



STEM IN THE OUTDOORS



EARLY - FIRST LEVEL (P1-4)

Created by Kim Aplin, PSDO, Aberdeenshire

Introduction

This resource was created for a small rural school in Aberdeenshire, comprising 2 classes: P1-4 and P4-7; these are the activities for P1-4. The activities were undertaken in a whole day of STEM Outdoor learning which was also attended by parents and grandparents who participated in the activities alongside their children.

The programme for the day was as follows:

STEM IN THE OUTDOORS FAMILY LEARNING DAY

9.15 am – 10.15 am

- UV bead investigations – P1-4/P4-7
- Build a raft from natural materials – P1-4

BREAK

10.30 – 11.30 am

Build a shelter for UV sensitive animals – 7 groups of 3 children

11.30am - 12.30pm

- Tree activity P1-4/P4-7
- Water Race (20 minutes) - 3 teams of 7 children

LUNCH

1.30 – 3.15 pm

Bug hunt P1-4/P4-7

Bug hotels P1-4/P4-7

The bug hotels were constructed in the classroom and were started but were completed the next day due to lack of time.

A risk assessment was undertaken for the day and is included in this document. This should be regarded as an example; each establishment should complete their own to reflect their own setting.

Many thanks to Fergie School, Head Teacher Mrs Matthew, staff, pupils, and parents for piloting this resource and for providing the example programme for the day and the risk assessment.

<i>Activity assessed</i>	Family Learning – STEM Outdoor Learning Day
<i>Date of assessment</i>	
<i>School</i>	

Step 1	Step 2	Step 3		Step 4		
<i>List Significant hazards here:</i>	<i>Who might be harmed and how?</i>	<i>What are you already doing?</i>	<i>What further action is needed?</i>	<i>Action by whom?</i>	<i>Action by when?</i>	<i>Done</i>
Use of bench hooks and junior hacksaws Use of hammers and panel pins. Handling of sticks, stones, grass etc.	Pupils may be harmed by the saw Pupils may be harmed by hammer/panel pins Pupils – contamination from dirty fingers	Children are appropriately supervised when using hand tools. Children are instructed in the use of tools. The tools are adequately maintained by a competent person. The tools are stored correctly in a secure place. Pupils to be reminded to wash hands and not touch mouth etc.	Teacher to set up area in classroom where tools can be used safely with adequate supervision. Tools should be tidied away immediately when finished. Ensure hands are washed frequently on the day.			

Description of activity: Making bug hotels.

Step 1	Step 2	Step 3		Step 4		
<i>List Significant hazards here:</i>	<i>Who might be harmed and how?</i>	<i>What are you already doing?</i>	<i>What further action is needed?</i>	<i>Action by whom?</i>	<i>Action by when?</i>	<i>Done</i>
Children to be supervised when investigating the local area	Members of group	Brief group about environment – children know that they must be in sight of an adult at all times.	Remind children on the day that they must be able to see an adult at all times.			
Injury from branches when looking at branches/plants on paths	Members of group	Avoid pulling branches. Ensure that observers are beyond reach of low branches. Long sleeves/trousers to be worn				
Slips and trips on wet paths/grass	Members of group	Brief group for conditions. Advise suitable footwear.				
Skin damage from UV in sunlight	Members of group	Advise wearing hats and taking water. Parents to provide sunscreen.				
Risk of injury when exploring the environment – nettles, lifting stones, slips/trips	Members of group	Long sleeves/trousers to be worn. Remind pupils to get adults to help when lifting stones. Replace stones carefully to prevent injury to fingers.				
Handling of sticks, stones, grass etc.	Pupils – contamination from dirty fingers.	Pupils to be reminded to wash hands and not touch mouth etc.				

Description of activities:

UV Bead investigations; Minibeast hunt; Building UV shelters – gathering plants, natural materials; Water race; Tree activities – investigating the local environment

ACTIVITY 1: Revealing UV light with colour changing beads

Background information:

