examples

Skill	Topic	Age Group	Country
RECORD DATA	Materials	9-10	Spain
	Animals including Humans	9-10	Spain
	Forces	4-5	Croatia

Science Outside the Classroom: Scientific Skills

CONCLUDE

Children need to learn how to bring together their findings to the question they asked initially – or a question posed to them. The verbalisation and writing of a conclusion, based on evidence and reasoning, is a key skill of scientists.

Examples

Skill	Topic	Age Group	Country
CONCLUDE	Materials	9-11	UK
	Light	7-8	UK
	Plants	5-7	UK

Science Outside the Classroom: Animals including humans

Lesson plans: Animals including humans

Children identified and named a variety of common animals and recognised that animals, including humans, have offspring which grow into an adult. They observed similarities and differences between animals and recognised that animals get nutrition from the food they eat. Children learned about the common characteristics of living things. Children learned about the main parts of the human body and its internal organs and their funtions. Children recognised how to keep their body healthy.

Science Outside the Classroom: Animals including humans

Lesson plans: Animals including humans #1

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Measuring	Concluding Specific skill – use simple scientific language to answer simple questions	
Country of Origin	Suggested Age Range	Suggested Theme
Croatia	4 – 5	Animals including Humans
Location outside the classroom	Benefits of using this location	
School Grounds	A large area is needed to measure the length of the small intestine effectively	
Learning Objectives - Scientific Skills	Learning Objectives - Knowledge	
To measure length using non-standardised objects - for this activity children are the non-standardised objects To communicate what they have found out using simple scientific language	To know what happens to the food we eat To know how long the small intestine is	
Key Vocabulary		
Scientific skills vocabulary – measure, measuring, conclude, concluding, communicate, tell, find out Knowledge vocabulary – internal organs, stomach, bowel, intestine, digestion		
Resources / Equipment		
• Equipment to build human model – large piece of sugar paper, different coloured string, cloth, tissue paper • Equipment to measure length – rope		
Teaching Activities		

Prior Learning – Children will have learnt about some of the organs in the human body and how they function. They will know that the stomach and intestines are used by our body to help us digest the food we eat.

Discuss – What organs do we have in our body?

Activity – Children work together with an adult to make a model of the human body and its organs on a large piece of sugar paper.

Explain – We have lots of organs in our body and they are all different sizes. They are going to think about the organs our body needs to use when we eat and digest food. When we eat and swallow food, it goes down a tube from our mouth to our stomach.

Demonstrate – Show children a model of what happens in our stomach when we swallow bread. Pour some water into a transparent sealed bag (to represent the stomach) and add some bread. Children watch over the next few minutes to see what happens to the bread.

Science Outside the Classroom: Animals including humans

Discuss and conclude – What happened to the piece of bread? Why did it do this? Encourage children to use simple scientific language when explaining what happened.

Explain – In our stomach, the bread gets broken down into very small pieces. The tiny digested pieces then go through a very long tube called the intestine (at this point the children do not need to understand the difference between the small and the large intestine). Tell them that today they are going to measure how long the small intestine is.

Activity – Give the children a piece of rope which is the same length as the small intestine (the small bowel) and ask them to lay out the rope in a straight line, stretching it out as tight as they can. The children will then work together to measure how many children are the same length as the human bowel.

Measure – Children lay down and stretch alongside the rope, head to toe, to measure how many children are the same length as the small intestine.

Discuss – How many children did you need? Does it matter what children were used for measuring the length?

Conclude – Ask children to tell you, using simple scientific language, what they have found out about how long the small intestine is.

Examples of children's work and teacher comments from country of origin

The children showed a great interest and curiosity for exploring and learning about the human body. It is essential to include these kind of activities to encourage active learning.
Next steps would be to think about how they can measure the volume of the human stomach or how long the blood vessels are so children can understand the size of the organs in the human body.

Science Outside the Classroom: Animals including humans

Lesson plans: Animals including humans #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Measuring	Recording
Country of Origin	Suggested Age Range	Suggested Theme
Spain	9 - 10	Animals including Humans

Location outside the classroom	Benefits of using this location
On the playground	They have room to exercise and don't have to worry about spillages
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To measure their heart rate by counting their pulse To predict how many bottles of blood they have in their body To measure and record how much blood they think they have in their body	To discover how hard and efficiently our heart muscles work

Key Vocabulary

Scientific skills vocabulary – predict, predicting, measure, measuring, record, recording, accurate, minute
Knowledge vocabulary – heart, blood vessels, pump, heartbeats, pulse, oxygen, carbon dioxide, nutrients

Resources / Equipment

- Equipment for counting heartbeats – heart rate chart, pencil
- Equipment for how much blood do you have – prediction chart and the following per pair of children: 2 large containers, 1 x 0.5L bottle, a small beaker, stopwatch, funnel, syringe

Teaching Activities

Discuss - Children will have previously learnt about the heart and found out some characteristics about this organ. Discuss this knowledge including the size of the heart, its location in the body, heartbeats and the reason why it never stops. Share this video of heartbeats with them and remind them how to find their heartbeat: https://www.youtube.com/watch?v=gJpT_wHZeF8

Activity 1: Counting heartbeats

Explain – They will be counting their heartbeat in order to measure their heart rate. They are going to do this when resting and again after skipping.

Measure and record – Children measure their heart rates when resting and after skipping. They will count the beats for one minute, write the numbers and compare their results.

Discuss – Did their heartbeat stay the same after exercise or did it change? How did it change? An adult heart rate is on average 70 beats per minute. How does your heart rate compare? Why do you think your heart rate increases after exercise?

Science Outside the Classroom: Animals including humans

Activity 2: How much blood do you have in your body?

Explain – They are going to investigate the research question, 'How much blood do you have in your body?' and think about how many 0.5L bottles of blood they have in their body.

Predict – Show children a 0.5L bottle and ask them to predict how many bottles of blood they have in their body. Children write a prediction on their prediction charts: I predict I have _ bottles of blood in my body.

Demonstrate – Show children a small cup or beaker with the exact amount of liquid (60ml) our heart pumps in just one beat. Explain that this volume represents how much blood is pumped each time their heart beats.

Explain – They are going to be given a range of materials that can be used to investigate the research question, 'How much blood do you have in your body?' They will need to think about how many heart beats they measured in the last activity and take this into account when calculating the amount of blood they have.

Activity – In pairs, children use a 0.5L bottle of water, a plastic container, a funnel and the small cup /beaker, to calculate how much blood they have in their body. If children are struggling to understand what to do, explain that they need to count and pour the correct amount of liquid for each of their heart beats per minute into the bottle and then into the container.

Measure and record– Children record the amount of liquid they pour into the container and add it up to calculate a total amount.

Discuss – How did their results compare to their prediction? A child has approximately 2.5L of blood in their body, that is 5 x 0.5L bottles, how accurate were your results compared to this?

Activity 3: Pumping blood

Explain – They are going to be challenged to try to work as fast as their own hearts by pumping all the "blood" (represented by water) in the container with a syringe into an empty container in just one minute.

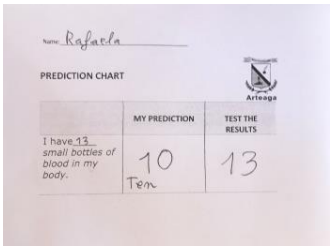
Activity – In pairs, one child will measure 1 minute accurately using a stopwatch while the other child attempts to pump and pass the blood (represented by water) from one container to the other using only a syringe.

Discuss – What did you find out? Did anyone manage to work as hard as their own heart? What does this tell us about how hard our heart muscles work and how efficient it is? It takes our body about 72 beats to move 2.5L of blood through our body in one minute and takes less than 60 seconds to pump blood to every cell in our body.

N.B. You could discuss how the amount of blood in our body depends on our size but also on various other factors such as altitude.

Science Outside the Classroom: Animals including humans

Examples of children's work and teacher comments from country of origin



We asked the children to explain their observations using their own words and language rather than encouraging them to speak in English as is usual in science lessons. This was because of the complexity of the topic. We would recommend doing this when the weather is not too warm. It is an excellent activity for children to see and understand that the heart is an amazingly strong and efficient muscle.

Science Outside the Classroom: Animals including humans

Lesson plans: Animals including humans #3

<table>
<tr><th colspan="3">Learning Scientific Skills Outside the Classroom</th></tr>
<tr><th colspan="3">Scientific Skills</th></tr>
<tr><td colspan="2">Observing</td><td>Identifying and Classifying
Specific skill – comparing animals</td></tr>
<tr><td>Country of Origin</td><td>Suggested Age Range</td><td>Suggested Theme</td></tr>
<tr><td>UK</td><td>KS1 specialist unit
Activity planned for children with severe learning difficulties</td><td>Animals including Humans</td></tr>
<tr><td colspan="2">Location outside the classroom</td><td>Benefits of using this location</td></tr>
<tr><td colspan="2">School grounds</td><td>A variety of animals can be seen outside and there are areas to find worms</td></tr>
<tr><td colspan="2">Learning Objectives – Scientific Skills</td><td>Learning Objectives - Knowledge</td></tr>
<tr><td colspan="2">To observe features of animals
To make careful observations using magnifying glasses and binoculars
To compare features of animals
To observe worms in a wormery</td><td>To know that animals have some features in common
To know that animals can be sorted into groups
To know what a worm needs to survive</td></tr>
<tr><td colspan="3">Key Vocabulary</td></tr>
<tr><td colspan="3">Scientific skills vocabulary – observe, observing, see, compare, comparing, same, different
Knowledge vocabulary – animal, reptile, mammal, bird, fish, minibeast, legs, wings, tail, water, air, ground, egg, fly, swim, fur, hair, large, small, wormery, survive</td></tr>
<tr><td colspan="3">Resources / Equipment</td></tr>
<tr><td colspan="3">• Equipment to compare animals – clear photographs, animal group labels
• Equipment to observe animals in local environment – magnifying glasses, binoculars
• Equipment to make a wormery – plastic container, small stones, moist soil, sand, dead and green leaves, spade for digging up worms, black paper, earthworms</td></tr>
<tr><td colspan="3">Teaching Activities</td></tr>
<tr><td colspan="3">Explain – They are going to be looking at different animals and comparing features which are the same in different groups of animals.

Activity – Show children a photograph of a bird, a fish, a bear, a beetle and a lizard (the photographs will need to be of living things that the children are familiar with). Allow children time to look at the photographs before discussing them.

Discuss – What animals are in the photographs? How do you know?

Activity – Pupils describe the animals in the photographs. An adult might look at the images with the pupils and ask them questions about the animals in order to help the children describe features of animals accurately.

  </td></tr>
</table>

Science Outside the Classroom: Animals including humans

Explain – Show the children some more photographs of different birds, fish, mammals (use mammals which are similar in appearance to bears), invertebrates (use invertebrates which are similar in appearance to beetles) and reptiles (use reptiles which are similar in appearance to lizards). Explain that they are going to look at the photographs and find animals which look the same and put them together in a group.

Activity – Children spend some time independently exploring the photographs and try to find some animals which look the same.

Activity – With adult support (if needed), children look at features of the animals which are the same and begin to sort the animals into groups which have something in common.
Explain – These groups of animals have different names. Introduce the labels – birds, reptiles, mammals, fish, amphibians and minibeasts (*invertebrates is too broad a category to introduce to pupils at this stage and they will already be familiar with the term minibeasts)*.

Discuss – Which group of animals needs which label? Which of these living things might we find here?

Activity – Children use their eyes, binoculars and magnifying glasses to see what they can find. If they can't find an animal, they might find a clue that suggests one has been there e.g., tracks, webs, nests, faeces.

Explain – They are going to look at an animal which belongs to one of these groups, the minibeast group, and are going to make something called a wormery.

Discuss – What do you think a wormery might be? Where could we find some worms? What would we need to put into a wormery that the worms will need?

Explain – Worms live underground where it is dark so the wormery will need to be dark, it will need lots of soil because they live in the soil under the ground and the worms will need some food and water.

Activity – Set up a wormery with the children by placing small stones in the bottom of a clear pot, this will allow the water to drain. On top of the stones, children will alternate layers of sand and moist soil and, on the top layer, they will put dead and green leaves.

Demonstrate – Show the children how to carefully dig for worms and pick them up so they don't harm any worms.

Activity – Children dig for worms and put them in their wormery. They then wrap the outside of the container with black paper so it is dark. The top of the container is left open so that the wormery has a supply of air.

Explain – They are going to leave the wormery in a cool place for two weeks and during that time they can look at the wormery and observe what they see.

Activity – Over the next two weeks, pupils can freely observe the wormery by carefully unwrapping the black paper and observe what they see.

Discuss – What did you see in the wormery? What were the worms doing? How did you know where they had been moving? What did they eat?

Science Outside the Classroom: Animals including humans

Examples of children's work and teacher comments from country of origin

The children are very interested in living things so they especially loved digging for worms and watching them in the wormery. They were surprised how quickly they could see evidence of movement. They found sorting the photos quite hard – clearer photos and photos of animals they were more familiar with were much easier.

An extension to this activity would be to look at features of the living things in each group e.g., birds lay eggs, have wings. Amphibians can live on land and in the water.

Science Outside the Classroom: Animals including humans

Lesson plans: Animals including humans #4

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Observing	Recording
Country of Origin	Suggested Age Range	Suggested Theme
UK	4 – 5	Animals including Humans

Location outside the classroom	Benefits of using this location
A safe space for an incubator and a chicken coop which will be kept outside	The chicks and chickens need a safe space to grow and develop
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To predict what will happen to a fertilised chicken egg To observe how a chick changes as it develops and grows into a mature chicken To record their findings in a drawing To record their findings in a simple life cycle	To know that a chick hatches from an egg To know that a chick grows and develops into a chicken To know that animals change as they get older

Key Vocabulary

Scientific skills vocabulary – predict, predicting, guess, observe, look, record, recording
Knowledge vocabulary – egg, chick, chicken, grow, older, bigger, yellow, fluffy, soft, incubator

Resources / Equipment

- Equipment to observe chicks – an incubator and fertilised chicken eggs, brooder, chicken coop, appropriate food
- Equipment to record observations – paper, pencil, post-it notes, life cycle images

Teaching Activities

This activity requires the use of living eggs which have been fertilised, these will need to be ordered in advance. It will take place over a number of weeks which allows children time to watch the chick hatch and observe how they develop as they grow.

Explain – They are going to observe what happens to a fertilised chicken egg which is kept in an incubator.

Discuss – Show the children some chicken eggs which have been fertilised and ask them to predict what they think will happen to the egg.

Predict – Children orally complete the sentence: I predict that the egg will ……

Explain – The eggs need to be kept somewhere warm or they will not hatch so we have to keep the eggs in an incubator.

Observe – Children observe the eggs over time (several days) in the incubator and observe carefully what happens when the egg hatches and the chicks emerge.

Science Outside the Classroom: Animals including humans

Explain – When the eggs hatch, the chicks emerge. These are baby chickens. They are going to observe and record how the chicks change as they develop and grow.

Activity – Pupils hold the baby chicks in their hands and other senses to describe the chicks using simple scientific language.

Discuss – What do the baby chicks look like? How do they feel? What size are they?

Record – Children draw a picture to represent the baby chick and tell an adult what they have drawn. An adult could annotate the drawing with the scientific language the children have used or the child can annotate it themselves if they are able to.
Activity – Over the next few weeks, at regular intervals, the children will watch them grow and observe how they change. During this time, they can hold them, watch how they behave, observe what they eat and describe their appearance.

Discuss – Every few days, discuss with the children their observations of the chicks and any changes they have seen.

Explain – When the chicks are old enough explain that they need somewhere bigger to live so they will be moved to a chicken coop outside. The children will visit the chicken coop in a few weeks to observe any further changes.

Activity – Children visit the chicken coop and make careful observations. Children record their observations in drawings and words.

Discuss – What do the chicks look like now they have grown into chickens? What do they eat?

Read – Share a story which mentions chickens laying eggs (for example Jack and the Beanstalk) or sing the song 'Chick, Chick, Chicken' with the children.

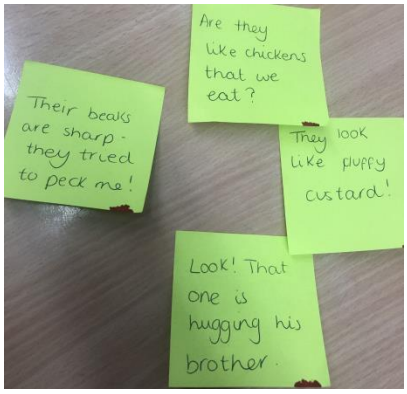
Discuss – Where did the eggs come from in the story/song?

Explain – Chickens lay eggs and these hatch into baby chicks. When a chick grows and develops into a chicken it can lay an egg. This is called a life cycle.

Record – Children record their understanding of the development and growth of a chick by providing images that they can order into a simple life cycle. The life cycle will include an egg, a chick and a chicken.

Examples of children's work and teacher comments from country of origin

Science Outside the Classroom: Animals including humans

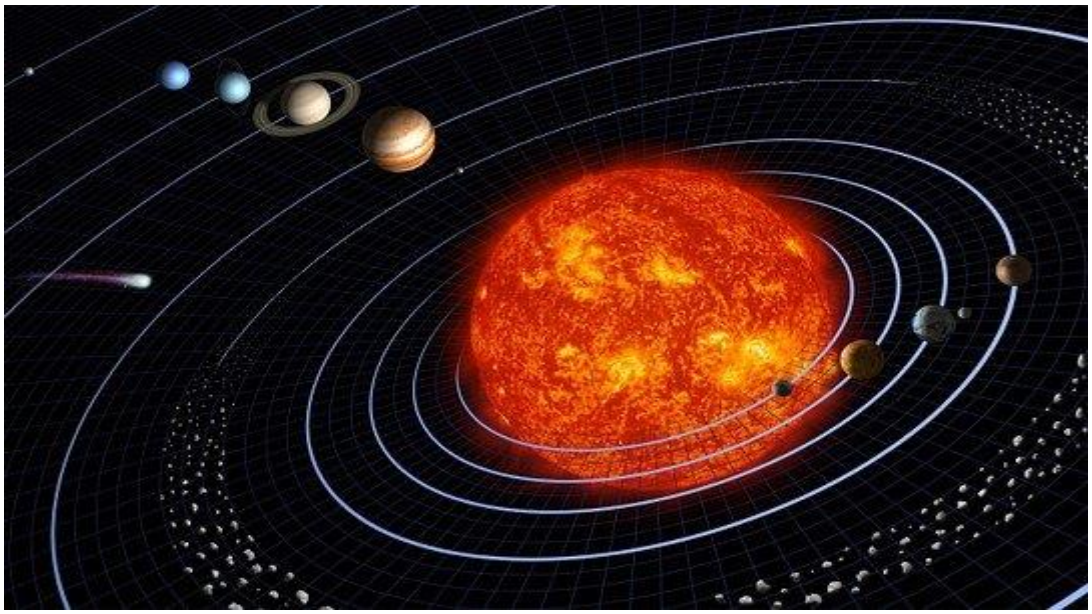


The children were able to verbalise that they knew an egg would either grow up to be a chicken or be eaten.
They made lots of observations about the chicks as they were holding them, this opportunity for first hand observations was invaluable. It was also very beneficial to see the chickens in the coop because the children were amazed that the once-yellow chicks were now a different range of colours and were also surprised by how much they had grown.
The next step would be to think about what other animals lay eggs or to explore how other animals (including humans) grow and develop.

It is important that after the activity the chickens are disposed of correctly or are sent to an appropriate home where they will be cared for correctly.

Science Outside the Classroom: Earth and Space

Lesson plans: Earth and space.



Children were introduced to a model of the solar system and explored the position of the Earth and the other planets relative to the Sun. They investigated the distance between the planets and made comparisons of size. Children explored how gravity affects their body movements and the relationship between a planet's mass and the force of gravity the planet exerts.