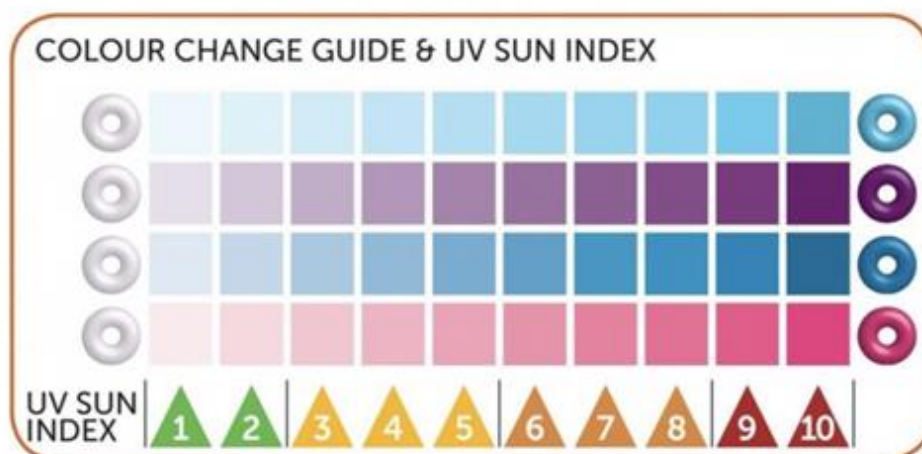
Ultraviolet radiation (also called UV light) is a type of light energy also called electromagnetic radiation. There are many forms of light energy and UV is one form of light energy; other forms include incandescent light, fluorescent light, halogen lights, LEDs, sunlight, neon etc. They are different based on the wavelengths they produce and how the light is produced. Some of these wavelengths create the visible spectrum and allow us to see colours. None of the energy present in the UV part of the spectrum is visible to the human eye; the only light energy that can be seen is called “visible light.” Thus, UV light is not visible.

UV Beads: The beads are white in ordinary, visible light but in UV light. While you cannot see UV light, this high-energy light excites the dye molecules in the beads resulting in a change in the shape of the dye molecules. The new shape affects the light colours the molecules absorb and reflect. Beads that turn red when exposed to UV light contain a dye whose molecules absorb all the visible light colors except red. Any red light striking the bead is scattered in all directions resulting in the beads’ red colour; they become assorted colours depending on the pigment added to each bead.

*Through creative play, I explore different materials and can share my reasoning for selecting materials. **SCN 0-15a***

*I can talk about science stories to develop my understanding of science and the world around me. **SCN 0-20a***

*I have contributed to discussions of current scientific news items to help develop my awareness of science. **SCN 1-20a***



0 = no UV light gets to the beads (i.e., it is a great UV blocker); 10 = all the UV light gets to the beads (i.e., it is a poor UV blocker) (Full sized chart on page 16).

Most weather forecasts now include a UV Index, so you know when it is safe to stay out in the sun a little longer. The UV Index goes from 0 to 11+; the higher the number, the less time you should be in the sun. The index changes according to the time of day and the season as well as the weather conditions. [UV – how to stay safe in the sun - BBC Weather](#)

Each child will need about 5 beads and string/a pipe cleaner.

The children make some observations about the beads (*white, plastic, round etc*). Thread a few beads onto a piece of string/pipe cleaner to make a bracelet. Now walk outside and watch what happens (*the beads change from white to brightly coloured*). Why? What has caused it? (*Air, sun, temperature?*) (*It is ultraviolet light from the sun that changes the beads from colourless to coloured. The sun produces many different types of light. The light we can see is called white light, but the sun also produces ultraviolet light, that we cannot see. Ultraviolet light is what causes you to get sunburn*).

How can you test to see what is causing the colour to change? (*e.g., test if it is sunlight by flipping the beads on top of the wrist, and then trying them under the wrist. If the children test by moving into the shade, there is a change of temperature involved too!*)

Let them investigate what happens in different places using the colour change guide. E.g., in the shade, under a tree, etc.

1. Investigate different sunglasses to see how well they can block out UV light.

Each group will need 2 cups, UV beads and a variety of sunglasses.

Place a few beads in two cups. Cover one of the cups with a lens of the sunglasses and go outside with your cups. If the beads under the sunglasses don't change colour, the glasses are good at blocking harmful UV light. *Which ones are the best? Can you rank them from bad to good?*

To allow an easier comparison which maybe more appropriate for younger children, the beads and sunglasses could be set up like this:

The sunglasses must be positioned carefully so that they shield the beads from the sunlight, but the beads can be observed, and the colours directly compared between the different sunglasses and the beads which are not shielded by sunglasses.

Note: this method works best in bright sunlight!



Suggested extension/additional activities:

- Test a variety of glass and plastic containers, or even prescription bottles, to determine which materials might block UV light. Place different transparent materials over the beads and observe what happens.
- The front windshield of most cars absorbs some UV radiation, so that the driver gets less eye strain. Usually, the side windows in a car do not have this built-in protection. Can you test this?
- Investigate sunscreens with different SPF and how effective they are in protecting us from the sun or test sunscreens of different brands with the same SPF. Do they all work as well?

The easiest way to do this is to put an equal number of beads into sealable plastic bags. Use one as the 'control' so this one will not have any sunscreen. Label the other bags with whatever is being tested and evenly spread a half-teaspoon of sunscreen directly onto the bag. Let the sunscreen dry completely and lay the bags next to each other in direct sunlight and watch them for two to three minutes. Sort the bags by the brightness of the colours by placing the brightest colours on the left (starting with the Control) and the palest colours on the right, and the other bags by decreasing colours in between.



Now check the labels to see how effective the sunscreens are. If the sunscreen products are performing as advertised, you should easily see colour differences in the bags. The Control bag on the left is full of colourful beads. At the right should be the palest beads under the highest SPF product with lower numbers on the other bags as the colours get less bright.

This links to HWB:

*I am learning to assess and manage risk, to protect myself and others, and to reduce the potential for harm when possible. **HWB 0-16a / HWB 1-16a / HWB 2-16a***

Design and build a shelter to protect an animal from the sun

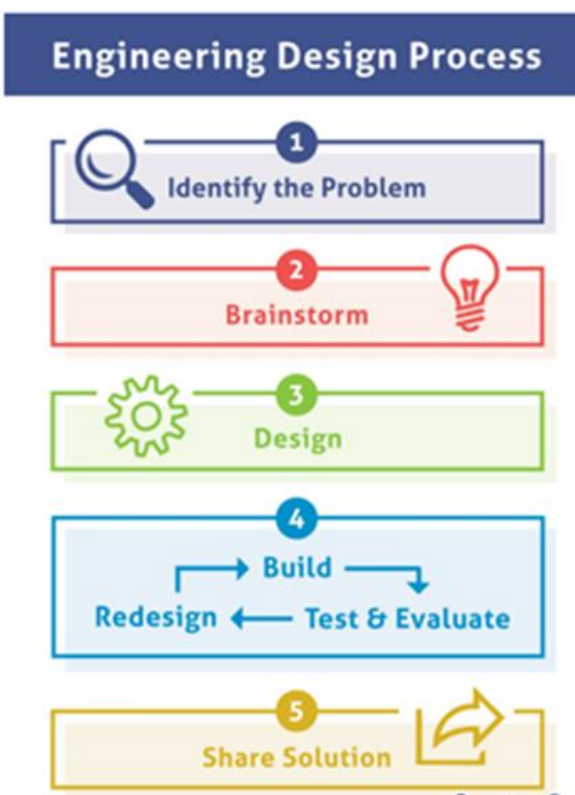
*I explore ways to design and construct models. **TCH 0-09a***

*I can design and construct models and explain my solutions. **TCH 1-09a***

Each group to make a creature with a pipe cleaner and UV beads. The beads are white in the shade/inside but coloured outside. Talk about how we keep ourselves safe in the sun (*sun hats, sunglasses, long sleeves t-shirts, suntan lotion etc*). How could

we protect our creatures from the sun? *By building a shelter – either from natural materials found outside or from recycled/craft materials.* Test them out! (Set some design criteria: must have a door, must be free standing etc)

This activity should involve the engineering design process to ensure it is a STEM activity rather than an arts and craft activity: The groups will need time to brainstorm and maybe sketch ideas out for their design and have time to build, test and improve their shelters.



ACTIVITY 2: Bug Hunt!

Background information:

96% of all known animals are invertebrates (animals without backbones). Animals are either vertebrates (animals with a backbone e.g., birds, fish, mammals, and there are 60,000 species) or invertebrates (animals without backbones e.g., insects, worms, spiders, and there are 1.3 million species).

It is important that all living creatures are disturbed as little as possible and returned to the exact spot where they were caught. Learners should be encouraged to replace rocks and stones gently back where they found them and follow all health and safety advice given e.g., washing hands before eating.

*I have observed living things in the environment over time and am becoming aware of how they depend upon each other **SCN 0-01a***

*I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions. **SCN 1-01a***

Egg box scavenger hunt:

Each group will need an egg box with some things to find stuck on the lid e.g.