Science Outside the Classroom: Earth and Space

Lesson plans: Earth and space #1

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Measuring	Recording	Selecting an Enquiry
Country of Origin	Suggested Age Range	Suggested Theme
Spain	8 - 9	Earth and Space

Location outside the classroom	Benefits of using this location
Outside on the playground	Large outdoor space to complete the enquiry
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To measure accurately using weighing scales, stop watches and tape measures To record results To plan how to set up a scientific enquiry to answer a question	To discover how gravity affects our body movements To know that the more mass (weight) a planet has, the more force of gravity it exerts To discover how our body movements change when there is less gravity

Key Vocabulary

Scientific skills vocabulary – measure, measuring, record, recording, enquiry, problem, test
Knowledge vocabulary – universe, planet, satellite, gravity, exert, gravitational force, force, mass, weight, athletics

Resources / Equipment

- Equipment for comparing weight – weighing scales, dumbbells, stop watch
- Equipment for comparing records – stop watches, tape measures, mats, discus, chalk

Teaching Activities

Explain/Pose a Question - Today they are going to be thinking about the question: **'**What would happen to the World records in athletics if the Olympics were held on other planetary bodies?'

1. **MOON**

Explain – Take the children outside to see the sky, maybe the moon, and explain that the Moon is a satellite of the Earth, it revolves around the Earth and is smaller than the Earth. The force of gravity pulls the Earth towards the Moon and vice versa. However, the strength of gravity depends on their sizes, the Moon's force of gravity is about 17% of that on the Earth.

Video – Show children the famous video of the arrival of man on the moon.

Discuss - How long does it take you to walk across the room? What do you think would be different if we went to the Moon? Why do the men seem to be floating when walking on the Moon?

Measure – Using a stopwatch and the video, children measure how long it takes for each step taken on the Moon.

Explain – They are now going to measure how long each one of their steps takes on Earth and

compare this to the time taken to do a step on the Moon.

Measure – Children use a stopwatch to measure how long each of their steps takes on Earth.

Discuss - How do their times compare to each other and how do they compare to the time taken to do steps on the moon?

Activity: My weight on Earth compared to my weight on the Moon
At this stage we are talking about weight rather than mass because the children have not been introduced to the difference between weight and mass yet.

Explain – They are now going to compare their weight on Earth to their weight on the Moon.

Measure – Children weigh themselves using weighing scales.

Activity – Children calculate their weight on the moon by dividing their weight by 5, this calculates their approximate weight on the Moon. Children then need to use dumbbells on the scales so they can see how many they need to make their comparative weight on the Moon.

Discuss – How does your weight on Earth compare to your weight on the Moon?

2. <u>JUPITER</u>

Explain – Jupiter is a much larger planet than Earth so the force of gravity on Jupiter is greater than that on Earth. This means that the children's weight on Jupiter is double the weight on Earth. They are going to do three athletics exercises and record the results they would get on Earth and then on Jupiter.

Demonstrate – Show the children how to correctly perform a high jump, 30m speed run and a discus throw and how to accurately measure their results.
(Appropriate health and safety considerations need to be considered in accordance with the school).

Activity – Children perform three tests: a high jump, a 30m speed run and a discus throw.

Measure – Children accurately measure the distances obtained or the time taken using suitable measuring equipment.

Record - Children record their results on Earth.

Explain - To calculate their records on Jupiter, they need to replicate their weight on Jupiter by doubling their weight, this is done by carrying another pupil of a similar weight on their back to complete the long jump and the 30m run. The weight of the discuss on Jupiter is replicated by using a heavier discuss.

Activity - Children repeat the three tests and record the results they would obtain on Jupiter.

Discuss – What did you find out? What was your record on Jupiter like compared to your record on Earth? Why is this? What do they think would happen to their athletic records if they were on the Moon?

Explain – They are going to find out what their athletic records would be on the Moon. They will need to plan their enquiry, thinking carefully about their weight on the Moon.

Select enquiry – Allow childen time to investigate ways in which they could solve this problem and plan their enquiry.

Activity – Children complete their enquiry and record their results.

Science Outside the Classroom: Earth and Space

Examples of children's work and teacher comments from country of origin
As an extension to this lesson, children could think about what happen if Earth was not close to another planet or if there was no gravity.

Science Outside the Classroom: Earth and Space

Lesson plans: Earth and space #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Measuring	Concluding Specific skill – communicate what they have found out using simple scientific language	
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	4 – 6	Earth and Space
Location outside the classroom	Benefits of using this location	
On the football field	They need a large space to carry out the activity and spread out the planets of the solar system	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To measure distance using a metre stick To say what they have found out using simple scientific language	To know the planets in our solar system To develop an understanding of distance in space	
Key Vocabulary		
Scientific skills vocabulary – measure, measuring, conclude, concluding, communicate, tell, find out, metre, metre stick, Knowledge vocabulary – Solar System, space, Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune		
Resources / Equipment		
• Equipment to identify planets - inflatable planets of the solar system, images of the planets • Equipment to measure the distance of planets from the Sun – inflatable planets of the solar system, metre stick, distances of the planets		
Teaching Activities		

Discuss– What is the Solar System? Where is it? What do they know about the planets in the Solar System? What order are the planets?

Activity – Children identify the different inflatable planets using images of the planets to help them. Children work together to put the inflatable planets in the correct order from the Sun with reference to a chart.

Discuss – Can they think of a way to remember the order of the planets? Create a list or poem or song to help them remember.

Explain – The planets are not the same distance apart and the inflatable planets need to be positioned to show how far they are from each other and from the Sun. Show children the distance of the planets from the Sun in metres and demonstrate how to use a metre stick to measure 1 metre, 2 metres etc.
N.B. To make this activity accessible for children of this age, the distances have been converted to the nearest metre (except for Mercury) so the children can measure the distance between them using a metre stick.

Science Outside the Classroom: Earth and Space

Activity – Children work together, with adult support, to measure the distance of each planet from the Sun using the following measurements:

Mercury: 57.9 million km = 0.5m
Venus: 108.2 million km = 1m
Earth: 149.6 million km = 1.5m
Mars: 227.9 million km = 3m
Jupiter: 778.3 million km = 8m
Saturn: 1,784 million km = 18m
Uranus: 2,871 million km = 29m
Neptune: 5,913 million km = 59m

Discuss – Which planets are close together? Which planets are far apart?

Conclude – What have you found out about the planets? What is the order of the planets? Adults ask children questions about the model of the solar system they have created. This provides an opportunity for the children to verbally communicate their findings.

Examples of children's work and teacher comments from country of origin

This activity requires a large space so a football pitch or a large meadow would be ideal. It was a very good activity to work across subjects because they were working on discussion (language), measurement (mathematics) and science. The children could see a clear diagram of the distances and, with the help of adults, they could convert the numbers together. It was an excellent activity for the children to work collaboratively.

If possible, it would be a good idea to paint the planets on the school ground so that the children could continue to talk about the solar system whenever they are outside.

Science Outside the Classroom: Earth and Space

Lesson plans: Earth and space #3

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Predicting	Concluding Specific skill – explain their findings using scientific language
Country of Origin	Suggested Age Range	Suggested Theme
UK	7-9	Earth and Space
Location outside the classroom	Benefits of using this location	
Any location outside	Pupils need ultraviolet light from the sunlight outside	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To observe the change in colour of a UV bead over a period of time To use their prior knowledge to make a prediction about the suitability of materials To conclude their findings and explain which material is the most suitable for an astronaut and why	To know that ultraviolet light from the Sun is dangerous to our skin and eyes To know that some materials are better at blocking ultraviolet light than others To know that astronauts in space are at greater risk of exposure to ultraviolet light	
Key Vocabulary		
Scientific skills vocabulary – observe, observing, look, predict, predicting, conclude, concluding, communicate, explain, repeat Knowledge vocabulary – sky, space, Earth, atmosphere, Sun, UV, light, ultraviolet, index, exposure, astronaut, opaque, material, protection		
Resources / Equipment		
• Equipment to test how good materials are at blocking ultraviolet light from the sun – ultraviolet beads, plastic dishes, samples of different materials e.g. cotton, aluminium foil, polyester, wool, denim • Equipment to measure intensity of ultraviolet light – ultraviolet sun index chart • Equipment for recording – paper and pencils		
Teaching Activities		
Discuss – Go outside and look up at the sky? What do you see? What is the sky? What is above the clouds? **Explain** – The sky is the space around the Earth which you can see when you are outside and look upwards. However, the sky includes everything above the Earth including things you cannot always see such as the atmosphere and outer space. *Optional website to explain what's in space in more detail: https://spaceplace.nasa.gov/story-whats-in-space/en/* **Discuss** – What do we mean by outer space and what could we find there? Where are we now? What is Earth? **Explain** – The Earth is a planet in space surrounded by an atmosphere, a thick layer of gas which keeps us warm, gives us oxygen to breathe and is where our weather happens. The Earth's atmosphere can also help to protect our planet by acting as a barrier between the Earth and harmful light from the Sun known as ultraviolet (UV) light (some children might know this as rays or radiation, explain that they are right but we are going to use the term UV light today - this will be more easily understood by all children). Explain that UV light is invisible to our eyes. It is produced by the Sun and can be damaging to our skin and eyes.		

Science Outside the Classroom: Earth and Space

Discuss – Does anyone live in space? What is an astronaut? What do they do? Where do they live?

Image – Show children some images of the International Space Station (ISS) and discuss what it might be like for astronauts living there.

Explain – Astronauts in space are at increased risk from the harmful effects of ultraviolet light because there is no atmosphere in space to protect them, they must therefore wear protective clothing and visors when outside the ISS. Explain that today they are going to investigate what materials are best at blocking out ultraviolet light and would therefore be the most suitable material for an astronaut's spacesuit. They are going to use ultraviolet beads and observe how they change colour over time when they are exposed to the Sun. The children will record these changes in a table and use the results to decide which material would be the most suitable for an astronaut. Explain that the UV index is a measure of the strength of the ultraviolet light – the higher the UV index, the more UV light goes through the material.

Predict – Show children the range of materials available to test and ask them to write a short prediction about which one they think will be most suitable and why. Remind them to use their prior knowledge of materials to support their prediction.

Demonstrate – Show children the ultraviolet beads, demonstrate how they work when they are exposed to UV light and explain how they can use the UV index chart to measure the change in colour observed. Demonstrate how to use the colour to measure the UV index.

Activity – Allow children some time to explore the beads and investigate what happens when they take them out into the sunlight, indoors or hide them under a material. Also encourage them to practise checking the colour of their bead against the index chart.

Demonstrate – Discuss with children how they could use these beads to test the materials and then demonstrate how this will be done. Children will go indoors so the beads return to colourless and place one ultraviolet bead in a clear plastic dish with the piece of material to be tested covering the top of the dish. This is repeated for each material they want to test. They will then put the dish on an opaque object (so UV light cannot enter underneath) and will take it outside for 1 minute. After a minute they will come back indoors to check the colour against the ultraviolet index chart and record their result in a table.

Discuss – How will they make this a fair test? They are changing the type of material so all other factors must be kept the same. Will they need a control? Should they repeat the test with the same material more than once to ensure their results are accurate?

Activity – Children complete the investigation and record their results in a pre-drawn table. *N.B. Lower attainers could use a table with the materials written in for them already whereas higher attainers could be challenged to draw their own results table rather than using the pre-prepared version.*

Discuss – What did they find out about the different materials? Which one is the most suitable for making an astronaut's spacesuit? How do they know? Was their prediction correct?

Conclude – Children write a concluding statement explaining which material they think would be the most suitable for an astronaut's spacesuit and justifying their answer using their results from the experiment.

Science Outside the Classroom: Earth and Space

Examples of children's work and teacher comments from country of origin

The visual aspect of this experiment was beneficial to the children because they could observe the changes in the colour of the beads and understood that this only happened when exposed to sunlight. The experiment works best when it is a sunny day rather than a cloudy day.

Science Outside the Classroom: Earth and Space

Lesson plans: Earth and space #4

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Measuring	Concluding Specific skill - identifying patterns
Country of Origin	Suggested Age Range	Suggested Theme
UK	9 - 11	Earth and Space

Location outside the classroom	Benefits of using this location
School grounds	A large space is needed for this activity and to gain an understanding of how far some planets are from the Sun.
Learning Objectives – Scientific Skills	**Learning Objectives - Knowledge**
To use their prior understanding of the planets to predict which planets will be close to the Sun To use steps to measure distance To explain what they have found out and identify any patterns between the size of the planets in our solar system and the distance between planets and the Sun	To understand the distance between the planets in the solar system To produce a model which represents the relative distance of the planets from the Sun

Key Vocabulary

Scientific skills vocabulary – predict, predicting, measure, measuring, conclude, concluding, accurate, identify, patterns
Knowledge vocabulary – distance, relative, Sun, Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

Resources / Equipment

- Equipment to produce a scale model of the solar system – string, pegs, planet labels, distance of planets from the Sun in km and in steps

Teaching Activities

Discuss – What are the names of the planets in our Solar System? Which planet is the largest and which is the smallest? Can they order the planets in increasing size?

Prediction – Using their knowledge of the planets, children make a prediction about the distance of each planet from the Sun. They could predict which planets might be the closest together and explain why, which might be the furthest apart or predict the order of distance between the planets.

Explain – They are going to be looking at the distance between the planets in the solar system. Show them the distance of each planet from the Sun in kilometres and explain that these numbers are all approximate. Read the numbers out to the children to ensure they read them correctly and understand the value of the distances.
Mercury – 57,910,000 km
Venus – 108,200,000 km
Earth – 149,600,000 km
Mars – 227,900,000 km
Jupiter – 778,412,000 km
Saturn – 1,426,725,400 km
Uranus – 2,80,990,000 km
Neptune – 4,504,000,000 km

Science Outside the Classroom: Earth and Space

Discuss – Were their predictions about the distance of the planets from the Sun correct? Give children an opportunity to discuss the distances in small groups and discuss how they compared to their predictions. What do they notice from their previous work on the size of the planets? Where are the smaller planets? Where are the larger planets?

Conclude – Using the data provided, can they identify any patterns between the size of the planets and the distance of the planets from the Sun.

Explain – They are going to represent the distance of the planets from the Sun on the school playground using a piece of string to represent the solar system and pegs to represent the position of the planets and their distance from the Sun. They cannot measure out the distances in kilometres so they will have to scale these measurements down.

Discuss – How could the measurements be scaled down?

Explain – They need to use 'relative' distances so they can see one distance in relation to another. To do this they are going to use steps to measure the distance between the planets. The Sun is at the centre of the solar system so this will be at step 0. Show children the number of steps for each planet to the Sun and explain that these are all relative distances based on the Sun being 1cm in diameter. The distances in steps are as follows:

Mercury = 1 step from sun
Venus = 2 steps from sun
Earth = 2.5 steps from sun
Mars = 4 steps from sun
Jupiter = 13 steps from sun
Saturn = 24 steps from sun
Uranus = 49 steps from sun
Neptune = 76 steps from sun

Activity – In small groups, children have a piece of string, the data provided above with the approximate distances and the number of steps required to represent this distance, some pegs and some planet labels. Children work in groups to place the planets at the correct distance from the Sun by pegging the planet label at the correct distance on the string.

Measure – Children need to accurately measure the distance of the planets from the Sun using their own steps as a way of measuring.

Discuss – What do they notice? Is their model accurate? Was the length of the steps the same for each planet? How could this affect the accuracy of their model?

Conclude – Using the model of the solar system and the relative distances from the Sun that they can now visualise using the pegs on the string, can they add to their conclusion from earlier in the lesson. Can they identify any further patterns between the size of the planets and the distance of the planets from the Sun?

Examples of children's work and teacher comments from country of origin

The children found this visual representation of the solar system really beneficial as they could clearly see the difference in the distances between the planets. It is essential to make sure there is enough room for all groups to complete the activity and that the string provided is long enough for each group.
The steps as a measurement tool prompted lots of discussion about the length of people's legs and the size of their feet and how these could affect the accuracy of the model.

"We found out that Jupiter wasn't the furthest planet away from the Sun even though it is the biggest."
"I noticed that Mercury, Earth and Mars are very close together compared to the distance between Uranus and Neptune."
"The planets which are closest to the Sun are usually the smallest planets."

Science Outside the Classroom: Forces

Lesson plans: Forces.

Children explored the idea that different forces act on an object and investigated the effects of air resistance, water resistance, friction and gravity. They observed how things move on different surfaces and made comparisons between objects. Children explored the idea that unsupported objects fall towards Earth because of the force of gravity. Children also recognised that mechanisms can allow a smaller force to have a greater effect.

Science Outside the Classroom: Forces

Lesson plans: Forces #1

<table>
<tr><th colspan="3">Learning Scientific Skills Outside the Classroom</th></tr>
<tr><th colspan="3">Scientific Skills</th></tr>
<tr><td colspan="2">Observing</td><td>Identifying and Classifying
Specific skill – comparing objects</td></tr>
<tr><td>Country of Origin</td><td>Suggested Age Range</td><td>Suggested Theme</td></tr>
<tr><td>Croatia</td><td>4 – 5</td><td>Forces</td></tr>
<tr><td colspan="2">Location outside the classroom</td><td>Benefits of using this location</td></tr>
<tr><td colspan="2">School Grounds</td><td>Children need a large space to complete the activity</td></tr>
<tr><td colspan="2">Learning Objectives – Scientific Skills</td><td>Learning Objectives – Knowledge</td></tr>
<tr><td colspan="2">To observe changes in a balloon’s shape
To observe the motion of a balloon
To compare tied and untied balloons</td><td>To understand how force changes the shape and motion of a balloon</td></tr>
<tr><td colspan="3">Key Vocabulary</td></tr>
<tr><td colspan="3">Scientific skills vocabulary – see, observe, compare, same, different
Knowledge vocabulary – balloon, air, inflate, fly, shape, change, move</td></tr>
<tr><td colspan="3">Resources / Equipment</td></tr>
<tr><td colspan="3">• Equipment to make balloon rockets – balloons, string, straws, sticky tape, fence/tree to tie the string to</td></tr>
<tr><td colspan="3">Teaching Activities</td></tr>
<tr><td colspan="3">Discuss – What is a balloon? How do we inflate it? How do we stop the air from coming back out? If we did not tie it up, what would happen to the balloon?

Activity – Teacher blows up a balloon in front of the children.

Discuss – What happens to the balloon when it is inflated? How does it look different to the uninflated balloon? How is it the same?

Explain – They are going to go outside and make some ‘balloon rockets’ and see how they travel/’fly’ along a piece of string. These will be made with support from an adult because it can be hard to inflate the balloons.

 
Demonstrate – Show the children that there are pieces of string tied from one end of the playground to the other with a straw threaded on each string. Show them how to inflate a balloon and help them to stick it to one of the straws using sticky tape. Tell them they are going to let go of the balloon when it is attached to the straw and say what happens.

Activity – Teacher inflates a balloon and ties it up so the air cannot escape. Children stick this to one of the straws on the string using sticky tape and let go. Children observe what happens to the balloon.

Discuss – What happened to the balloon when they let go? What happened to the shape of the balloon? Did the balloon move?</td></tr>
</table>

Science Outside the Classroom: Forces

Explain – They are going to repeat the experiment but this time they will use a balloon which is tied up. What do they think will happen?

Activity – Teacher inflates a balloon and gives it to a child - making sure the child holds the ends of the balloon and does not let the air escape. Working together, another child tapes the balloon to a straw on the string. Once the balloon is attached, they let go of the untied balloon and observe changes in the balloon.

Discuss – What happened to the untied balloon when they let go? What happened to the shape of the balloon? Did the balloon move?

Compare – Was there a difference in the way the tied and untied balloons travelled along the string? How was it different? How was it the same? Did the balloons change shape?

Discuss – What made the balloons move?

Explain – The balloons change shape when we force air into them to make them inflate. When we let go, the air escapes from the balloon so the balloon goes back to its un-inflated shape. When the untied balloon is attached to the straw and you let go it is the force of the air escaping that makes the balloon move along the string.

N.B. To help children understand that air is forced out the balloon, you can hold the ends of an untied balloon and let them put their hand over the end. Children can feel the force of the air escaping when you let the balloon deflate.

Examples of children's work and teacher comments from country of origin

Regardless of the complexity of this theme, these young learners can understand the effects of forces if it is presented in a creative and interesting way.
As an extension to this activity, chidren could investigate using different shaped balloons or different orientations of the string.