Something which has never been alive	Something that uses energy from sunlight to make its own food
Something which is not biodegradable	Something that was once alive

Or...

A scavenger hunt:

Yellow	Green	White
Brown leaf	Jaggy leaf	White flower
Seed	Twig	Moss

Animals in the school grounds

See how many animals you can find! Search under things, on plants, in the grass and fill in the chart (page 11). A simple identification key is useful to have for this too such as the *OPAL Bugs Count Pocket ID Guide* (See P4-7 resource pack).



Depending on the time of year and what the children find, this could be followed up with looking at lifecycles in the classroom; we found caterpillars and a chrysalis in our survey!

Survey Sheet: Animals in the school grounds

	 Use tally marks	Make notes or draw some pictures!
How many animals did you find in total?		
What was the biggest animal you found?		
What was the smallest animal you found?		
Which animal did you find the most of?		
Which animal did you find the most interesting?		

ACTIVITY 3: Trees!

*I have observed living things in the environment over time and am becoming aware of how they depend on each other. **SCN 0-01a***

*I can distinguish between living and non-living things. I can sort living things into groups and explain my decisions. **SCN 1-01a***

*I can estimate how long or heavy an object is, or what amount it holds, using everyday things as a guide, then measure or weigh it using appropriate instruments and units. **MNU 1-11a***

*I can estimate the area of a shape by counting squares or other methods. **MNU 1-11b***

Each pupil will need:

Clip board

Paper

Pencil

Wax crayon

A laminated sheet/poly pocket with a 1 cm grid drawn on to it.

Choose a tree and touch the bark. What does it feel like?

Make a rubbing of the bark.

Look at the size and shapes of the leaves: are they bigger or smaller than your hand? What shape are they? Carefully look at a leaf and draw it. Can you estimate its area by putting a grid over and counting the squares?

Can you put your hand right round the trunk?

Can you put your arms right round the trunk?

Can you talk about how big it is?

How many hands would you need to go right round the trunk?

Are there plants growing ON the tree? Do you know what they are?

ACTIVITY 4: Build a Bug Hotel

I explore ways to design and construct models. TCH 0-09a

I can design and construct models and explain my solutions. TCH 1-09a

I explore everyday materials in the creation of pictures/models/concepts. TCH 0-10a

I can recognise a variety of materials and suggest an appropriate material for a specific use. TCH 1-10a

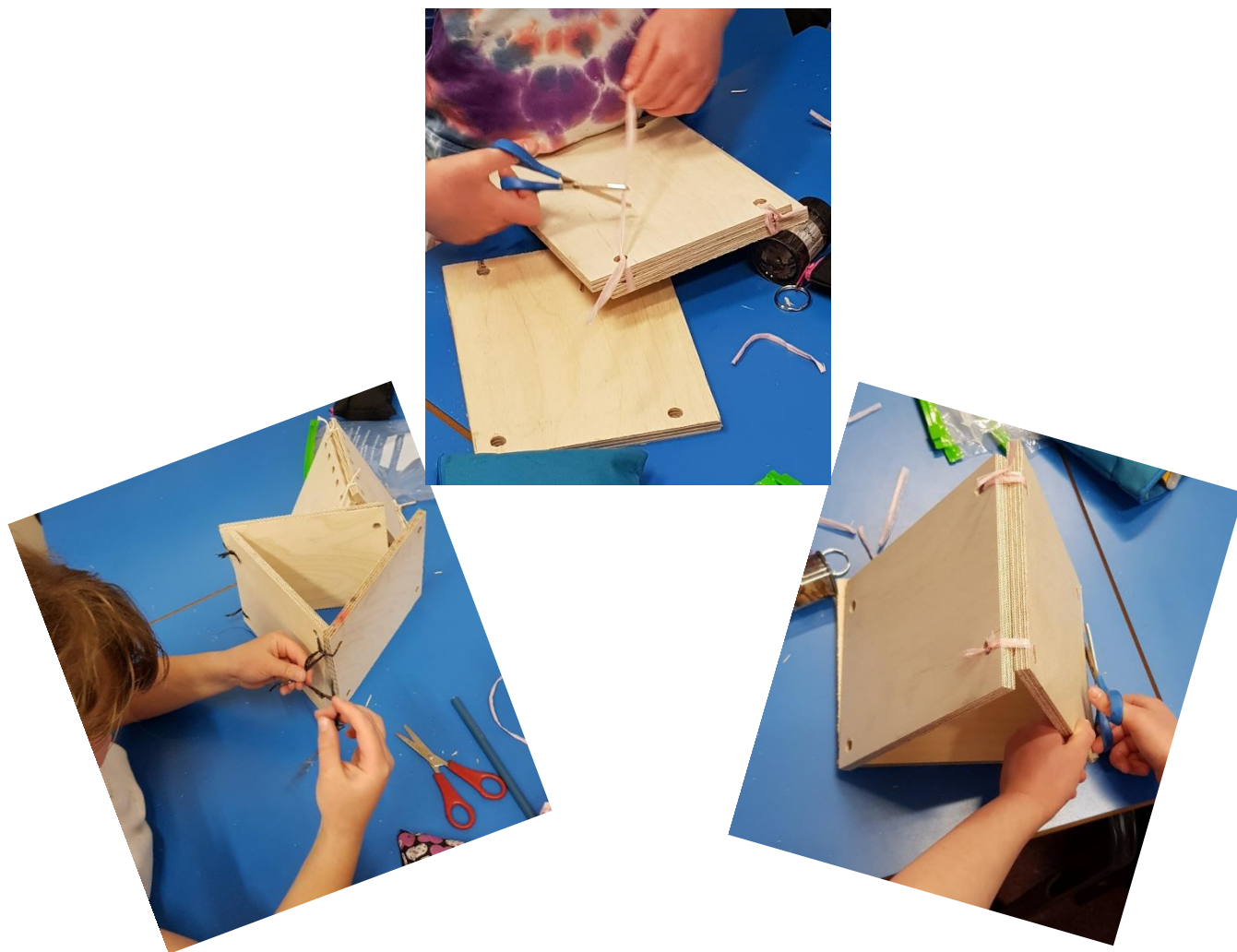
There are many options here – from simple to the more complicated.