Science Outside the Classroom: Forces

Lesson plans: Forces #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Measuring	Recording
Country of Origin	Suggested Age Range	Suggested Theme
Spain	9 - 10	Forces

Location outside the classroom	Benefits of using this location
Outside on the playground	There are high areas to release objects from and a large space for cars and rockets to travel
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To use prior knowledge to make a prediction To accurately measure mass and distance using appropriate measuring equipment To record results in a table	To know that gravity is a force which makes objects fall towards Earth To understand the law of inertia To discover the effects of a change in mass on the movement of a toy car To know that every action has an equal reaction and apply this principle to a balloon rocket

Key Vocabulary

Scientific skills vocabulary – predict, predicting, measure, measuring, accurate, record, recording, scales
Knowledge vocabulary – inertia, gravity, motion, mass, acceleration, deceleration, action, reaction, force

Resources / Equipment

- Equipment for gravity speed test – a large and small ball, a piece of paper
- Equipment for mass – metre long strip of cardboard, toy cars, weighing/mass scale, measuring strip, Lego, tape
- Equipment for balloon rockets – straw, string, balloons, tape

Teaching Activities

Discuss – Through discussion, retrieve pupil's prior knowledge on forces. There are always forces acting on us, forces affect everything and they can change how things move.

Explain – Tell children that today they are going to explore some of the different forces which can act on objects and look at three laws which apply to forces. They are going to start by looking at the force of gravity. Gravity is a force which makes objects fall towards the centre of the Earth.

Activity 1: Gravity

Prediction – They are going to drop a large ball and a small ball from the same height at the same time and see which one hits the floor first. Children predict which one is going to hit the ground first and why.

Activity – In pairs or small groups, children drop a large ball and a small ball (such as a football and a tennis ball) from the same height at the same time.

Science Outside the Classroom: Forces

Discuss – Was their prediction correct? Why do you think this was?

Activity – Children repeat the activity, again making a prediction first, using one of the balls from the previous activity and a piece of paper.

Discuss – Were their predictions correct? What do their findings tell us about how gravity pulls on objects? What happens when you drop something light like paper?

Explain – Gravity makes all falling objects accelerate at the same rate. Things only slow down or speed up if there is another force acting on it. Paper takes longer to fall than the balls because it is slowed down more by the air, the force of air resistance makes objects descend more slowly than when they are moving under the influence of only gravity.

Activity 2: Mass and deceleration

Explain – They are going to use a ramp for some toy cars and investigate the effect of mass on deceleration and therefore on distance travelled before objects stop moving. Children need to be aware that gravity also acts on the cars pulling them down but this is not explored in this situation. Explain that they can choose their own cars but will need to accurately measure the mass of each car they use. The cars will be sent down the ramp ensuring that an equal force is applied to each car at the top of the ramp to ensure a fair test. The distance the cars travel before they stop will be recorded.

Measure – Children choose the three cars they want to use and measure their mass accurately using scales. The mass of each car will be recorded.

Activity – In groups of three, children build a ramp using a piece of cardboard with Lego bricks to support the ramp. They place each of their chosen cars at the top of the ramp and apply an equal force to the cars so they roll down the ramp.

Measure – Children measure the distance the cars travelled beyond the ramp before they stopped with a measuring strip and record their results in a table. Pupils should repeat the experiment at least 3 times so that they can have increased trust in their results.

Discuss – What did your results show you? What effect does mass have on the deceleration of a car and consequently the distance it travelled?

Activity 3: Blast off

Explain – They are going to investigate what happens when you create a balloon rocket.

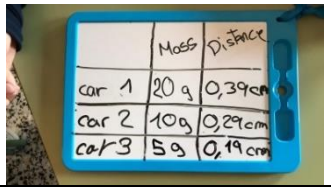
Demonstrate – Show children how to make a balloon rocket. One child will thread a piece of string through a straw and hold it in a horizontal position while another child inflates a long party balloon. The balloon is then carefully taped to the straw while a child continues to hold its neck. They then release the balloon.

Activity – Children work in small groups to make balloon rockets which they then release and watch the 'rockets' fly across the strings.

Discuss – Children share and discuss their experience with the balloon rockets. How and why did the rockets fly?

Explain – When the air was released out of their balloons in one direction, the force pushed the balloons in the other direction. This powerful forward motion comes from the energy of the balloon forcing the air out. As predicted by Newton's Third Law: "For every action there is an equal and **opposite** reaction". Children have forced gas out of the rocket without

Science Outside the Classroom: Forces

burning fuel, as it happens with real rockets.
Examples of children's work and teacher comments from country of origin
 *Next steps could be to use different materials for the ramps to think about friction, a different type of force that opposes motion. They could also try the balloon experiment with a different shaped balloon. Finally, they can try to put the string upward and compare and write down the results. Vertical position will slow down the speed of the rocket due to the effect of gravity.*

Science Outside the Classroom: Forces

Lesson plans: Forces #3

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Measuring	Recording	Concluding Specific skill – explain their findings using scientific language
Country of Origin	Suggested Age Range	Suggested Theme
UK	9 - 11	Forces

Location outside the classroom	Benefits of using this location
Outside on playground	There needs to be a large space for the children to move around freely and build their levers with wood
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To make accurate measurements in cm using a ruler or tape measure To record their results in a suitable table To explain what they have found out using relevant scientific language	To know that machines help make work easier To recognise that machines, including levers, allow a smaller force to have a greater effect

Key Vocabulary

Scientific skills vocabulary – measure, measuring, record, recording, table, results, conclude, concluding, variable, fair test
Knowledge vocabulary – force, machine, function, fulcrum, lever, load, effort, pulley

Resources / Equipment

- Equipment to make levers – piece of word or item to act as a fulcrum, planks of wood, objects to act as a load
- Equipment to measure accurately – ruler, tape measure
- Equipment to record results – paper, pencil, clipboards

Teaching Activities

Discuss - What is a machine?

Explain – A machine is something that makes work easier. We use machines every day without even thinking about it, examples of different types of a simple machine would be a lever, pulley, inclined plane, wedge, screw or wheel and axle. Almost all mechanical devices are machines.

Discuss – What examples of each type of simple machine can you think of? Examples you could discuss include:
Lever – has a fulcrum, load and effort e.g., scissors, pliers, staples, seesaw, wheelbarrow, tweezers
Pulley – has a rope and wheels with a groove e.g., a well, crane, flag pole, roller blind, lift
Inclined plane –uses a slope, e.g., roller coaster, dumper truck, slides, ramps, skateboard ramps
Wedge – has a pointed edge and can be driven into something to separate it e.g., a doorstop, an axe, a nail, knives
Screw – inclined plane wrapped around a pole e.g., screw, swivel chair, jar lid

Science Outside the Classroom: Forces

Wheel and axle – a wheel has a rod/axle running through it e.g., bike wheel, car

Explain – They are going to be investigating one type of a simple machine – levers. Levers help us to lift a load with less effort.

Demonstrate – Show how levers work to reduce the effort required by drawing a diagram of a see-saw on a flipchart or board and labelling the different features (load, effort and fulcrum). You could demonstrate using an example of a see-saw by showing them a plank of wood (a long body) which is balanced on an object in the centre (the fulcrum) and using a book as the load. The fulcrum is the turning point.

Explain – There are different features on a machine which works as a lever. There is a fulcrum – the point at which the lever pivots, the body – the long body which rests on the fulcrum to form the base of the lever and the load – the object being lifted. To use a lever, you need to apply some effort. The effort is the force which is applied to make the object move. These three parts can occur in different orders. In a see-saw, the order is L, F and E. This is an example of a first-class lever.
When you push (effort) down one end of the lever, it makes the other end go up (load). Levers help to make work easier because they enable us to lift things, we would not be able to lift on our own; they reduce the effort needed.

Activity – Children look at some examples of levers within school and spend time thinking about how they work – some examples could be scissors, see-saw, stapler, wheelbarrows and bottle openers. Scissors and pliers are other examples of a first- class level (L, F and E). A wheelbarrow and nutcracker are examples of a second-class lever as the order is E, L and F. A fishing rod and tweezers are examples of third-class levers as the order is F, E and L.

Explain – They are going to investigate the question: 'What effect does it have if we move the position of the fulcrum along the length of the plank – but keep it in between the load and effort?' They will be provided with a long plank of wood for their lever and a second block of wood which will act as a fulcrum. Working in small groups, they will investigate the position of the fulcrum on the effort they need to use to lift the same load.

Demonstrate – Show them how to safely make and use a lever and also how to accurately measure the position of the fulcrum along the length of the plank.

Discuss – How will they make this test fair? Only one variable can be changed if the test is fair, what variable will they be changing? What variables will need to stay the same? How do they measure the effort they use to make the load move?

Activity – Children to investigate the question using a lever. They can choose what objects they would like to use as a load. Some children may change the order of the load, effort and fulcrum.

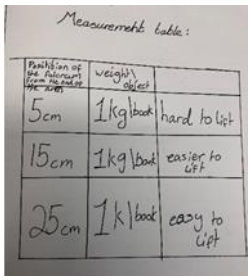
Measure and record – Children accurately measure in centimetres the position of the fulcrum in their lever and record their results in a table. They will draw an appropriate table thinking about the best way to record their results.
NB: Lower attainers can be provided with a pre-drawn table.

Discuss –What did they find out? Does moving the fulcrum affect the effort needed to lift a load? Did they notice any patterns in their results – was it the same regardless of what type of load they used? How do their findings relate to the use of real-life simple machines?

Conclude – Children to write a conclusion explaining what they found out, ensuring they have responded to the initial question: 'What effect does it have if we move the position of the fulcrum but always keep it in between the load and effort?' They need to explain how the distance between the load and the fulcrum effects the effort required to lift the load. Children must use appropriate scientific language in their conclusions.

Science Outside the Classroom: Forces

Additional activity – Can they lift themselves or an adult with ease using their lever?
Examples of children's work and teacher comments from country of origin



The practical activity associated with the lesson enabled them to easily understand the concept of how levers work and the idea of a machine making work easier was confirmed by their ability to easily lift an adult or each other using their lever.

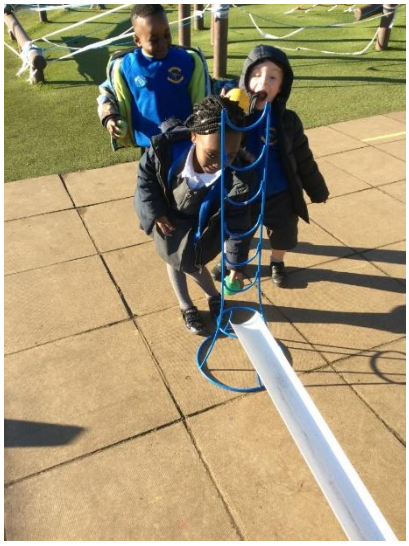
Science Outside the Classroom: Forces

Lesson plans: Forces #4

<table>
<tr><th colspan="3">Learning Scientific Skills Outside the Classroom</th></tr>
<tr><th colspan="3">Scientific Skills</th></tr>
<tr><td colspan="2">Measuring</td><td>Concluding
Specific skill – use simple scientific language to answer simple questions</td></tr>
<tr><td>Country of Origin</td><td>Suggested Age Range</td><td>Suggested Theme</td></tr>
<tr><td>UK</td><td>4 – 5</td><td>Forces</td></tr>
<tr><td colspan="2">Location outside the classroom</td><td>Benefits of using this location</td></tr>
<tr><td colspan="2">Outside on playground</td><td>There needs to be a large space for the ball to travel after it has left the ramp. A hard surface is best.</td></tr>
<tr><td colspan="2">Learning Objectives – Scientific Skills</td><td>Learning Objectives – Knowledge</td></tr>
<tr><td colspan="2">To measure how far a ball travels before stopping
To say what they found out using simple scientific language</td><td>To know that the steeper a ramp, the further a ball travels before stopping
To know that the faster an object falls, the further it will travel before stopping</td></tr>
<tr><td colspan="3">Key Vocabulary</td></tr>
<tr><td colspan="3">Scientific skills vocabulary – measure, measuring, conclude, concluding, communicate, tell
Knowledge vocabulary – fall, higher, steeper, further, faster</td></tr>
<tr><td colspan="3">Resources / Equipment</td></tr>
<tr><td colspan="3">• Equipment to make ramp – guttering or a piece of wood, stand/objects to make a stand
• Objects to roll down ramp – balls of different colours (but same diameter and mass)
• Equipment to measure distance – beanbags, rulers</td></tr>
<tr><td colspan="3">Teaching Activities</td></tr>
</table>

Science Outside the Classroom: Forces

Discuss – What will happen if I put an object at the top of a ramp and let it roll down. Where does it stop? Why does it stop? What might affect how fast it rolls down? Will the height of the ramp affect how far it travels before it stops? Will the colour of the ball affect how far it travels before it stops?



Explain – They ae going to explore the question, 'Will the height of a ramp affect how far a ball travels before it stops?'

Demonstrate – Show the children a ramp outside which has been made using guttering so the ball does not fall off. Demonstrate how to place a ball on the top of the ramp and let go to see how far it travels after reaching the bottom of the ramp and travelling on the ground. They do not need to push the ball but just let go of it. The children should place a bean bag on the playground where the ball has stopped as a way of measuring how far it has travelled.

Activity - Children take it in turns to put a ball down the ramp and see how far it travelled, they mark where it stops with a beanbag. They repeat the activity using different coloured balls.

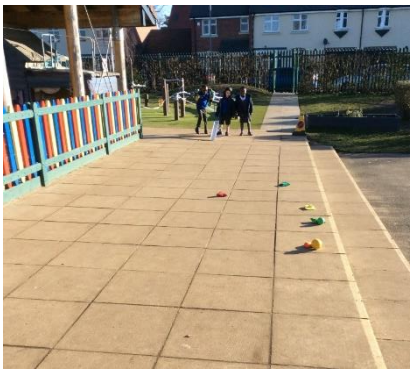
Measure - Children measure how far the balls travelled by placing a beanbag where they stopped.

Discuss – Did the colour of the ball make the ball travel a further distance? How do you know? Did the balls all travel the same distance before they stopped? Encourage the children to answer using the scientific language – measure, fall, faster and further. Record their responses.

Explain – We are going to make the ramp higher now which will make it steeper. Explain what you are doing as you raise the top end of the ramp further from the ground.

Discuss – Do they think the balls will travel a shorter distance, a further distance or stay the same now that the ramp is steeper? Why do they think this? Do they think the colour of the ball will make a difference to the distance travelled? Do they think the ground surface will make a difference when the ramp is steeper?

Activity – Children repeat the activity above taking it in turns to put a ball down the ramp and using a beanbag to measure how far it travels. They can use different coloured balls to confirm their findings from the last activity to see if the colour makes a difference as well as the steepness of the ramp.



Discuss and conclude – Did the steepness of the ramp make the balls fall faster? How do they know? Encourage the children to answer using the scientific language – measure, steeper, fall, faster and further. Did all the balls travel the same distance? Why? Explain that it is friction between the ball and ground that will slow down the moving ball. Did the colour make a difference? Record their responses.

Explain –The balls will move with a greater speed down the higher ramp and then travel for a further distance beyond the drain pipe before they stop. Ensure that children understand that the colour of the ball does not affect how quickly it falls to the ground. There will be variations in

the distance travelled due to the surface of the ground.
Examples of children's work and teacher comments from country of origin
The children really loved doing this activity and using the beanbags to measure how far their ball travelled. They did have to be reminded not to push the ball down the ramp but just to let it fall down on its own. *Some of the children asked why the ball fell to the ground. You could introduce the word 'gravity' to higher attainers if you feel it is appropriate.* *The activity produced lots of dialogue using the scientific vocabulary introduced.*

Science Outside the Classroom: Forces

Lesson plans: Forces #5

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Concluding Specific skill – communicate what they have found out using simple scientific language	
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	3 – 6	Forces
Location outside the classroom	Benefits of using this location	
Outside in an open space	A large open space is required to park a vehicle	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To make a prediction To say what they have found out using simple scientific language	To know that we can change the force needed to move something	
Key Vocabulary		
Scientific skills vocabulary – predict, predicting, conclude, concluding, communicate, tell, find out Knowledge vocabulary – push, pull, force, plane, slope, change		
Resources / Equipment		
• Equipment required – van or large vehicle, bike and a wooden plank to use as a ramp		
Teaching Activities		

Prior Learning – Before the lesson, children should have access to an inclined plane in their play, so they gain some familiarity with one.

Activity – Go outside and show the children a bike.

Discuss – How can they make the bike move?

Activity – Children investigate the different ways they can make a bike move.

Explain – To move the bike you need to use a force. A force is something that can make things move. Pushing, pulling and twisting are types of force.

Discuss – What forces did they use to move the bike?

Explain – Show children a parked van and explain that now they need to move the bike and put it in the van.

Discuss – Is it possible to put the bike inside the van? How could they do this?

Science Outside the Classroom: Forces

Activity – Children work together to investigate whether they can put the bike in the van and think about what forces they are using to move the bike.

Discuss – Could they put the bike in the van? How easy was it to move the bike? What forces did they use to move the bike? Did they need more force to try and put the bike in the van than the force they needed to just move the bike? Did they use more than one force?

Explain – Show the children a wooden plank and explain that they could use this to try and help them move the bike and put it in the van. They will investigate whether using the plank makes it easier to put the bike in the van.

Predict – Children verbally predict whether they think it will be easier to put the bike in the van using the wooden plank. Children's prior experience with an inclined plane in their learning environment will ensure they have enough knowledge of inclined planes to make a prediction.

Activity – Children work together to investigate whether they can use the wooden plank to help them move the bike? During the activity, teachers should listen to the children's conversation and help the children as appropriate. Children should be encouraged to use the words push, pull, force and slope appropriately.

Discuss – Could they use the plank to help them put the bike in the van? Was it easier to put the bike in the van using the plank? Was their prediction correct?

Explain – Using the plank made it easier to move the bike because they didn't need to use as much force. They used the plank to change the force needed to move the bike.

Conclude – Children explain what they found out using simple scientific language. If appropriate, children could draw an annotated diagram to explain what they did and what they found out.

Examples of children's work and teacher comments from country of origin

We would recommend that the children have time to test the plane by themselves. Allowing them to explore independently helped them to find a solution to moving the bike.
Before and after the lesson, the children were given access to an inclined plane in their outdoor learning environment. This enabled them to continue exploring this concept in their independent play and consolidate their learning.
The suggested next step is for children to identify where inclined planes are used in their surroundings, for example on buildings and climbing frames.

Science Outside the Classroom: Habitats

Lesson plan: Habitats.

Children explored the idea that most living things live in a habitat to which they are suited and that this habitat provides for the basic needs of an animal or plant. They identified and named plants and animals in their local environment and learned that living things can be grouped in a variety of ways.

Science Outside the Classroom: Habitats

Lesson plans: Habitats #1

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying	Recording
Country of Origin	Suggested Age Range	Suggested Theme
Spain	11 - 12	Habitats

Location outside the classroom	Benefits of using this location
Wetlands	Biodiversity
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To make careful observations of birds, crustaceans and plants in an ecosystem To classify birds using a bird study chart To classify crustaceans according to their sex To identify the three parts of Posidonia To record their data in a chart	To discover the great variety of birds in the area and their characteristics To find out the importance of tiny crustaceans as the basis of the ecosystem food chain To distinguish Posidonia among other marine remains and learn about their benefits To become aware of the ecological importance of a natural park and its great diversity of ecosystems

Key Vocabulary

Scientific skills vocabulary - observe, see, identify, classify, classification, record
Knowledge vocabulary – wetland, salt pans, forest, dune and the names of animals in the habitat (e.g. flamingo, avocet, little egret, black-headed gull, brine shrimp and Spanish tooth carp)

Resources / Equipment

- Equipment for observation of animals – binoculars, magnifying glasses
- Equipment for identification – bird study chart

Teaching Activities

Activity 1: Bird – watching

Explain – They are going to be observing different species of birds found in the wetlands using binoculars and identifying them using a bird study chart. They will be recording their data and thinking about any links between the species of birds they observe and the ecosystem where they live.

Demonstrate – Show children how to use the binoculars correctly to observe birds and demonstrate how to look for specific features of the birds which will help them to identify the species of bird.

Activity – In groups of five, with the help of binoculars, children observe real birds in the environment and match these to the images on the "The Bird Study Chart". They need to look at the bird's features and use these to help them identify the correct species of bird on the chart. Children are encouraged to comment on the different characteristics of the birds, such as colour, beak shape, feathers and size, and discuss whether these features are related to the ecosystem in which they are found.

Science Outside the Classroom: Habitats

Record – Children record appropriate data on "The Bird Study Chart". This data will include:

- Name of the Species
- Number of individuals
- The ecosystems where they live: pond, forest or dune

Discuss – What different birds have they found in the area? Do the characteristics of the birds depend on the ecosystem where they live?
N.B. - Although the study focuses on birds and mainly on water birds, it could also be used for the rest of the terrestrial vertebrates found in the Park, such as reptiles).

Activity 2: Shrimp Classification

Discuss - What is a crustacean? Where can they be found?

Explain – They are going to look for a very special crustacean found in this environment known as the primitive brine shrimp (Artemis Salina). These crustaceans are an important food source for many birds such as flamingos and fish such as the Spanish tooth carp and are therefore an important part of the ecosystem food chain.

Demonstrate – Show children how to use the magnifying glasses to observe the tiny crustacean and look for specific characteristics on the crustacean which will enable them to classify the crustaceans by their sex - males have a pincer around their mouth which they use for mating whereas the females don't.

Activity – Children observe the tiny crustaceans, with the help of magnifying glasses, and classify them by their sex, thinking about the relationship between the number of males and females.

Discuss – How easy was it to classify the shrimp according to its sex? Was there an even number of males and females or was one sex more prevalent? Discuss the process of Parthenogenesis (a form of asexual reproduction in which females produce eggs that develop without fertilisation) and whether this could be linked to the number of males and females identified. Is there a relationship between the colour of the flamingos and the pigments found in Artemis Salina? Finally, discuss the extreme salinity of the water which is resisted by these primitive crustaceans.

Activity 3: Posidonia Identification

Explain – They are going to be looking for a plant that lives on the seabed called Posidonia. Posidonia is not a seaweed and is very precious for the marine ecosystem because it is home to a large number of animals such as sharks, some molluscs and sponges. These animals live and reproduce in Posidonia meadows.

Demonstrate – Show children the different parts of the Posidonia plant – the stem, the leaves and 'sea-balls' which are formed from the hairs of the stem. Pupils will also need to be shown the different parts of the beach where the plant can be found.

Activity – Children are challenged to observe Posidonia and think about where it is located. They will also identify the three parts of the plant – the stem, the leaf and the sea ball.

N.B. – An additional activity could be to look for other animals remains on the beach, such as shells, and

Science Outside the Classroom: Habitats

make scientific observations about the remains they found.

Concluding discussion – Why was it important to use binoculars and magnifying glasses to make observations? Discuss the importance of the birds, crustaceans and Posidonia in this ecosystem.

Examples of children's work and teacher comments from country of origin

NAME	Nº	ECOSYSTEM	CHARACTERISTICS

The instruction and rules of a protected natural space must be clear from the beginning. Noises should be avoided so they don't disturb the wildlife.
The species of animals and plants are specific to the area. Schools can identify places of scientific interest in their location to carry out similar studies.

Science Outside the Classroom: Habitats

Lesson plans: Habitats #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying Specific skill - sorting into groups	Concluding
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	4 – 6	Habitats
Location outside the classroom	Benefits of using this location	
Grass field near the forest	There is plenty of room for the children to move around and it also provides a local habitat for the children to explore	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To observe features of different animals To sort animals into groups To say what they have found out using simple scientific language	To know what a habitat is To name some habitats To know which habitats some animals might live in	
Key Vocabulary		
Scientific skills vocabulary – see, look, observe, same, different, sort, group, communicate, found out Knowledge vocabulary – animals, feature, habitat and names of habitats (e.g. desert, rainforest, mountains and snow)		
Resources / Equipment		
• Photographs of different types of habitats (e.g. desert, rainforest, sea, lake, forest, mountain and snow) • Photographs of different types of animal which would live in these habitats (e.g. jelly fish, eel, squirrel, moose and gorilla)		
Teaching Activities		

Explain – They are going to be looking closely at different animals today and thinking about where they live. Tell them that the place where a plant or an animal lives is called its habitat.

Discuss – What different animals can you name? Do these animals all look the same?

Activity – Children look at different pictures of animals which have noticeable differences and talk about what they can see. Encourage them to look closely at and observe the animal's features, for example its colour, size, how it moves, what is covering its body, how many legs it has.

Discuss – Are any of the animals the same? Do any of them look the same? How do they look the same? How do they look different? Discuss what is meant by putting things into groups and sorting them.

Demonstrate – Show children pictures of 4 different animals and demonstrate how you would sort them into two different groups by looking closely at their features. Talk to them about the features that the animals have e.g. I am going to sort these animals into two groups – the animals in this group have 2 legs but the animals in this group have no legs or this group of animals can swim but this

Science Outside the Classroom: Habitats

group can't.

Activity – Children sort their animal pictures into groups and say why they have grouped them. Encourage the children to give a reason and say what is the same or what is different about their animals.

Discuss - Do all these animals live in the same place? Remind them that the place in which an animal lives is called its habitat. Why do you think they might live in different places?

Explain – There are lots of photographs around the field which have different pictures of habitats on them. They are going to try and match the animals in their pictures to the correct habitat and think about why they have chosen that habitat for their animal.

Activity – Children move around the field trying to find the correct habitat for their animal. When they have decided which habitat is correct, they need to tell an adult why they have chosen that habitat. They can then repeat the activity with a different animal.

Discuss – What animals live in certain habitats e.g. What animals have their habitat as the sea? Why do these animals live here? Link this to their earlier observations of animal's features such as the way it moves, its shape, size or colour.

Conclusion – Children explain what they have found out about habitats, they could do this by telling an adult or by writing a sentence if they are able. Encourage pupils to use the word habitat in their response.

Extension activity – Children look at the animals they can see in their local habitat - use magnifying glasses and binolulars to observe animals in their local habitat and think about why they live in that habitat.

Examples of children's work and teacher comments from country of origin

This activity was good as it invited discussion about the pictures. The children talked about biological differences and in the activity there were no limits as to how the discussion should be led (except for the question about which habitat the children thought the animals belonged to). It was useful to be in an open space so the children could move around, observe and be curious.

Science Outside the Classroom: Habitats

Lesson plans: Habitats #3

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predict	Observe	Record
Country of Origin	Suggested Age Range	Suggested Theme
UK	KS1 specialist unit Activity planned for children with severe learning difficulties.	Habitats
Location outside the classroom	Benefits of using this location	
Snail habitat e.g. a wildlife garden	Children can find and collect snails and their food source	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To predict which food the snails will eat To observe snails and use magnifying glasses for closer observation To record which food the snails ate in a tally chart jj	To know where snails obtain their food To begin to think about why snails live in certain places To recall the basic needs of what living things need to survive from previous work To identify that snails can be found in a habitat to which they are suited	
Key Vocabulary		
Scientific skills vocabulary – predict, prediction, observe, record Knowledge vocabulary - habitat, live, food source, predator, trail, foot, mouth, leaf, flower, fruit, thrive, survive		
Resources / Equipment		
• Equipment to observe snails – living snails, plastic plates/petri dishes, magnifying glasses, foods such as leaves and fruit including those found in snail habitat e.g. hosta leaves, dandelion leaves, cucumber, banana, grass, birch leaf, lettuce, cabbage • Equipment to create a snail habitat - lidded glass tank with air holes in the lid, moist soil, rocks, dead wood, food sources such as leaves the snails were found on, cucumber • Resources to create spaces where the snails can hide - leaves, bark, sticks		
Teaching Activities		
Discuss – What is a snail? What do they look like? How do they move and where might they live? **Explain** – The place where something lives is called its habitat. They are going to make a habitat for a snail by making a snail terrarium. A terrarium is a see-through container which will allow them to observe the snails for a few days before they put them back into their normal habitat. Explain that the snails will need some things in their terrarium to help them survive. They are going to collect some snails from their local habitat, some food for them to eat and things for them to hide under. Explain that snails need to hide so that predators, such as birds, can't find them and eat them. **Discuss** – What food could we put into the terrarium for the snails to be happy and to thrive? What could we put in that the snails could hide under? **Activity** – Go outside with the children and collect the things they need to create 		

the terrarium – allow them to make decisions about what should go where and why. They will use these to make a terrarium in their classroom which is ready for their snails.

Explain – Now their terrarium is ready they are going to collect some snails. Talk with the children about where they might be, for example under things or hiding from birds that like to eat them. Before they put the snails in the terrarium, they are going to observe what the snails like to eat.

Demonstrate – Show the children where they could look for snails and how to collect them by gently picking the snail up and placing it on a flat hand or on a plastic dish/petri dish. It is important to explain to the children about being gentle when handling the snails, not pulling them off things or touching the soft parts, just the shell.

Activity – On a damp morning, children go outside and look for snails (the number they collect will depend on the size of your terrarium) and look for signs of things the snails might have eaten. Children collect leaves grass, bark etc. - anything that might be snail food.

Explain – They are now going to observe what the snails like to eat using the things they have collected.

Activity – Find a clear area and give each child a plastic sheet on the ground. Choose four different foods and place them around the edge of the sheet and place a snail in the middle of the sheet.

Predict – Ask the children which food they think the snail prefers to eat. Which food will the snail go to? Why do they think this?

Activity - Children watch to see which food the snail prefers and then try a different snail to see if the same thing happens. They can use a magnifying glass to observe the snail more closely and see if they can see different parts of the snail's body.

Record – The results can be recorded as a tick list or a tally chart for speed. Individual results can be recorded when the children are back in class.

Activity – Place the snails in the terrarium with the food and ensure the children wash their hands thoroughly.

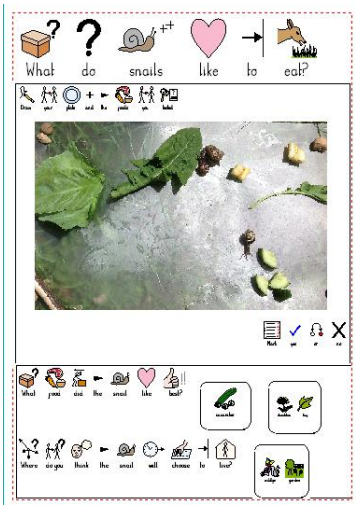
Discuss – What was their favourite food? What other foods did the snails eat? What didn't they like? Where might a snail live? Why?

Explain – Over the next few days they are going to observe the snails and see what they like to eat. They are also going to go back to the habitat where the snails were found to see what food they can find there for the snails.

Discuss – What did they find out about the snails? What food do they like to eat? Why do they live in a certain habitat?

Examples of children's work and teacher comments from country of origin

Science Outside the Classroom: Habitats



Dandelion leaves and cucumber were the snail's favourite food. The children went back to their normal habitat and saw that there were dandelion leaves outside and they found out that snails liked eating the cucumbers in the vegetable garden.

Children observed the snails moving and eating for 2 more days before releasing them. They were so fascinated by them that they often chose to have a snail out of the tank on a piece of plastic with some food just to watch them.

They discovered that the snails are more active at night and were also amazed at the slime on the tank and on the cucumber skin. They were also lucky enough to find three white snail eggs in the tank one morning and were very excited by this.

The children were sad to let the snails go so we read 'The Bog Baby' – this helped them understand that creatures need to go home. When they released them, they looked for leaves which were the same as the ones the snails liked and hid them away from birds. They also put two together so they had friends.

Science Outside the Classroom: Habitats

Lesson plans: Habitats #4

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying	Concluding Specific skill - identifying patterns
Country of Origin	Suggested Age Range	Suggested Theme
UK	9 - 11	Habitats
Location outside the classroom	Benefits of using this location	
Contrasting locations around the school grounds	Children can collect living invertebrates from a range of different habitats and observe them through first-hand observations	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To make careful observations of invertebrates To identify characteristics of invertebrates To classify invertebrates using identification keys To use their findings to identify patterns found in a natural environment and present these findings appropriately	To give reasons for classifying animals based on specific characteristics	
Key Vocabulary		
Scientific skills vocabulary - observe, see, identify, classify, classification, key, data, pattern, conclude, conclusion Knowledge vocabulary – organism, external observable characteristics, invertebrate, arachnid, arthropod, centipede, crustacean, insect, millipede, mollusc, worm, exoskeleton, habitat, microhabitat		
Resources / Equipment		
• Equipment to collect invertebrates in different microhabitats - clear dishes, bucket or large container, water, plastic bags, sieves, fishing nets, white sheet, wooden spoons, plastic spoons, paintbrushes • Equipment to make pitfall traps - trowels, yoghurt pots or small plastic cups, card, small stones • Resources to entice invertebrates – cheese, fruit, meat such as cat food • Equipment for identification – identification keys, magnifying collector pots, magnifying glasses		
Teaching Activities		
This lesson will need to be taught over a consecutive 2-day period because the pitfall traps will need setting up the day before. **Discuss** – What is an invertebrate and what different groups do they belong to? Recap their knowledge of the different invertebrate groups, the differences between the groups and how we can identify what group a living organism belongs to (e.g. by observing its external characteristics). Discuss whether they think invertebrate groups always live in one particular microhabitat? What is the difference between a habitat and a microhabitat? What types of microhabitat do we have in our local environment? **Explain** - They are going outside to collect living invertebrates from the different microhabitats within their local environment and make careful observations of these organisms using magnifying glasses and magnifying collector pots. They will identify the invertebrates using classification keys and classify them into one of the different invertebrate groups - arachnid, arthropod, centipede, crustacean, insect, millipede, mollusc and worm. They will record their findings and use their data to identify any patterns in the micro-habitats of invertebrates within their local natural environment. *N.B. They might find other organisms which are not invertebrates and although these will be a good point for discussion they*		

are not the focus of the lesson.

Demonstrate – Show children different methods outside which can be used to collect invertebrates from the microhabitats within their environment and demonstrate how to carefully collect them using either a plastic spoon or a small paintbrush, taking care not to damage or harm the organism in any way. Use images to demonstrate what a pitfall trap should look like and explain how to set one up. Only demonstrate the methods which are applicable to their local environment.

- Pitfall traps – These need to be set up on the first day so that invertebrates are collected overnight. To make the trap they will need to dig a small hole in the ground and place an empty yoghurt pot or small cup in the hole so that the rim is level with the soil surface. A small amount of food bait should be placed inside the container, to entice the invertebrates into the trap, along with some leaves, grass or small stones for hiding under. The trap is then covered with a piece of card or thin piece of wood raised a little by small stones so that invertebrates can crawl underneath and into the trap. Finally, the card/wood is secured with small stones on top. The traps are left overnight and examined the next day for invertebrates.

Pitfall traps can be set up on the floor in different microhabitats e.g. in flowerbeds, on the woodland floor, amongst leaf litter, alongside footpaths, in open grass, in vegetable plots, under bushes.

- Trees – Place a white sheet on the floor under the canopy of a tree (it is best to use a tree with low hanging branches). Shake or hit the tree and branches carefully (once or twice at most) with a large wooden spoon or stick and collect the invertebrates which fall out.
- Bushes/Hedges – Use the same method as shown above for trees.
- Under logs or stones – Carefully turn over logs and stones on the floor and identify the invertebrates they find.
- Pond – Half-fill a bucket and collecting dishes/pots with water. Use a net to dip into the pond and sweep the water in a figure of eight pattern (near the edge of the pond will probably collect the most invertebrates). Gently turn the net into the bucket and collect any invertebrates found.

N.B. Explain the importance of not damaging the microhabitats and returning the organisms to where they found them when they have finished identifying and classifying them. Invertebrates should be identified in situ if possible without the need to collect them. Logs and stones which have been moved must be returned to their original location.

Activity - Children work in small groups outside to collect invertebrates from the different microhabitats using the methods discussed. They make careful observations of the invertebrates' characteristics using the magnifying glass or magnifying container and then identify them using a classification key. Children must return all invertebrates back to their microhabitat after identification. Children will record the invertebrates they have identified in a table – name of microhabitat, name of invertebrate, numbers found and invertebrate group. Can they see any patterns in their data? Children write a conclusion which explains how they think the external characteristics and microhabitat are related and explain any patterns they found in their data.

Differentiation – provide a table for the low attainers to record their data in and write a conclusion collaboratively as a small group.

Discuss – Children share their findings. Think back to the original question and discuss - do invertebrate groups always live in one particular microhabitat? Discuss any patterns they identified in their data. What conclusions did they make? Children offer reasons for any differences they found about which invertebrates live in which microhabitats.

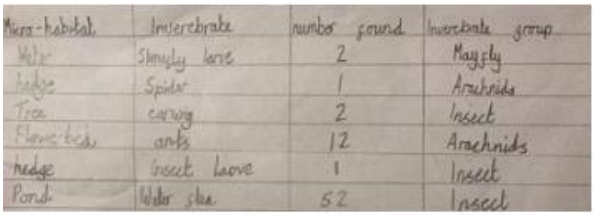
Conclusion – Pupils edit and finalise their conclusions based on their findings and the class discussion.

———

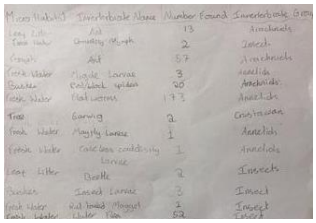
Note – pupils will only complete this activity once but it could be repeated at different times throughout the year or at

Science Outside the Classroom: Habitats

various intervals throughout a season to identify further patterns, similarities and differences.
Examples of children's work and teacher comments from country of origin
This activity provided excellent observational opportunities for the children to identify a variety of invertebrates.



Micro-habitat	Invertebrate	number found	Invertebrate group
Water	Stonefly larve	2	Mayfly
hedge	Spider	1	Arachnids
Tree	earwig	2	Insect
Flower-bed	ants	12	Arachnids
hedge	Insect larve	1	Insect
Pond	Water skie	52	Insect



Science Outside the Classroom: Habitats

Lesson plans: Habitats #5

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Recording	Concluding
Country of Origin	Suggested Age Range	Suggested Theme
Croatia	5 – 6	Habitats
Location outside the classroom	Benefits of using this location	
School Grounds	There are a variety of different habitats	
Learning Objectives – Scientific Skills	Learning Objectives - Knowledge	
To make careful observations using a magnifying glass To record their findings on a data sheet and with a camera To record their findings in a poster To say what they found out using simple scientific language	To know what a habitat is To name some habitats To know what habitat an animal might live in	
Key Vocabulary		
Scientific skills vocabulary – see, observe, record, recording, communicate, find out Knowledge vocabulary – habitat and names of habitats (e.g. iceberg, desert, swamp, meadow, oceans and snow), dry, wet, moist, cool, warm, hot, animal and plant names, different plants		
Resources / Equipment		
• Equipment for observing – magnifying glass, data sheets, cameras • Photographs of different types of habitats (e.g. desert, rainforest, sea, lake, forest, mountain and snow) • Photographs of different types of animal which would live in these habitats (e.g. jelly fish, eel, squirrel, moose and gorilla)		
Teaching activities		

Science Outside the Classroom: Habitats

Explain - Today they are going to start by looking at their local environment to see what plants and animals they can see.

Activity 1: School Plant Hunt

Activity - Children go on a tour of the school grounds with an adult and observe the plants they find. They should be encouraged to explore the shapes, colours and textures of the leaves on the plants and trees and compare the leaves from different plants. They should also be encouraged to name the plants they know and be introduced to the names of the plants they are unsure of. This will enable the children to be learning some English vocabulary at the same time.

Demonstrate – Show children how to use the magnifiers to closely observe plants and how to use the camera to take photographs of the plants as a record of their findings.

Activity – Children play the Little Nature Detective game. The aim of the game is for the children to observe their local habitat using the magnifiers and if they find a specific plant, animal or habitat in their local environment they record it on the data sheet provided.

Activity 2:

Explain – They are going to think about different habitats around the world and what animals might live there. Explain that a habitat is the place where plants and animals live.

Discuss – Where do animals live? What kind of habitat do they live in? Encourage, through discussion, a variety of contrasting habitats such as mountains, the ocean, deserts, swamps, meadows and the snow. Show images of these habitats as you discuss them.

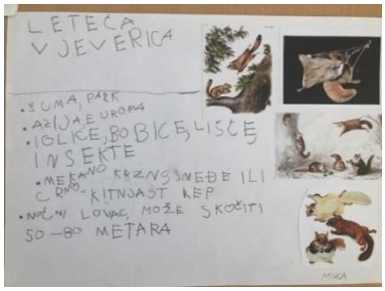
Explain – The habitat must be suitable for an animal and provide things the animal needs to survive such as food and shelter.

Activity – Children are given photographs of the different habitats and animals which live in them. Children match the animals to the correct habitats, thinking about why the animal might live there, and name both the habitat and the animal. During the activity, children should be encouraged to look at specific features of the animals which make them suited to that habitat and what food and shelter is available for the animals.

Recording – Children record their findings by drawing a poster which includes one of the habitats studied and an animal that lives there. When this is finished they will verbally explain to the class what they have drawn and tell them about their habitat and the animal that lives there. To extend children's thinking, they should be asked why their animals lives in that particular habitat? The posters can be grouped together to make a class encyclopaedia.

Examples of children's work and teacher comments from country of origin

Science Outside the Classroom: Habitats



This activity encouraged children to learn actively. They showed interest in the animals and their features includiing their diet. For example the snake who can eat a deer and the fish with an enormous red mouth. There were also numerous comments from parents about the children's continuous interest at home.
A suggested next step is to look at the seasonal changes in habitats throughout the year.

Science Outside the Classroom: Light

Lesson plans: Light

Children explored the way that light behaves and identified different sources of light. Children observed that shadows were formed when light was blocked and found patterns in the way shadows change.

Science Outside the Classroom: Light

Lesson plans: Light #1

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Concluding Specific skill – communicating what they have found out using simple scientific language	
Country of Origin	Suggested Age Range	Suggested Theme
Croatia	5 – 6	Light
Location outside the classroom	Benefits of using this location	
Open space outside	The children need the light from the sun to make clearly visible shadows on the ground	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To make careful observations of shadows To say what they have found out using simple scientific language	To know what a shadow is To know that shadows can be different in size and colour	
Key Vocabulary		
Scientific skills vocabulary – observe, see, conclude, communicate, tell, find out Knowledge vocabulary – shadow, light, block, see-through, transparent, colours, larger, smaller		
Resources / Equipment		
• Equipment to create shadow drawings – transparent plastic, coloured pens		
Teaching Activities		

Discuss – What are shadows? Why do they occur? Do all objects create a shadow? How big are shadows? Where do they occur?

Activity: Exploring Shadows

On a sunny day, children time spend time outside to explore any shadows they can find or make. Encourage them to think about what object has made the shadow and their responses to the initial discussion. Move their bodies around and observe what happens to their shadow? What happens to their shadow when they move? Why?

Explain – Shadows outside are formed when the light from a light source, the Sun, is blocked fully or partly by an object. Their bodies have created a shadow because they are blocking the light from the Sun.

Activity: Shadow Drawing

Children draw on a piece of transparent plastic using different coloured pens. They can choose freely what to draw but should be encouraged to draw in block colours. Children hold their drawings up to the Sun (carefully) and observe the drawing which is on the ground created by light passing through the transparent plastic or affected by the colours.

Science Outside the Classroom: Light

Children explore whether their shadow drawing changes when the surface of the ground changes e.g., exploring grass, concrete, gravel and shaded surfaces.

Observe – Children observe what happens if they change the distance of their drawing from the ground. Look at the size of the drawing, the sharpness of the edges and the intensity of the colours. They can record their observations by taking photographs or measurements.

Conclude – Children say and write what they have found out using simple scientific language, encourage them to talk about the shape, size and colour of their image on the ground.

Discuss – What did they find out? Did their shadow change when the surface of the ground changed?

Examples of children's work and teacher comments from country of origin

Children showed great interest in this activity. They were often were curious about their shadows and now it was meaningful .It is very important to include this kind of activity when planning science to encourage active learning outdoors in a real life context.

Science Outside the Classroom: Light

Lesson plans: Light #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Measuring	Concluding
Country of Origin	Suggested Age Range	Suggested Theme
Spain	9 - 10	Light

Location outside the classroom	Benefits of using this location
Outside on the playground	There are areas of sunlight and shade

Learning Objectives – Scientific Skills	Learning Objectives – Knowledge
To use prior knowledge to make a prediction To accurately measure time using a stopwatch To orally report their findings from investigations	To know that absorbed light may transform into heat energy To know that different colours absorb heat differently To know how and why a rainbow is formed

Key Vocabulary

Scientific skills vocabulary – predict, measure, measurement, accurate, conclude, conclusion
Knowledge vocabulary – ray, energy, absorb, absorption, reflect, reflection, refract, refraction, heat, spectrum

Resources / Equipment

- Equipment for absorption of light – different coloured balloons (white, black and coloured), black marker pens, magnifying glass, stopwatches
- Equipment for rainbows – bubble mixture, straws, CDs, white paper or a white surface

Teaching Activities

Discuss – Through discussion retrieve pupil's prior knowledge on light.

- What is our biggest, brightest and hottest source of light on Earth? (Sun)
- How do we see? (Light enters eye which can convert light into electrical signals in the retina).
- What is visible light made of? (Seven colours in spectrum, the rainbow: red, orange, yellow, green, blue, indigo and violet).
- Why do objects look different colours? (The whole spectrum of visible colours from the Sun can hit an object which can then absorb or reflect the different colours according to its colour. The reflected light enters our eyes. Black objects absorb all colours and white objects reflect all colours).
- What happens when you wear clothes which are different colours? (Different colours absorb light and can make you feel hotter or cooler – light has energy).

Activity: Absorption of light

Demonstrate – Show children how to concentrate the light rays from the Sun onto a balloon using a magnifying glass by standing with their back to the Sun so the light rays are coming from behind them. Using a black balloon, show what happens as the energy of the light from the Sun is absorbed by the black rubber material and heats up the air inside the balloon.

Activity – Children hold a magnifying glass and a balloon and try to concentrate the light rays onto the balloon. It will be beneficial for the children to practise this with a balloon

Science Outside the Classroom: Light

before they begin to make accurate measurements of time using a stopwatch.

Explain - The balloons are different colours to show how the colour of the balloon affects how long it takes to heat up the air inside the balloon. When the air is warm it will make the balloon burst. They are going to time how long it takes to burst a balloon.

N.B. It is extremely important to remind the pupils of health and safety - they should not stare directly at the sun and should not direct the rays of light from the sun onto anything other than their balloon.

Predict - Before starting the activity, children individually make a prediction and justify their answer, " _____ *balloon will pop faster, because*_____*".*

Measure – Pupils will use a stopwatch to accurately measure the time it takes in seconds for the black and white balloon to explode once the light ray has been concentrated on its surface.

Conclude – What did you find out? Was your prediction correct? Did all the balloons explode? Why does a balloon explode? Which colour balloons explode faster and why?

Explain – Different colours absorb heat differently because they absorb and reflect the light from the Sun differently. The energy from the light which is absorbed is transformed into heat energy. This heats up the air inside the balloon which means it then moves around much more, eventually the increasing force of the faster moving air hitting the inside surface of the balloon makes the balloon burst. The increasing force leads to an increase in pressure.

Activity: Creating a rainbow

Activity - Children use a bubble solution (concentrated washing up liquid and water) and straws to blow bubbles. They observe the changes in colour on the bubbles before they pop.

Activity - Children use CDs to try and reflect the sunlight from the surface of the CD and create a rainbow on a white surface/poster.

Predict - The children predict how the shape and colours will change when they alter the angle of the CD and how the shape and colours will change when the distance between the surface/poster is changed.

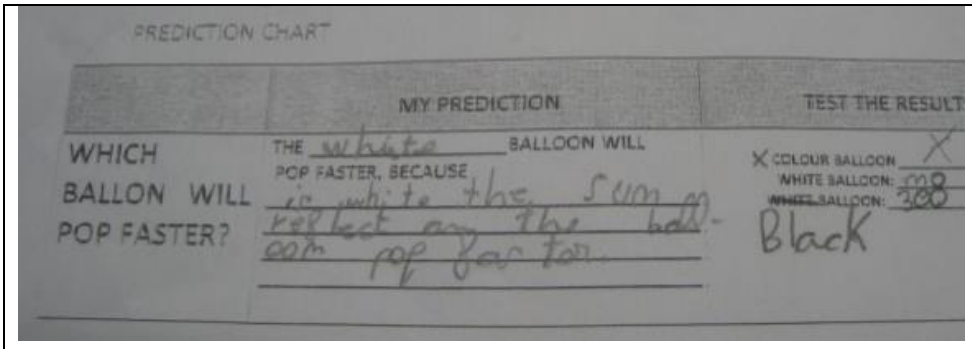
Conclude – What colours did you see? What colour is the sunlight? What happened when the sunlight passes through the bubble or hits the surface of the CD? What happened when the distance was changed? Where did you see a rainbow? Can we all see exactly the same effect (the same rainbow) from the same angle? Why?

Explain – When sunlight hits the bubble or the surface of the CD, the white light from the Sun is refracted. Refraction changes the direction of the light waves in white light so the different colours of the spectrum are now visible to the human eye, this is seen in a rainbow.

Examples of children's work and teacher comments from country of origin

Consider how absorption of light is applicable to day-to-day activities and explore other ways of making rainbows.

Science Outside the Classroom: Light



PREDICTION CHART

	MY PREDICTION	TEST THE RESULT
WHICH BALLON WILL POP FASTER?	THE white BALLOON WILL POP FASTER, BECAUSE is white the sun reflect on the ball- oon pop fas tar.	X COLOUR BALLOON X WHITE BALLOON: m8 ~~WHITE~~ BALLOON: 300 Black

Science Outside the Classroom: Light

Lesson plans: Light #3

<table>
<tr><th colspan="3">Learning Scientific Skills Outside the Classroom</th></tr>
<tr><th colspan="3">Scientific Skills</th></tr>
<tr><td colspan="2">Identifying and Classifying</td><td>Concluding
Specific skill – communicate what they have found out using simple scientific language</td></tr>
<tr><td>Country of Origin</td><td>Suggested Age Range</td><td>Suggested Theme</td></tr>
<tr><td>UK</td><td>KS1 specialist unit
Activity planned for children with severe learning difficulties.</td><td>Light</td></tr>
<tr><td colspan="2">Location outside the classroom</td><td>Benefits of using this location</td></tr>
<tr><td colspan="2">Outside on a sunny day</td><td>Children need sunlight to test their materials</td></tr>
<tr><td colspan="2">Learning Objectives – Scientific Skills</td><td>Learning Objectives – Knowledge</td></tr>
<tr><td colspan="2">To identify materials which reduce transmission of light
To say what they have found out using simple scientific language</td><td>To know that sunlight is dangerous for our eyes
To know how to protect our eyes from the Sun</td></tr>
<tr><td colspan="3">Key Vocabulary</td></tr>
<tr><td colspan="3">Scientific skills vocabulary – compare, comparing, best, suitable, conclude, communicate, find out
Knowledge vocabulary – Sun, sunlight, light, transparent, opaque</td></tr>
<tr><td colspan="3">Resources / Equipment</td></tr>
<tr><td colspan="3">• Materials – transparent materials (for example, coloured and clear plastic sheets) and opaque materials (for example foil, fur or card)
• Equipment to make sunglasses – materials used for exploration, pipe cleaners, sticky tape and scissors</td></tr>
<tr><td colspan="3">Teaching Activities</td></tr>
<tr><td colspan="3">Discuss – Take children outside on a sunny day and put on a pair of broken sunglasses where one of the lenses is broken. What is wrong with my sunglasses? What are they supposed to do?

Explain – The light from the Sun is a very strong light and is dangerous. If I look directly at the Sun, it could damage my eyes, so I wear sunglasses to protect my eyes on a sunny day. I need to fix my sunglasses to protect my eyes and have lots of different materials I could use to try and fix them. They are going to make their own pair of sunglasses and use them to find out which material would be the most suitable to fix my sunglasses. Some materials are transparent and let the light pass through them but other materials are opaque and do not let the light pass through them.

Activity – Children explore the different materials provided by handling them and looking through them and begin to think about which material would be best for sunglasses to reduce the amount of light from the Sun. Talk about why they would choose a material.</td></tr>
</table>

Science Outside the Classroom: Light

Demonstrate – Show the children how to make the sunglasses frame using pipe cleaners and how to attach their chosen material to the frame using sticky tape.

Activity – Children make their own pair of sunglasses as independently as possible using their chosen material. Adults to provide support where it is needed.

Discuss – How can we test how good our sunglasses are at protecting our eyes from the Sun? How will we know if they are protecting our eyes? Do we want glasses that block out all the light?

Activity – Children go outside in the sunlight and wear their sunglasses. Children try on each other's sunglasses and compare how good the materials are at blocking out light from the Sun.
NB: Health and Safety – remind children of the importance of staying safe in the Sun and remind them not to look directly at the Sun.

Record – Adults record the activity using photographs so the children can use them later on to remind them what they did or to help them indicate which material they thought was the best.

Conclude – Children say which material they thought was the most suitable for protecting their eyes from the Sunlight. They can use the photographs taken earlier in the day to help them explain which material they thought was the best or can talk using their voice, signs or symbols. With adult support, complete a sheet showing which material they thought was the most suitable from their observations. Children may group the materials according to whether they are transparent, opaque or translucent.

Examples of children's work and teacher comments from country of origin

The children loved this lesson and thought it was funny that I had broken my glasses! It was a great way to hook them into the lesson. They enjoyed exploring whether the materials would be good for sunglasses or not. They were very influenced by the colour or shininess of the materials but when they tried to wear them, they realised they could not see. They were all able to choose something that let light through – some found it harder to think about how much they would be able to see e.g., the translucent bubble wrap. Many children used the vocabulary transparent and opaque correctly. Some translucent materials were also included in this activity to broaden the range of materials the children could explore but the term translucent was not introduced to them.

Science Outside the Classroom: Light

Lesson plans: Light #4

<table>
<tr><th colspan="4">Learning Scientific Skills Outside the Classroom</th></tr>
<tr><th colspan="4">Scientific Skills</th></tr>
<tr><td colspan="2">Observing</td><td colspan="2">Recording</td><td>Concluding
Specific skill – explaining what they have found out</td></tr>
<tr><td colspan="2">Country of Origin</td><td colspan="2">Suggested Age Range</td><td>Suggested Theme</td></tr>
<tr><td colspan="2">UK</td><td colspan="2">9 - 11</td><td>Light</td></tr>
<tr><td colspan="3">Location outside the classroom</td><td colspan="2">Benefits of using this location</td></tr>
<tr><td colspan="3">Playground</td><td colspan="2">The children need to use the light from the Sun to explore shadows and reflections outside</td></tr>
<tr><td colspan="3">Learning Objectives - Scientific Skills</td><td colspan="2">Learning Objectives - Knowledge</td></tr>
<tr><td colspan="3">To make careful observations of shadows and reflections
To record their observations in annotated diagrams and through photographs
To conclude their findings and explain their observations</td><td colspan="2">To know that shadows are formed when light from a light source is blocked by an opaque object
To understand factors that affect shadows
To know what reflection means
To know the difference between specular and diffused reflection</td></tr>
<tr><td colspan="5">Key Vocabulary</td></tr>
<tr><td colspan="5">Scientific skills vocabulary - observe, see, record, recording, conclude, explain, findings
Knowledge vocabulary – straight line, natural, artificial, light, source, ray, shadow, transparent, translucent, opaque, reflection, specular, diffused</td></tr>
<tr><td colspan="5">Resources / Equipment</td></tr>
<tr><td colspan="5">• Equipment to explore shadows – chalk
• Equipment to explore and record reflections – iPad/cameras, paper, pencils</td></tr>
<tr><td colspan="5">Teaching Activities</td></tr>
<tr><td colspan="5">Prior Learning – Children will have previously learned about how light appears to travel in a straight line.

Discuss – Pose questions on light sources, shadows and reflections.

1. Transparent materials let light pass through them in straight lines, so that you can see clearly through them. TRUE
2. Translucent materials let no light through them. FALSE - translucent materials let some light through but scatter the light in different directions. We cannot see clearly through translucent materials.
3. A glow stick is a natural source of light. FALSE- glow sticks are man-made and are therefore artificial.
4. The closer an object is to a light source, the smaller the shadow. FALSE - as an object moves closer to a light source, its shadow becomes bigger.
5. For a shadow to be formed, the path of the light must be blocked. TRUE
6. Reflections are only possible from a smooth surface. FALSE</td></tr>
</table>

Science Outside the Classroom: Light

Explain – Today they are going to be exploring some of these features of light in more detail. The first activity is going to be about artificial and man-made light, the second about shadows and the third about reflections.

Activity 1: Light Sources

Explain – The are going to look at a range of light sources and decide if they are natural or artificial sources of light. *Ensure a candle is included as an example because this can cause an interesting discussion about whether it is a natural or artificial source of light. Do not use the Moon as an example as this is not a source of light and is a common misconception amongst children. This would be a good opportunity to reinforce the idea that the Moon does not emit light.*
If possible, do this activity outside on the playground.

Activity – Children stand on the playground in the middle, on one side of the playground is a sign saying artificial light and on the other side is a sign saying natural light. The adult will say different forms of light and the children will decide whether it is artificial or natural and move to the appropriate sign.

Activity 2: Exploring Shadows

Explain – They are going to explore shadows and observe what happens to their shadow as they move around.

Activity – On a sunny day, children go onto the playground and using the light from the Sun's rays draw around their own shadows using chalk. The children compare their shadows with that of their peers and observe the changes in their shadow as they move around.

Discuss – Ask children the following questions and discuss their responses.

- Does the height of the child affect the size of the shadow? (Yes - the larger an object, the larger the shadow.)
- Does changing direction change the direction of the shadow? (No, as long as the direction of the light is the same, the rays will travel in the same direction and therefore the shadow will still be cast in the same place.)
- What happens to your shadow when you jump? (The shadow moves as the body moves but it still stays the same size and shape.)
- Are shadows only cast by opaque objects?

Record – Children draw annotated diagrams which represent their findings.

Conclude – Children write a short paragraph explaining their understanding of shadows, how they are formed and what happens to the shadows if the object which cast them moves.

Activity 3: Reflections

Explain – A reflection happens when light hits a surface and is reflected (bounces off). Light is always reflected at the same angle it hits the surface. Today they are going to look at two different forms of reflection. Explain that:

- Specular reflection is when light is reflected from a smooth, flat surface
- Diffused reflection is when light is reflected from a rough surface.

Science Outside the Classroom: Light

Activity – Children hunt around the school grounds and observe different types of reflection from smooth and rough surfaces. *(Prior preparation will aid this activity – e.g., pond reflections, mirror reflections, glass in buildings).*

Record – Children record examples of specular and diffused reflection using photographs.

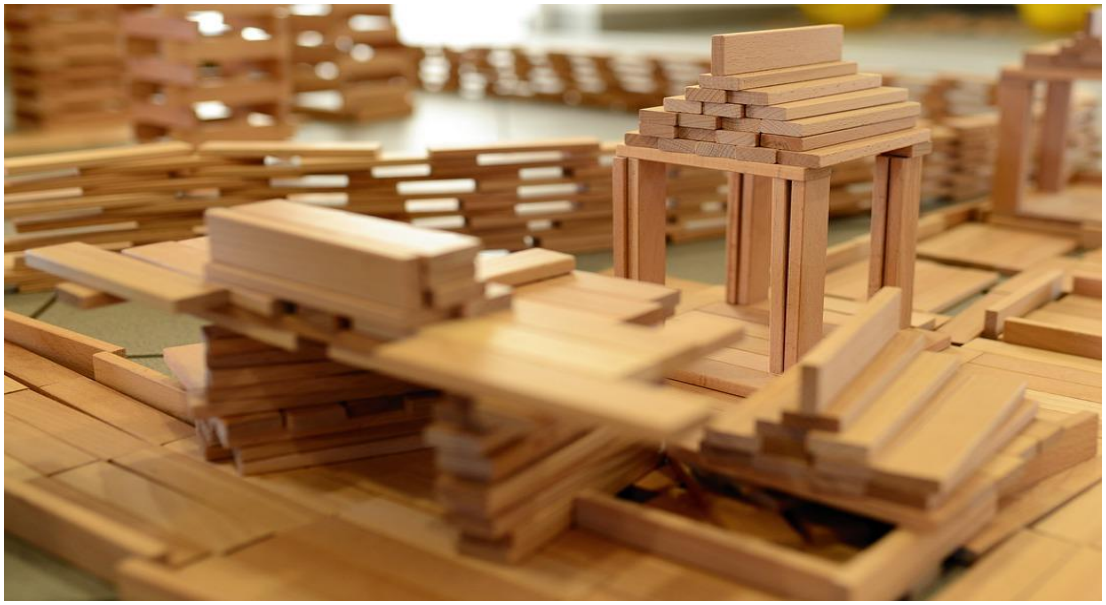
Conclude – Children annotate the reflection photographs, explain the difference between the two types of reflection and explain what they found out from their observations.

Examples of children's work and teacher comments from country of origin

Children enjoyed exploring different features of light outside.
Next steps for this lesson could be to explore how shadows change throughout the day and linking this to the relative movement of the Sun and the Earth. Children could also use their knowledge of specular reflection to explore how periscopes work.

Science Outside the Classroom: Materials

Lesson plans: Materials.



Children identified and named a variety of everyday materials and distinguished between an object and the material from which it is made. They explored the properties of materials and compared the suitability of everyday materials. Children also investigated reversible changes and used their knowledge of solids, liquids and gases to decide how mixtures could be separated.

Science Outside the Classroom: Materials

Lesson plans: Materials #1

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Identifying and Classifying Specific skill – comparing materials	Concluding	
Country of Origin	Suggested Age Range	Suggested Theme
Croatia	4 – 5	Materials
Location outside the classroom	Benefits of using this location	
School Playground	There is a wide range of materials outside. There is a large space and a flat surface to construct their houses on	
Learning Objectives – Scientific Skills	Learning Objectives - Knowledge	
To compare the properties of brick, straw and wood To say what they have found out using simple scientific language	To know that materials have different properties To name some simple properties of brick, straw and wood	
Key Vocabulary		
Scientific skills vocabulary – compare, comparison, conclude, communicate, tell, find out Knowledge vocabulary – brick, straw, wood, properties, strong, weak, bendy, hard, soft		
Resources / Equipment		
• Equipment to explore materials and build houses – a selection of bricks, wood and straw • Book – The Three Little Pigs – prior lesson to provide familiarity with the story		
Teaching Activities		

Activity – Show children the three materials which were used by the pigs in the story: bricks, sticks and straws. Allow them time to play with and explore the materials.

Discuss – Ask questions relating to the properties of the materials which encourage the children to compare the three different materials e.g., Which material do you think is the strongest? Which material is the smoothest? Which material is the hardest? Which materials can you bend?

Compare and conclude – Children answer the questions above using a full sentence which includes simple scientific language e.g. The …… is the …… material.

Explain – There are lots of different materials outside. Ask the children to explore the materials and see if they can find some examples of the materials the three little pigs used to build their houses.

Activity – Children find some examples of bricks, straw and wood from the materials available in the outside area. An adult should ask children questions about the materials they are looking at to see if they can name some of the properties of the material and to ensure they can identify the bricks, straw and wood.

Science Outside the Classroom: Materials

Explain – They are going to use the three different materials to build houses.

Activity – Children work together to build a house out of straw, a house out of bricks and a house out of wood like the pigs in the 'Three Little Pigs' did.

Drama – Children act out the part of the wolf by try to blow their houses down.

Discuss – Which house could you blow down? Which house was the strongest? Which material do they think is the best to build a house? Why?

Conclude – Children complete the following sentence using simple scientific language: I would build my house out of ……. because it is the …….

Discuss – Which house couldn't be blown down in 'Three Little Pigs'? Why? Link this to the properties of brick and why it is commonly used for building.

Discuss – Which materials are used to build our school? Why have these materials been used?

Examples of children's work and teacher comments from country of origin

The prior learning involving the story 'Three Little Pigs' increased the children's motivation and curiosity towards the materials. In addition, it worked well to combine the Science learning with the drama play activities.
The next steps following this lesson would be to investigate the waterproof properties of the three materials.

Science Outside the Classroom: Materials

Lesson plans: Materials #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Identifying and Classifying Specific skill – comparing materials	Predicting	Observing
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	3 – 5	Materials

Location outside the classroom	Benefits of using this location
Woods	The materials need to be left in an outdoor environment
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To make comparisons between different materials To make predictions based on their previous knowledge and experiences To make observations of materials over time in the outdoor environment	To know that materials break down (degrade/decompose/rot) in the outdoor environment To know that some materials do not break down quickly in the outdoor environment

Key Vocabulary

Scientific skills vocabulary – compare, same, different, predict, think, observe, see, time
Knowledge vocabulary – fruit, plastic, metal, paper, plaster, environment, rot, decay, survive, material

Resources / Equipment

- Equipment for exploring materials – samples of material e.g., fruit, plastic, metal, paper and plaster (not objects made of the material)
- Equipment for exploring degradation of materials – samples of materials explored; nails, hammers and a plank of wood in the outdoor environment

Teaching Activities

Discuss – Show children a piece of fruit, some plastic, paper, plaster and some metal and discuss what materials they are.
To prevent any confusion between an object and the material it is made from, make sure the children are shown a piece of material that has not been made into an object e.g., show them a piece of plastic, not a plastic spoon.

Activity – Children explore the sample of materials. While exploring the materials, adults should encourage the children to describe the materials using simple scientific language. Which material is the hardest? Which material is the softest? Which material is the smoothest? Which material is the roughest? Children go on a material hunt outside and find some items which are made out of these materials.

Explain – They are going to leave some materials outside for a few weeks and observe what happens to them over time. They are going to see which material survives the best in the outside environment and which material rots the quickest.

Science Outside the Classroom: Materials

Predict– What do they think will happen to the materials if they are left outside? What material do they think will rot the most if it is left outside? Children to verbally complete the sentence: I think the ……. will rot the most because ……

Encourage the children to think about items made of these materials that they have just found on their material hunt or they have previous experience of in real-life and consider what happens to these when they are outside e.g., a seesaw is made out of metal and is outside in the playground or the playhouse which is made of plastic in the outdoor area.

Activity – Children go into the woods/outside space and find somewhere they can leave the materials. They work together to hammer the materials into a plank of wood which is dug into the ground.

Activity – Over the next few days and weeks, go back to the materials, take photographs and observe what has happened to them over time. Discuss what has happened and compare how the materials have survived in the outdoor environment.

Examples of children's work and teacher comments from country of origin

This activity allows the children to look at how materials decay in the outdoor environment in the short term (over a few days) and also in the long term (over a period of a few weeks or more). The materials can be left outside for as long as the adults feel it will still benefit the children and their learning.

Photographs were taken of the materials when we went back to revisit them. This helped the children to see how the materials changed over time.

Science Outside the Classroom: Materials

Lesson plans: Materials #3

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Observing	Recording
Country of Origin	Suggested Age Range	Suggested Theme
UK	KS1 specialist unit Activity planned for children with severe learning difficulties.	Materials

Location outside the classroom	Benefits of using this location
An area where there is a hard surface such as the playground	Children can clearly see if the ground is wet or dry
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To predict which material is the most suitable for an umbrella To observe waterproof properties of materials To record their findings	To know what the term waterproof means To know that some materials are waterproof and some are not To recognise whether a material is waterproof

Key Vocabulary

Scientific skills vocabulary – predict, predicting, observe, observing, see, record, recording
Knowledge vocabulary – material, properties, waterproof, wet, dry

Resources / Equipment

- A broken umbrella and a working umbrella – which belong to a familiar toy (e.g., gingerbread man), jug of water
- Equipment to make umbrellas – stick frame, materials, sticky tape, scissors
- Materials – a range of materials, for example foil, cling film cardboard, plastic, fabric, tissue and kitchen roll
- Equipment for recording – results table and an umbrella sheet

Teaching Activities

Demonstrate – Outside using a familiar toy, show children a broken umbrella which belongs to the toy (e.g. a gingerbread man) and pour water on it. Talk about what is wrong with the umbrella? What should it do? Show them a working umbrella and pour water on it to show them what happens. Talk about the words wet and dry.

Explain – An umbrella is made out of a waterproof material. Waterproof means it does not let water go through it. They are going to make a new umbrella for the gingerbread man using a waterproof material. Show the children different materials they could use.

Activity – Children explore the different materials, encourage them to feel the materials and stretch them to see what happens.

Predict – Which material do you think would be waterproof and would therefore be the most suitable for an umbrella.

Demonstrate – Show the children how to make an umbrella using a stick frame and the material. Cut the material using scissors so it is slightly bigger than the frame and then use sticky tape to secure the material to the frame.

Science Outside the Classroom: Materials

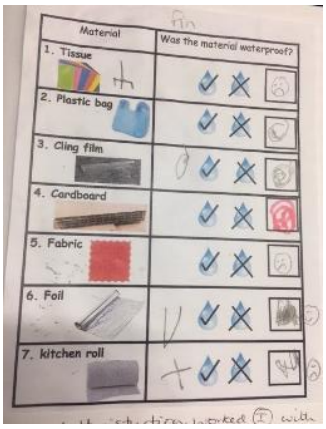
Activity – Children work together, with adult support where necessary, to make umbrellas using the stick frames and the different types of material to be tested. Ensure that every child helps to make at least one umbrella.

Discuss – How can we test the materials to see if they are waterproof? Show children the jug of water and the gingerbread man to prompt them.

Explain – They are going to lay the gingerbread man on the floor and hold an umbrella over him. They will then pour water on the umbrella and observe what happens to the gingerbread man and the floor around him.

Discuss – What does it mean if the gingerbread man is wet? What does it mean if the gingerbread man stays dry? Is the material waterproof or not?

Activity – Children work together to test each of the umbrellas. They hold the umbrella over the gingerbread man and, with support if needed, slowly pour water onto the umbrella. Children observe what happens to the gingerbread man and the floor surrounding him.



Record – Adults should record each observation photographically with a camera so that the children can look at these later on and use them as a prompt to remind them what they observed.

Sort – After testing all the materials, can children sort the materials into waterproof and not waterproof based on their observations.

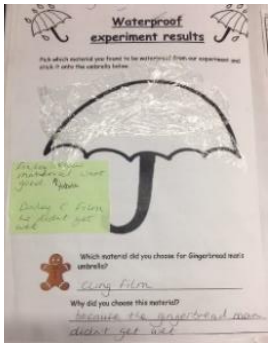
Record – Take the children to an area that is dry and show them the photographs taken earlier. Children use the photographs to help them record their results, with support if required, using a results table which has been prepared for them.

Discuss – Which materials are waterproof? Which materials are not waterproof? What is the best material to use to make an umbrella for the gingerbread man?

Conclude – Children use talk, signing or symbols to explain what they were doing and what they found out.

Record – Children record the material they think is the most suitable for an umbrella by completing an umbrella sheet with adult support.

Examples of children's work and teacher comments from country of origin



The children loved this lesson and were quite good at predicting if the materials would be waterproof or not. They were very influenced by the colour or shininess of materials! Some made comments about the ease of using a material like the card being hard to bend or the foil tearing very easily. One child concluded that the material had to be 'good' (explaining that it would not tear - it was 'strong' and bendy) as well as waterproof.

Science Outside the Classroom: Materials

Lesson plans: Materials #4

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Selecting an enquiry	Identifying and Classifying Specific skill – comparing methods	Concluding
Country of Origin	Suggested Age Range	Suggested Theme
UK	9 – 10	Materials
Location outside the classroom	Benefits of using this location	
On the playground	Large space and no need to worry about spillages	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To select the equipment and method needed for a scientific enquiry and justify their decisions To compare methods of separation To present their findings in a written conclusion using relevant scientific language	To know that materials in a physically mixed mixture can be separated To know that materials in a physically mixed mixture can be separated by sieving or filtering or decanting To know that a mixture containing more than one state of matter can be separated	
Key Vocabulary		
Scientific skills vocabulary – enquiry, equipment, compare, comparing, method, justify, conclude, concluding, explain, communicate Knowledge vocabulary – material, properties, mixture, separate, sieve, filter, decant, magnetic, solid, liquid, gas, particle, physical, chemical		
Resources / Equipment		
• Equipment to explore separation – solids of various sizes (for example rocks, stones, sand, pasta and pine cones), container to store the mixture, collection trays • Equipment to separate materials – sieve, cardboard and scissors (in case they want to make their own sieve), filter paper, magnets, tweezers, beaker, containers for separating materials		
Teaching Activities		
Discuss – What is meant by separation? What is a meant by a mixture? **Explain** – They are going to be exploring different ways to separate materials in a mixture. A mixture is when 2 or more materials are mixed together. To separate materials, it is important to consider the properties of a material and their state of matter and how they are connected (physically or chemically). **Discuss** – Show pupils a tray which contains a mixture of materials which are only solids and are easy to separate (the materials will be mixed physically not chemically for example rocks, stones, sand, pasta and pine cones). Can we separate these materials? How could we separate them? **Activity** – Children work in small groups to separate the materials into different trays. **Discuss** – How difficult was it to separate the materials? Why was it easy? What equipment did they use to separate the		

Science Outside the Classroom: Materials

materials? Ask the children to mix their materials back together and then pour some sand into each mixture. Can we separate the materials now? Do we need to do anything differently?

Activity – Children work in the same groups to separate the new mixture into different trays.

Discuss – How difficult was it to separate the materials this time? What was different? Why was this harder? Did you have any grains of sand left on any of your other materials? Were your materials completely separated?

Explain – They have been separating mixtures which only contain solids. The smaller the solid object, the harder it is to separate it, this is why it was more difficult with the sand.

Discuss – What different equipment could I use if I wanted to separate mixtures of solids or solids and liquids? Can they think of any real-life scenarios where mixtures of materials need separating?

Demonstrate – Show the children how to a) sieve mixtures to separate materials, b) filter a mixture containing a solid and a liquid and c) slowly decant a liquid in order to separate a sediment from the liquid.

Compare – What similarities are there between these processes? What differences are there?

Explain – Provide pupils with a container which contains a mixture of different sized solid objects (including sand), water and small solid magnetic objects. Explain that they are going to think about the properties of the materials in the mixture and their state of matter and use this information to help them separate the materials. They will need to decide what method and equipment is the most suitable for their materials. Show them the equipment they have available to use.

Activity – Pupils work in small groups and **select** methods and equipment to separate the materials. During the activity, talk about the choices they have made in their enquiry and how these were based on their knowledge of the material's individual properties and what each mixture contains.

Discuss – Were you successful in separating your mixture? Which materials were difficult to separate? Which materials were easy to separate? Are there are materials you could not separate? Why?

Conclude – Children write down a conclusion which communicates what they have found out about the separation of materials from a mixture.

Examples of children's work and teacher comments from country of origin

The pupils enjoyed trying to separate the materials using different types of equipment and the fact that some solid objects went through the sieve and others did not enabled them to visually see the difference in size between solid objects. They particularly enjoyed using the magnets at the end to separate the metallic objects.
A suggested follow-up lesson would be to look at the most effective material for filtering or to investigate how to separate a solid from a liquid (for example salt or sugar) when it has dissolved in the liquid. - this could be in the examples used on this day – get them to mix the salt and water and then try to separate them.

Science Outside the Classroom: Materials

Lesson plans: Materials #5

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Measuring	Recording
Country of Origin	Suggested Age Range	Suggested Theme
Spain	9 - 10	Materials

Location outside the classroom	Benefits of using this location
On the playground	Close to a water source and a large space to work in Don't need to worry about spillages
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To predict the suitability of materials To measure accurately using small pipettes To record results in a table	To understand the difference between absorbent and waterproof materials To understand that different materials are suitable for particular uses

Key Vocabulary

Scientific skills vocabulary – predict, predicting, measure, measuring, record, recording
Knowledge vocabulary – material, properties, waterproof, absorbent, fragile, tough, elastic, rigid, shiny, dull, transparent, opaque, hard, soft, magnetic

Resources / Equipment

- Equipment for scavenger hunt – a large blanket containing a wide range of different objects made from different materials
- Equipment for testing materials – different materials (examples could include cotton, plastic bags, aluminium foil, newspaper, bubble wrap and wool)
- Equipment for measuring water – small pipettes, small bowls/containers to hold water

Teaching Activities

Explain – They are going to explore the properties of different objects and the materials they are made from.

Activity – Provide a large range of different objects for children to explore. Teachers say a property of materials and the children predict from the materials available which ones have that specific property e.g. Which materials are waterproof? Which materials are good at insulating and keeping you warm? Which materials are strong?

Activity 1: What are they made of?

Discuss – What are the properties of the different materials they explored? Discuss the properties of the materials and classify them according to their properties.

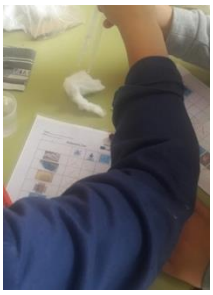
Activity – Children work in small groups or pairs to solve a series of riddles in a material scavenger hunt. Each riddle should provide clues which lead to an object that has been

hidden in the school grounds. The riddles provide descriptions or definitions in terms of the object's properties and uses. Children work co-operatively to solve the clues and classify all the objects.

Activity 2: Absorbent or waterproof?

Discuss – What is the difference between materials which are absorbent and those that are waterproof? Can you tell just by observing or feeling a material?

Explain – They are going to investigate what happens if they drop water onto different materials.



Discuss - What will happen if they drop the same quantity of water onto different materials?

Explain – A material that soaks up water is absorbent and a material which keeps water out is waterproof. They are going to do a comparative test to determine which materials are absorbent and which are waterproof.

Activity – Children carry out a comparative text to investigate whether different materials are absorbent or waterproof.

Measure and record – Children drop a small quantity of water onto different materials and compare how much water is absorbed. The quantity of water dropped on to the materials will be measured accurately using a small pipette.

Record – Children record their results in an appropriate table.

Discuss and conclude – Using their results, children say which material was the most absorbent and explain how they know.

Activity 3: Testing waterproof materials

Discuss – How do they know if a material is waterproof? Which materials were waterproof? Were their predictions at the start of the lesson correct? What material is the most waterproof?

Explain – They are going to test the material they think is the most waterproof and investigate whether it would protect an electronic tablet from water.

Activity – Children wrap their tablet (made out of cardboard prior to this lesson) in their chosen material and submerge the tablet in a bowl of water. Is the tablet protected by their chosen material?

Discuss – Did their material protect their tablet from water? Was their material waterproof? How do they know?

Conclude – Children explain whether their material was waterproof and how they came to that conclusion. Can they determine the failure/success of their protector in terms of its waterproofing properties and explain the reasons why? Were there initial predictions accurate? Was their material suitable?

Examples of children's work and teacher comments from country of origin

Science Outside the Classroom: Materials



Children shared their findings with the rest of the class and determined the failure or success of their materials. The real-life application of the experiment was beneficial to the children and was extended by then suggesting other questions they could investigate e.g. What kind of material would you use to wrap food and keep it safe? An extended activity suggestion is to use two balloons to make a waterproof case for a mobile phone – https://www.youtube.com/watch?v=A4RHEZO4DyU.
The learning could also be extended by using Venn diagrams and Carroll diagrams to organise materials by their properties and to investigate other properties such as thermal insulators.
Cross curricular work could also be linked with suggestions for reducing, reusing and recycling materials.

Science Outside the Classroom: Plants

Lesson plans: Plants

Children identified and named a variety of common wild and garden plants in their local environment. They observed differences between flowering and non-flowering plants and identified the parts of a flowering plant. Children explored the part flowers play in the life cycle of a flowering plant and observed how seeds and bulbs grow into mature plants. Children also investigated what plants require to germinate, grow and stay healthy.

Science Outside the Classroom: Plants

Lesson plans: Plants #1

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Observing	Identifying and Classifying Specific skill – comparing growth
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	3 – 6	Plants
Location outside the classroom	Benefits of using this location	
Flower Bed	They need an area outside that can be used for planting seeds or plants.	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To predict what will happen to a seed To observe changes in a seed To observe changes in plant growth over time To compare seeds	To know that plants can grow from seeds To know that plants need the right amount of light and water in order to grow and stay healthy	
Key Vocabulary		
Scientific skills vocabulary – predict, predicting, observe, look, compare, same, different Knowledge vocabulary – seed, shoot, plant, water, warmth, air, vegetation, greenery, flora, life cycle, growth		
Resources / Equipment		
• Equipment to grow seeds in plastic pockets – seeds (examples could include pea, bean, lettuce and radish seeds), plastic pockets, water, watering can, kitchen roll • Equipment to grow seeds in pots - seeds (examples could include pea, bean, lettuce and radish seeds), small plant pots, soil, water, watering can • Equipment to grow plants outside – soil, plant boxes, water, watering can, plants grown from seed		
Teaching Activities		

This activity involves planting seeds and looking at how they develop and grow into plants. Children will need to look at the plants over a period of 2-4 weeks to observe changes over time.

Discuss – What do you know about plants? Where do plants come from? What is a seed?

Explain – A seed is the fruit of a plant and can grow into a new plant if it has the right conditions to grow. Today they are going to plant some seeds in small pots and in plastic pockets to observe how they grow over time. They are going to find out what plants need to be able to grow and stay healthy.

Discuss – What do plants need to be able to grow? What would happen if we excluded some factors such as water or sunlight? What if the plants were exposed to too much water?

Explain – The seeds that they grow are going to be put in different places to see if they all grow in the same way. They will need to have a control seed which has everything it needs to grow into a plant and will have some other seeds which are either given too much water or no water. They will also put some seeds in the dark to see whether they can grow

Science Outside the Classroom: Plants

without light. Children will look at the seeds and the developing plants over a prolonged period of time and will observe how the plants grow and develop from the seed.

Activity 1: Plastic Pockets
Children plant seeds in closable plastic pockets.
1 - Some of the plastic pockets are placed in the preschool window in direct sunlight and are given some water.
2 - Some of the plastic pockets are placed in the preschool window in direct sunlight and are not given any water.
3 - Some of the plastic pockets are placed in the preschool window in direct sunlight and are given lots of water.

Activity 2: Pots
Children plant seeds in small plastic pots.
1 - Some of the pots are watered and placed in an area of preschool where there is sunlight.
2 - Some of the pots are watered and placed in an area of preschool where there is no sunlight
N.B. a common misconception is that seeds need light to germinate. This is not true. The plant, once germinated, requires light to grow into a healthy plant.

Predict – What do they think will happen to the seeds they have planted? Do they think some of the seeds won't grow, if so, which ones and why?

Observe – Children will look at the plastic pockets and pots daily and observe what has happened. They will observe how the seeds they have planted change and develop over time and will also observe changes in the plants that grow from the seed. Using the plastic pockets will enable them to observe changes in the seed really clearly. They could document these changes through drawings or they could take photographs using a camera or an iPad.

Discuss – What did you find out? What do seeds need to be able to grow and develop into a plant? What do plants need to grow and stay healthy? What happened if the seeds or plants have too much water?

Compare – What differences in growth did they observe between the seeds grown in different conditions? Which plant is that largest? Which plant is the tallest? Are the plants the same colour?

Activity 3: Planting outside
The small plants which they have grown are planted outside in planting boxes. Children can watch the plants grow and develop into adult plants and can harvest any crops they produce. As an extension activity, children could also plant some seeds outside and compare their growth to the seeds they have planted inside.

Explain – Collect the seeds from the crops they have harvested and explain the life cycle of plants.

Examples of children's work and teacher comments from country of origin

It is important you have the time to implement this activity effectively as it requires children to follow the seed's growth for a prolonged period of time. When the plants are finished, the children should harvest in the plants and the produce. Then they can examine and taste the produce. This allows children to understand the life cycle of a plant from seed to plant and back to seed again.

Science Outside the Classroom: Plants

Lesson plans: Plants #2

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Observing	Concluding Specific skill – use simple scientific language to answer simple questions
Country of Origin	Suggested Age Range	Suggested Theme
UK	KS1 specialist unit Activity planned for children with severe learning difficulties.	Plants
Location outside the classroom		Benefits of using this location
Unmown grass		There are lots of grass seeds
Learning Objectives – Scientific Skills		Learning Objectives – Knowledge
To predict what might grow from a seed collected from the grass To make careful observations of growing seeds To say what they found out using simple scientific language		To know that plants grow from seeds To know how to care for seeds To know what conditions seeds need to grow and germinate
Key Vocabulary		
Scientific skills vocabulary – predict, predicting, observe, observing, see, conclude, concluding, communicate, tell Knowledge vocabulary – plant, seed, germinate, grow, root, shoot, leaf, wet, dry, light, warmth,condition, grass		
Resources / Equipment		
• Equipment to collect seeds – old woollen socks • Equipment to observe seeds – magnifying glasses • Equipment to germinate seeds – clear plastic bag, water		
Teaching Activities		

May is the best time to complete this lesson because it is when a lot of grasses and flowers are in seed. They will have previous experience of what conditions plants need in order to grow and stay healthy.

Explain – They are going to be exploring seeds. What is a seed?

Discuss – Where can they find seeds? Would we find them inside? Where outside might we find them? Why are they important?

Explain – They are going to go on a seed hunt and see if they can find any seeds on the grass. They are going to try and collect some seeds using socks.

Activity – Children place an old woollen sock over their shoe and walk or run through the grass. (A slightly damp sock is sometimes more successful at collecting seeds.) When they are finished, they carefully remove the sock and place it in a sealed clear plastic bag, if the sock is not damp it will need to be moistened slightly before sealing

the bag.
If children are non-ambulatory, a stone can be placed in the sock and a string attached to it from their foot or wheelchair so the sock can be dragged through the grass.

Explain – They are going to look closely at the sock using a magnifying glass to see if they can find any seeds on their sock.

Activity – Children use a magnifying glass to make careful observations of any seeds they have collected on their sock. They will be able to see the seeds on the sock through the clear plastic bag.

Predict – Children predict what might grow from the seeds they have collected? I predict my seed will grow into ……

Explain – They are going to see what plants grow from their collected seeds and see if their prediction was correct. The seeds will need to be kept somewhere where they have everything they need in order to germinate and grow into a plant. What conditions will the seeds need?

Discuss – What conditions do they need to be able to grow?

Activity – With adult support, children tape the plastic bags to a well-lit window. *This activity could be extended by placing seeds in different conditions so that they can observe what happens if a seed is placed somewhere where the conditions are not correct.*

Discuss – What part of the plant do they think they will see first?

Explain – They are going to observe the seeds over the next few weeks and see whether anything begins to grow.

Activity – Children observe the seeds regularly over the next few weeks. They will use magnifying glasses to closely observe the seed and look for any changes.

Discuss – Regularly discuss the growth of the seed with the children and ask them to tell you using talk, signs or symbols what they have observed.

Record – Take photographs of the seeds during this time to record any observations. These will also act as a prompt to remind children what they have observed during the last few weeks. You could use time-lapse photography if available.

Discuss – What plant did grow? What part of the plant grew first? Why are seeds important? What conditions did the seed need in order to germinate and grow?

Conclude – Children use simple scientific language to tell you using talk, signs or symbols what they observed and what plant grew from their seed. Was their prediction correct?

Examples of children's work and teacher comments from country of origin

Science Outside the Classroom: Plants

My children loved this activity, especially collecting the seeds. They couldn't believe how small the seeds were and that they grew in a bag on a sock! We attached the sock bags to our classroom window inside and they all grew. They were hard to identify but it was clear that they were plants.
A next step would be to look at different seeds and compare their size, shape and colour. Children could also compare seeds to bulbs and explore any similarities or differences between the two.

Science Outside the Classroom: Plants

Lesson plans: Plants #3

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying Specific skill – comparing flowers	Recording
Country of Origin	Suggested Age Range	Suggested Theme
UK	9 – 10	Plants
Location outside the classroom	Benefits of using this location	
An area where there are flowering plants in the school grounds	There are flowers for the children to observe	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To make careful observations of flowering plants To compare the reproductive organs of flowering plants To record their observations	To know that some plants reproduce by sexual reproduction To know that there are male and female reproductive organs in a flowering plant To locate and name the reproductive organs in a flowering plant To develop an understanding of sexual reproduction in plants	
Key Vocabulary		
Scientific skills vocabulary – observe, observing, compare, comparing, similar, different, record, recording Knowledge vocabulary – flower, life cycle, reproduction, sexual, germination, pollination, fertilisation, offspring, male, female, stem, receptacle, petal, sepal, stem, pollen tube, anther, filament, ovule, ovary, style, stigma, carpel, nectar, gametes, fusion		
Resources / Equipment		
• Equipment to observe flowers – magnifying glasses, flowering plants • Resources for scavenger hunt - envelopes containing information on: stem, receptacle, petals, sepal, stamen, anther, filament, pollen, carpel, stigma, style, ovary and ovule. • Equipment to record observations – flowers to dissect (for example tulip and lily), tweezers, white paper, pencil, glue or sticky tape		
Teaching activities including differentiation		
Children will have previous knowledge of the life cycle of plants including germination and pollination. **Explain** - Plants are essential to every living thing and are all around us. **Discuss** – How do plants continue to live and grow? They need to reproduce or they will become extinct but how do they do this? What is the life cycle of a plant? **Explain** – The life cycle of a plant is: Germination – Plant Growth – Pollination – Fertilisation – Seed formation - Seed dispersal – Germination. To complete the life cycle, a plant must reproduce and produce offspring. Plants can do this in two different ways:		

- Asexually – requires 1 parent which produces an exact copy of the parent plant.
- Sexually – requires 2 parents and the fusing of male and female sex cells (gametes) and produces offspring which are not identical to the parent.

Explain – They are going to explore sexual reproduction in plants and observe the features of a plant involved in sexual reproduction.

Discuss – Show children a diagram of a plant. What parts of the plant can they label? What is the function of this part?

Activity – In pairs, children look at the plant diagram and discuss what different parts they can name and their function.

Discuss – What parts of the plant do you know? *(This provides an opportunity to assess their current knowledge and correct any misconceptions the children have before you continue the lesson).*

Explain – A flowering plant has many different parts which are involved in sexual reproduction, each of these parts has a specific function.

- Watch a video which clearly shows the process of sexual reproduction in plants.

Discuss – What do you know about sexual reproduction in plants? What is the process of sexual reproduction?

Explain – They are going to do a scavenger hunt in the school grounds in small groups. They will look for envelopes which contain the parts of a flowering plant and their correct definition. They will use this information to help them label an enlarged diagram of a flowering plant. (Each group will need to have a complete set of plants parts and a diagram of a plant.) The envelopes will contain information about: the stem, receptacle, petals, sepal, stamen, filament, anther, pollen, carpel, stigma, style, ovary and ovule.

Activity – Children complete their scavenger hunt and use the information found to label a plant diagram.

Discuss – The different parts of the flowering plant and their function.

Explain – They are now going to closely observe real flowering plants to look for evidence of the different parts discussed today.

Activity - Children use magnifying glasses to carefully observe flowering plants in the outside area and think about the similarities and differences between these parts in the flowers they observe.

Compare – Do the parts look the same in every plant? What is the same? What is different?

Explain – They are going to dissect two different flowers, a tulip and a lily, and identify the different parts in these plants.

Demonstrate - Show them how to start at the base of the flower and remove the sepals first using tweezers or their fingers and then carefully pull apart the remaining parts.

Record – Pupils record their observations by sticking each part of their plant onto a piece of paper and correctly labelling each part.

Compare – Do the parts look the same in the lily and the tulip? How are they different? Was one flower easier to dissect than the other? Were some parts easier to identify in one flower than the other?

Discuss – Why do the parts of a flower vary in appearance amongst different flowers?

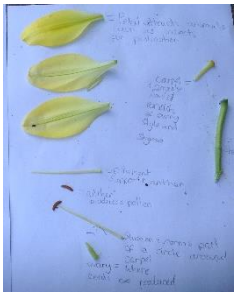
Science Outside the Classroom: Plants

Examples of children's work and teacher comments from country of origin

Pupils enjoyed the practical aspect of the lesson. They found that on some flowers it was easy to recognise the reproductive parts whereas on others they were much harder to identify. This observation enabled pupils to understand that although flowers have the same parts, there is still great diversity amongst them.

An extension to this lesson would be to identify whether there are the same number of petals/sepals/stamens/carpels on each flower? Is there a pattern based on the flower's location or pollination method?

Using resources they find outside, can they create their own flower using different materials to represent the parts of the flower.



Science Outside the Classroom: Plants

Lesson plans: Plants #4

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and classifying Specific skill – comparing flowers	Recording
Country of Origin	Suggested Age Range	Suggested Theme
UK	4 – 5	Plants
Location outside the classroom	Benefits of using this location	
School grounds	There are lots of different flowers growing that the children can observe	
Learning Objectives – Scientific Skills	Learning Objectives – Knowledge	
To make careful observations of flowers in their local environment To make comparisons between different flowers To record their observations in a drawing	To identify parts of a plant – leaf, stem, flower, petal To know that flowers are not all the same	
Key Vocabulary		
Scientific skills vocabulary – observe, see, compare, comparing, same, different, record, recording Knowledge vocabulary – plant, stem, leaf, flower, petal, roots		
Resources / Equipment		
• Equipment to make observations – magnifying glasses, flowering plants • Equipment to record observations – clipboards, flowering plants, paper, pencils, pastels		
Teaching Activities		

Explain – They are going to go outside and observe the flowers and plants that are growing in the school grounds. Explain that a flower is part of a plant. Many plants produce flowers but some plants, like ferns and mosses, do not. There are different parts to a plant.

Demonstrate - Using a flowering plant in the school grounds, identify and show children the stem, the leaves, the flower and the petals of the plant. Include the root of the plant by explaining that this part of the plant is in the soil so we cannot see it but it anchors the plant in the ground and takes up water and food/nutrients.

Activity – Children walk around the school with an adult looking at the different plants and flowers they can see growing there. As they are walking around, the adult should encourage a discussion about the flowers they observe in the school grounds and assess whether children can correctly identify the different parts of a plant.

Discuss – Did you see any plants that produce flowers? What colour were the flowers? Were all the flowers the same?

Explain – They are now going to look closely at the flowers on a plant. All flowers have petals. They are going to use

Science Outside the Classroom: Plants

magnifying glasses so that they can observe the flowers in more detail and look closely at the petals on different flowers.

Observe – Children use magnifying glasses to make careful observations of flowers. Can they count the number of petals a flower has? What colour are the petals? What shape are they? What do they feel like?

Explain – Flowers don't all look the same. They are going to look closely at the flowers of two different plants and think about what is the same and what is different.

Compare – Show children two different plants which have contrasting flowers. Children make careful observations of the flowers using magnifying glasses and make comparisons. Encourage children to think about the size, colour, shape, number of petals, texture and smell.

Discuss – What was the same? What was different?

Explain – They are growing to draw one of the flowering plants they have seen growing in the school grounds using pencils and pastels. They are going to do this outside using a clipboard to lean on so they can observe the flower as they are drawing.

Demonstrate – Show the children how to use look closely at the flowering plant and use their observations to help them draw the flower. e.g. I have counted five petals on my flowers so my drawing needs to have five petals. I need to draw a stem to support my flower.

Record – Children record their observations of a flower in an observational drawing.

Examples of children's work and teacher comments from country of origin

The children loved this lesson and really enjoyed looking at and comparing the different flowers. Going outside and looking first-hand at the plants and flowers also enabled us to assess clearly who understood the different parts of a plant and who could make careful observations of a flower.

This lesson also covers the following Early Learning Goals:
PS&E: Managing Feelings and Behaviour - ELG - They work as part of a group or class and understand and follow the rules.
Physical Development: Moving and Handling – ELG - They handle equipment and tools effectively, including pencils for writing.
Mathematics: SS&M – ELG - They explore characteristics of everyday objects.
UTW: The world – ELG - Children know about similarities and differences in relation to living things.
UTW: The world – ELG - They make observations of plants.
EA&D: Being Imaginative – 40-60 - Create simple representations of objects. Chooses particular colours to use for a purpose.

Science Outside the Classroom: Rocks

Lesson plans: Rocks

Children explored rocks and soils in their local environment. They compared and grouped rocks based on their appearance and simple physical properties and recognised that soils are made from rocks and organic matter.

Science Outside the Classroom: Rocks

Lesson plans: Rocks #1.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying Specific skill - comparing rocks	
Country of Origin	Suggested Age Range	Suggested Theme
Croatia	3 – 4	Rocks
Location outside the classroom	Benefits of using this location	
School Playground	The artificial rocks need to be placed in a sunny location to dry. Rocks from around the school grounds are used.	
Learning Objectives – Scientific Skills	Learning Objectives - Knowledge	
To compare the properties of artificial rocks and natural rocks To make careful observations of artificial rocks	To know the difference between artificial and natural rocks. To know the simple properties of rocks including colour, shape, size and hardness	
Key Vocabulary		
Scientific skills vocabulary – see, observe, compare, same, different Knowledge vocabulary – rock, stone, pebble, sand, water, sun, artificial, natural, hard, wet, dry		
Resources / Equipment		
• Equipment to make artificial rocks – sand, water, baking soda, plastic containers, cookie moulds • Equipment for comparing rocks – natural rocks (igneous – e.g., granite, basalt, pumice), magnifying lenses, hammers, mallets, scales, something to scratch the rock on		
Teaching Activities		

Discuss – Ask the children where they can find rocks? Are they all the same size? Do they all look the same? Where do they think rocks come from? What are they used for? (If appropriate, recap on previous learning from books, photographs and posters about rocks and their different colour and sizes). Use and define the words, rock, pebble and stone.

Explain – The centre of the Earth is a very hot liquid. When this liquid cools down and becomes a solid it can make a type of hard rock (Igneous). It can take a very long time for rocks to be formed. These rocks can be different colours, sizes and hardness. Explain they are going to make an artificial rock and compare it with a real rock.

Activity 1: Making Artificial Rocks

Demonstrate – Show the children how to mix together sand, warm water and baking soda in a plastic container. With help, the children mix and pour their mixture into a mould and put it in a sunny place for a few days to dry and become solid.

Science Outside the Classroom: Rocks

Observation over time – Children look at the artificial rocks over the next few days as they dry out and observe the changes. Ask the children questions about the appearance of the rocks in the mould. What do they notice? What colour is it? How hard is it? Does it look different today? How? Why?

Activity 2: Comparing Artificial Rocks with Real Rocks

Demonstrate – Remove the hardened artificial rocks from the moulds. Show children how they could compare the different rocks e.g., comparing colour, size, the smoothness or the surface, hardness, how heavy it weighs.

Activity – Children look at the differences and similarities between artificial rocks and natural rocks. They can use magnifying lenses and scales to make careful observations. They could use a hammer or small mallet to try and break the rocks.

Discuss – What did they find out? Compare the features of the artificial and real rocks? Could they break the rocks? Which rocks were hardest – artificial or natural? What happened to the rocks when they were hit with the hammer or mallet?

Explain – It is much more difficult to break down natural rock because they are much harder because the Earth is much hotter than the warm water.

Examples of children's work and teacher comments from country of origin

They observed closely and patiently how artificial rocks dry by checking them and looking for changes every day. They used the rocks they made to build a little wall and also made houses using real rocks, stones and pebbles in the school outdoor area.
They could try using different types of sand – texture, colour – to make artificial rocks.

Science Outside the Classroom: Rocks

Lesson plans: Rocks #2.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying Specific skill – comparing sand	Recording
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	3 – 6	Rocks
Location outside the classroom	Benefits of using this location	
Forest	An area where many rocks (stones, pebbles, sand) can be found	
Learning Objectives – Scientific Skills	Learning Objectives - Knowledge	
To compare sand made from different rocks To observe sand using a digital microscope To record their findings using a drawing	To know that rocks can be broken down into smaller parts and these parts can be useful to us To know that stones and pebbles come from larger rocks To know sand is made from a rock	
Key Vocabulary		
Scientific skills vocabulary – observe, compare, same, different, record, draw Knowledge vocabulary – rock, stone, pebble, sand, forest, sandpaper		
Resources / Equipment		
• Equipment to collect stones - buckets • Equipment to make sand – sandpaper, stones, trays • Equipment to observe sand – microscope (small handheld), computers		
Teaching Activities		

Discuss – Where do the rocks (stones and pebbles) come from on the forest floor? Are they all the same – shape, size, colour, weight?

Explain – Stones are small pieces which have broken off a larger piece of rock because of the effect of the weather. A pebble is a small stone made smooth and round by the action of water or sand.

Discuss – Where do you find sand in the forest? What does it feel like? What does it look like? How can we make sand? Is all sand the same?

Explain – They are going to find out how sand is made by doing an investigation using a special abrasive paper called sandpaper. *(Sandpaper is a name used for a type of coated abrasive that consists of sheets of paper or cloth with abrasive material glued to one face. Sand is not now used in the manufacture of this product).* They are

Science Outside the Classroom: Rocks

going to collect some stones from the forest floor and use these stones to make sand.

Demonstrate – Show children how to use the sandpaper safely and carefully to rub the edges of the rocks/stones/pebbles to produce smaller bits of rock – called sand.

Activity – Children feel different types of sandpaper and think about how they could use this to make sand. Children collect different examples of small rocks/stones/pebbles from the forest floor. They rub/sand them using the sandpaper and create a pile of sand on their tray. Children can experiment with different types of rocks/stone to see if the grains of sand they produce look the same or different.

Observe– Show children how to use a microscope to look carefully at the grains of sand they have produced from their rocks/stones/pebbles. Explain that a microscope enlarges the image so they can look at it more closely.

Record – Children record their findings in a drawing.

Compare – Children compare the sand produced by different rocks. What do the grains of sand look like when they are enlarged? Do the grains of sand all look the same or do they look different? Do they get different types of sand from the different stones?

Examples of children's work and teacher comments from country of origin

The children had spent time before this activity visiting the forest and looking at different rocks and stones. They had also watched some films about rocks and stones. These activities meant that the children had some knowledge already and were very curious about different stones and sand.

Science Outside the Classroom: Rocks

Lesson plans: Rocks #3.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Observing	Recording
Country of Origin	Suggested Age Range	Suggested Theme
UK	6 - 7	Rocks
Location outside the classroom	Benefits of using this location	
School grounds	Children can collect soil samples from different locations within the school grounds	
Learning Objectives – Scientific Skills	Learning Objectives - Knowledge	
To predict what they think they will find in soil To make careful observations of soil from different locations To record their findings using a picture	To know that soil is a mixture of tiny pieces of rock, dead plants and animals, air and water To know that soil is essential for life on Earth	
Key Vocabulary		
Scientific skills vocabulary – predict, prediction, observe, see, record, picture Knowledge vocabulary – soil, rock, dead, plants, animals, air, water, essential, needed, life, Earth, components, parts		
Resources / Equipment		
• Equipment to share predictions – white board and pens • Equipment to collect soil samples - trowel/small spade, white observation trays • Equipment for observation and separation of components – magnifying glasses, tweezers, spoons, sieves • Equipment for recording – paper and pencils or a camera to take photographs of images created from the components of soil		
Teaching Activities		

Activity – Pupils write the word 'soil' in the middle of a whiteboard and on the outside write or draw what they know about soil, where do you find soil and predict some items, they think you can find in soil. Discuss their initial thoughts. Clarify difference between soil and mud (soil and water) and raise awareness of living and dead components within soil.

Explain – Today they are going to take a closer look at soil and investigate what soil is made of and whether all soil is the same. They are going to dig up soil from different areas in the school grounds and observe the soil closely to see what it is made of.

Activity 1: Soil Observation

Activity – Children dig up some soil from one area in the school grounds and put it in a white observation tray. Using magnifying glasses, they make careful observations and using sieves, spoons and tweezers they try to separate out the different components they find. They repeat this in a second location. Locations could include a flower bed, next to a path, by a pond, under a tree, in a shady area, in a sunny area or by the playground.

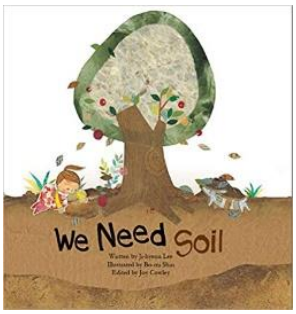
Science Outside the Classroom: Rocks

Record – Children produce a 'picture' which shows the different components they found in the soil in each location.

Compare – What did they find in their soil sample? How easy was it to separate the items they found? Were their predictions correct? What did they find in their second sample of soil? What was the same? What was different?

Activity 2 – Comparing Soil Pictures

Compare – Compare the pictures produced by different groups. Do the pictures look the same or different? What does this tell us about the soil in different locations?



Discuss – Why do we need soil? Did their soil samples show any examples of the things described in the story? Talk about how some of the things in the soil might be too small to see.

Share a story – Read a book - for example 'We Need Soil' by Ji-Hyeon Lee - which describes how many kinds of living things need soil e.g. different creatures live in the soil and the soil contains nutrients that plants need to grow. The story also explains how living things become part of the soil when they die.

Examples of children's work and teacher comments from country of origin

This lesson worked well for the pupils to observe what components make up the soil. Making the pictures encouraged them to look more closely at the soil. This activity could be repeated at various intervals throughout the year to observe changes across the seasons e.g., in autumn/winter they would see a higher proportion of leaves decomposing in the soil whereas in the spring or summer they would find more invertebrates in the soil.

Science Outside the Classroom: Rocks

Lesson plans: Rocks #4.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Observing	Identifying and Classifying	Recording
Country of Origin	Suggested Age Range	Suggested Theme
UK	9 - 11	Rocks

Location outside the classroom	Benefits of using this location
School grounds	There are a wide variety of rocks for the children to find and it provides a wide-open space for classification.

Learning Objectives – Scientific Skills	Learning Objectives – Knowledge
To identify different rock types To make careful observations of rocks To identify features of igneous, metamorphic and sedimentary rocks To classify rock types using a classification fact file To record their findings	To know some common features of igneous, metamorphic and sedimentary rocks To know how igneous, metamorphic and sedimentary rocks are formed

Key Vocabulary

Scientific skills vocabulary – observe, see, identify, classify, classification, features, record
Knowledge vocabulary – igneous, metamorphic, sedimentary, granite, basalt, pumice, obsidian, andesite, limestone, chalk, coal, flint, marble, slate, anthracite

Resources / Equipment

- Resources required for rock observation – examples of igneous, metamorphic and sedimentary rock types, magnifying glasses
- Equipment required for identification of rocks – classification fact files, hoops and labels for sorting
- Equipment required for recording – paper and pencils

Teaching Activities

Discuss – There are lots of different rocks on Earth - what different types of rock types can they think of? (e.g., granite, marble, pumice, sandstone). Rocks can be classified/grouped together according to how they are made/formed and what they look like and what they do – these are called their features. What groups of rocks do they know? Igneous, metamorphic or sedimentary rock.

Activity 1: Features of Rocks

Observe - Provide samples of all three rock types for children to observe, using magnifying glasses for closer observation. Children will observe features (colour, hardness, grain size, contain fossils) of these three rock types.

Discuss – What features are common to all igneous / metamorphic / sedimentary rocks. What similarities did you find? What differences did you find? Which is the easiest type of rock to identify? Why? Which is the hardest?

Science Outside the Classroom: Rocks

Explain – They are going to use the features they have observed and a rock classification fact file to help them identify and classify rocks within the school grounds.

Activity 2: Identification of Rocks

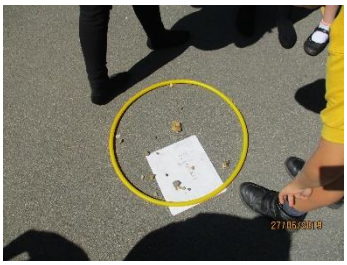
Activity – Children search the school grounds for different rocks and make close observations of the rocks they find using magnifying glasses.

Classify – Children use the classification fact files provided to help them classify the rocks as either igneous, metamorphic or sedimentary and place them in hoops on the playground. During the activity, adults can pose questions as the children place the rocks in the hoops. Are all the white rocks chalk? Do all sedimentary rocks have layers? Is one type of rock dominant in the school grounds? Why might this be?
It may be advisable to place some examples of the three types of rock around the school grounds, so they have an opportunity to identify all three types of rock.

Record – Children chose rocks of their choice, one from each of the three rock types. Draw a picture of the rocks and label it with the observable features they used to classify it as igneous, metamorphic or sedimentary.

Discuss – Children choose a rock to present to the class, explaining their findings using the correct scientific terms and vocabulary. Encourage the other children to ask questions in order to deepen their own learning and understanding.

Examples of children's work and teacher comments from country of origin



The practical aspect of this lesson was useful for children to observe the differences and similarities between rock types.

Science Outside the Classroom: Sound

Lesson plans: Sound

Children explored how sounds are made and associated a sound with something vibrating. They recognised that sound vibrations travel through a medium to the ear and explored how sounds get fainter as the distance from the sound source increases.

Science Outside the Classroom: Sound

Lesson plans: Sound #1.

<table>
<tr><th colspan="4">Learning Scientific Skills Outside the Classroom</th></tr>
<tr><th colspan="4">Scientific Skills</th></tr>
<tr><td colspan="2">Identifying and Classifying
Specific skill – comparing sound</td><td colspan="2">Recording</td></tr>
<tr><td>Country of Origin</td><td colspan="2">Suggested Age Range</td><td>Suggested Theme</td></tr>
<tr><td>  Croatia</td><td colspan="2">5 – 6</td><td>Sound</td></tr>
<tr><td colspan="2">Location outside the classroom</td><td colspan="2">Benefits of using this location</td></tr>
<tr><td colspan="2">Large quiet area outside</td><td colspan="2">Using a space outside enables you to limit the noise from other areas within school and allows the children to make sounds without disturbing others</td></tr>
<tr><td colspan="2">Learning Objectives – Scientific Skills</td><td colspan="2">Learning Objectives - Knowledge</td></tr>
<tr><td colspan="2">To compare the loudness/volume of sound made by rattles
To record their findings in a table with the support of an adult</td><td colspan="2">To compare the loudness/volume of sound made by rattles
To record their findings in a table with the support of an adult</td></tr>
<tr><td colspan="4">Key Vocabulary</td></tr>
<tr><td colspan="4">Scientific skills vocabulary – compare, comparison, record, recording, table, results,
Knowledge vocabulary – sound, loud, louder, quiet, quieter, material, rattle, names of musical instruments, shake</td></tr>
<tr><td colspan="4">Resources / Equipment</td></tr>
<tr><td colspan="4">• Equipment to explore sound – for example musical instruments, tubing and pipe
• Equipment to make rattles – containers of different sizes shapes and materials; a selection of natural materials collected by the children prior to the lesson.</td></tr>
<tr><td colspan="4">Teaching Activities</td></tr>
</table>

Science Outside the Classroom: Sound

Discuss – How can they make a sound using the musical instruments and materials provided? Children are encouraged to describe what they will do. e.g., banging, blowing, scraping or hitting materials together.

Activity 1 - Provide children with lots of different musical instruments they can use to make different sounds. Give them time to explore the different sounds they make and the way they can be used to make different sounds.

Activity 2 – Children make a rattle using a container and materials of their choice from rocks, pebbles, leaves, straws and small pieces of wood etc. They are asked to name the materials they used and to describe the sounds they make.

Compare – In small groups, the children compare with each other.

- Who has the largest rattle? Who has the smallest rattle?
- Who has the most material inside their rattle? (This would provide an opportunity to practise their counting skills)
- Which ones makes the loudest sound? Which ones make the quietest sound?
- How can they make the sound louder or quieter?

Explain – We use the word volume to measure how loud or quiet a sound is, for example we can change the volume of the radio or television if we want it to be quieter or louder.

Discuss – in small groups, the children discuss the sound produced by the rattle using the word 'volume'.

- Is the largest rattle making the greatest volume of sound?
- Is the rattle with the most material making the greatest volume of sound?
- How can they change the volume of sound?

Record – Children work in a group with an adult to make a poster which records and presents their findings.

Examples of children's work and teacher comments from country of origin

The children showed a strong interest for this activity. They spent a long time manipulating the materials for their own rattle – this showed their need for sensory exploration.

Science Outside the Classroom: Sound

Lesson plans: Sound #2.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Predicting	Recording	Concluding
Country of Origin	Suggested Age Range	Suggested Theme
Spain	9 - 10	Sound

Location outside the classroom	Benefits of using this location
Outside on the playground	A large quiet outdoor space is needed to complete the activities
Learning Objectives – Scientific Skills	**Learning Objectives – Knowledge**
To make predictions based on their prior knowledge and understanding To record observations using annotated diagrams and a table To present their findings in a written conclusion using relevant scientific language	To know that sound is made up of sound waves To know that sound waves can move energy because sound is a type of energy To investigate how long it takes for different sounds to be reduced to low levels

Key Vocabulary

Scientific skills vocabulary – predict, predicting, hypothesis, justify, record, recording, conclude, conclusion, explain, measure
Knowledge vocabulary – sound, sound waves, ear drum, vibration, intensity, volume, loud, amplitude, decibel, noise

Resources / Equipment

- Equipment for 'Ripples on water' – tuning fork, bowl of water, paper, pencil
- Equipment for 'Sound you can see' – porex/polystyrene balls, speaker, paper, pencil
- Equipment for 'Can you hear it?' – Tibetan bowl, musical triangle, shakers

Teaching Activities

Explain – Today they will be investigating different properties of sound using four research questions:

- What happens if we place a tuning fork in and on water?
- What happens if porex/polystyrene balls are placed on a loudspeaker playing loud sounds?
- How far can sound travel in air?
- Where are the loudest sounds in the local environment?

Activity 1: Ripples on water from a tuning fork

Predict – Children make a prediction about what will happen when a tuning fork is placed on the surface of water/in the water and give a reason.

Activity - Children tap turning forks against a book (or rubber bung but not a tabletop) and observe what happens if they dip it into a bowl of water. Repeat activity and touch the surface of the water. The children holding the tuning fork should explain what they felt when the fork was hit and touched the water.

Record and conclude – Children draw what they see and write a conclusion explaining whether their prediction was correct. (Waves move on the water surface because of the movement of the tuning fork being transferred)

Science Outside the Classroom: Sound

Activity 2: Polystyrene balls on a loudspeaker

Predict – Children make a prediction, with a reason, about what will happen when porex/polystyrene balls are placed on a loudspeaker which is connected to a source of sound (radio, record player, noise generator) and the sound is louder and quieter.

Activity – Children place porex/polystyrene balls on a loudspeaker and then turn on the music. They observe what happens to the balls and will investigate what happens to the balls if you change the volume (amplitude) of the sound. If a sound source is available to vary the frequency, then the children can observe the motion of the balls if the frequency is changed.

Record and conclude – Children draw an annotated diagram which demonstrates their findings and write a conclusion explaining whether their prediction was correct.

Activity 3: Can you hear it?

Predict – Children make a prediction, with a reason, about how far the sound made from a musical instrument will travel before they can no longer hear it.

Activity – Children work in pairs – one child makes a sound with each of the percussion instruments and the other child walks away from the instrument. The second child counts the number of steps until they can no longer hear the sound. The volume of sound from the different instruments needs to be considered.

Record and conclude – Children record the numbers of steps taken for each instrument in a table. They use this data to write a conclusion explaining whether their prediction was correct.

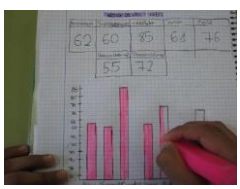
Activity 4: The Noise busters

Explain –The loudness of sound is related to the amplitude of a sound wave and can be measured with a decibel scale. A noise level about 85 decibels is harmful.

Activity – Measure noise level in different locations around the school and local environment using a decibel meter. Draw graphs to show the readings.

Discuss – Which locations had a noise level which would be considered harmful? Discuss the consequences of noise pollution.

Examples of children's work and teacher comments from country of origin



The health and safety issues of these activities should be brought to the children's attention.

Science Outside the Classroom: Sound

Lesson plans: Sound #3.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Identifying and Classifying Specific skill – comparing objects		Concluding Specific skill – communicate what they have found out using simple scientific language
Country of Origin	Suggested Age Range	Suggested Theme
Sweden	2 – 3	Sounds
Location outside the classroom		Benefits of using this location
Woods		There are a variety of different natural materials for the children to collect
Learning Objectives – Scientific Skills		Learning Objectives – Knowledge
To compare the sounds made by natural materials in a container To say what they have found out using simple scientific language		To investigate the sound made by different instruments To know that sounds can change in volume, some are loud, some are quiet To make their own instrument using natural materials
Key Vocabulary		
Scientific skills vocabulary – compare, same, different, communicate, find out Knowledge vocabulary – sound, volume, loud, quiet, natural, material		
Resources / Equipment		
• Musical instruments • Containers for collecting materials and containers for making instruments using the materials collected • Sound recorder		
Teaching Activities		

Science Outside the Classroom: Sound

Explain – They are going to find out about making sounds from musical instruments and then make their own instrument to compare the sounds they can make using materials they can find in the wood.

Activity 1 – Children play with the different instruments and investigate how they make a sound. Do they have to blow, hit or pluck the instrument to make a sound? Can they make different sounds using the same instrument?

Discuss – How did they use the instruments to make a sound? Could they make different sounds? How?

Activity 2 – In small groups, children walk around the wood to collect a range of materials they think they could use to make different sounds. The collected materials are grouped together in trays for all the children to use.
Each child chooses one of the materials and tests whether it can be used to make a sound on its own. They then put the material into a container (a jar or a plastic tub) and uses the material in the container as an instrument.

Children think about whether the instrument they have made makes a sound and how the sound is made. They can record their sounds using a sound recorder – this allows them to hear their sounds again and helps them to compare the sounds made by different materials.

Discuss – Which materials made a sound in the container? Do the materials in the containers all make the same sound or do they make different sounds? Use the recordings to listen to loud and quiet sounds. Which material made the loudest sound in the container? Which material made the quietest sound in the container? Can they use the same material in their container to make a loud sound and a quiet sound?

Explain – The materials make a sound when they move around in the container. When the material hits the side of the container it makes a sound. If it hits the side gently it makes a quiet sound. The harder it hits the side, the louder the sound. We use the word volume to describe how loud a sound is. We have a volume button on the radio and television - if we turn the volume up, the sound gets louder. If we turn the volume down, the sound gets quieter.

Activity – Can they make a loud noise with their voice? Can they make a quiet sound with their voice?

Examples of children's work and teacher comments from country of origin

It was good to have two teachers on this activity. One teacher accompanied the children and investigated the sounds being made and the other teacher stayed in the areas where the materials were gathered. Both teachers asked the children questions and discussed the children's findings. The adults also helped to record the children's different sounds so the children could come back and listen to the sounds.

Science Outside the Classroom: Sound

Lesson plans: Sound #4.

Learning Scientific Skills Outside the Classroom		
Scientific Skills		
Measure		Record
Country of Origin	Suggested Age Range	Suggested Theme
UK	KS1 specialist unit Activity planned for children with severe learning difficulties.	Sound
Location outside the classroom		Benefits of using this location
Large open space outside		You need a large open area which is quiet and where children can measure a long distance
Learning Objectives – Scientific Skills		Learning Objectives – Knowledge
To measure distance in metres using a trundle wheel To record data in a table		To know how to make a sound using their body To know that they use their ears to listen to sounds To know that sound can travel To know that some sounds travel further than others To know that a quiet sound is harder to hear than a loud sound
Key Vocabulary		
Scientific skills vocabulary – measure, measuring, metre, distance, record, recording, table, results Knowledge vocabulary – loud, quiet, near, far, whisper, shout, sound, travel		
Resources / Equipment		
• Equipment for making sounds – drum, bell, children's voices • Equipment to measure distance – trundle wheel, chalk, cones • Equipment for recording – clipboard, results table, pencils		
Teaching Activities		

Science Outside the Classroom: Sound

Explain – They are going to go outside and explore whether sound can travel from a place where it is made to them. If a sound is made, we can hear it because the sound travels to our ears.

Discuss – What is sound? Can they think of different ways to make a sound using their voice? Can they make different sounds using their body? How far can sound travel? How far away can we hear sound?

Activity 1 – Go outside into a large space and ask one child to stand in the centre of the other children and speak in a whispering voice. Children say whether they can hear the voice. The same child moves to another place on the playground and speaks again in a whispering voice. Children say whether they can hear the voice. Repeat with another child whispering.

Explain – They are going to test some sounds to see how far away they can go until they cannot hear the sound anymore. They are going to measure the distance away from the sound in metres.

Demonstrate – Show the children how to measure a distance in metres using a trundle wheel.
Activity 2 – Children choose a base/starting point which will be point 0 metres where the child will stand to make a sound. They work together, with adult support as required, to measure distances of 10 metres across the playground. For children who can count to ten, they can push and count together the clicks on the trundle wheel until they get to ten clicks. A different child will draw a chalk mark on the floor at this point and place a cone on top of the mark to show that this is 10 metres. This process is repeated from each cone until they have worked together to measure 100 metres.

A child stands at the base and makes a sound. The remaining children will move in 5 metre intervals across the playground and listen to whether they can hear the noise. If they can hear it, they will tick the correct box in a pre-drawn table.

Record – Children listen to different sounds (for example a whisper, a shout, a bell and a drum) and record in a table whether they can hear the sound at different distances.

Discuss – Together, the class will discuss their results. How far away could they hear sound? Is it the same distance for all the sounds? Is it easier to hear a quiet sound or a loud sound?

Examples of children's work and teacher comments from country of origin

The children really responded well to this activity and I was amazed at their recall of previous discussions about sound and the vocabulary they used independently.

They loved the measuring and took it all very seriously – making sure the cones were in a straight line and watching each other to make sure they counted properly. They also loved making sounds – especially the shouting! They soon realised it was hard to communicate when they were far apart so decided on sign language to say start stop, and wait! They wanted to use a thumbs up when each sound was recorded and ready for the next. They asked why they could see their friends, but they couldn't hear them.
Next, we would talk about where sounds are coming from and how it can help us in our daily life, for example we can hear cars on a road and even though we can't see them we know there must

be a road and a car nearby.