This is a useful video: <https://www.youtube.com/watch?v=aQShgicRF5U>

It demonstrates how to make a bug hotel from flowerpots and plastic pots and where to place them outside.

It also shows how to make a tub bird feeder, and bird feeders from pinecones and recycled plastic bottles. It also has some other suggested activities such as making 'climbing' beasts, life cycles on a paper plate and ways to find mini beasts.





If tools are to be used, it is important that a risk assessment is undertaken and that the children are taught to use the tools safely.

'An introduction to using practical tools in the Technologies' webinar can be viewed here:

<https://www.youtube.com/watch?v=gxP4WZgeFYk>

Help sheets to show how to use tools safely in the classroom. including videos of tools being used and Health and Safety Information can be found here:

<https://blogs.glowscotland.org.uk/as/abshireprimaryscience/2022/05/31/how-to-use-tools-in-primary-school/>

ACTIVITY 5: The Water Race!
(Fun activity to end the day?)

*I value the opportunities I am given to make friends and be part of a group in a range of situations. **HWB 0-14a / HWB 1-14a / HWB 2-14a***

*Through taking part in a variety of events and activities, I am learning to recognise my own skills and abilities as well as those of others. **HWB 1-19a***

*I can design and construct models and explain my solutions. **TCH 1-09a***

Objective: to transport as much water as possible across a distance using only a container(s) constructed from the paper supplied.

Materials:

Each team needs:

5 sheets A4 paper

Bucket of water

Empty bucket

Rules:

1. Only one cup of water at a time can be transferred
2. A second water run can only be commenced when the first team member returns to the water bucket
3. Only the materials supplied can be used
4. The judge's decision in all matters is final

Judging:

The winning team will be the one that transfers the greatest volume of water across the distance in the time given (15 minutes)

The water carrying devices must be designed and made from paper. The teams have 5 sheets of paper so can make 5 cups or use more than one sheet per cup to make sturdier cups.

ACTIVITY 6:STEM challenge – Build a raft!

I explore ways to design and construct models. TCH 0-09a

I can design and construct models and explain my solutions. TCH 1-09a

Through creative play, I explore different materials and can share my reasoning for selecting materials for different purposes SCN 0-15a

Through exploring properties and sources of materials, I can choose appropriate materials to solve practical challenges SCN 1-15a

This activity should involve the engineering design process and the children should be encouraged to:

The challenge ‘problem’ is

Build a raft that floats using only natural materials.

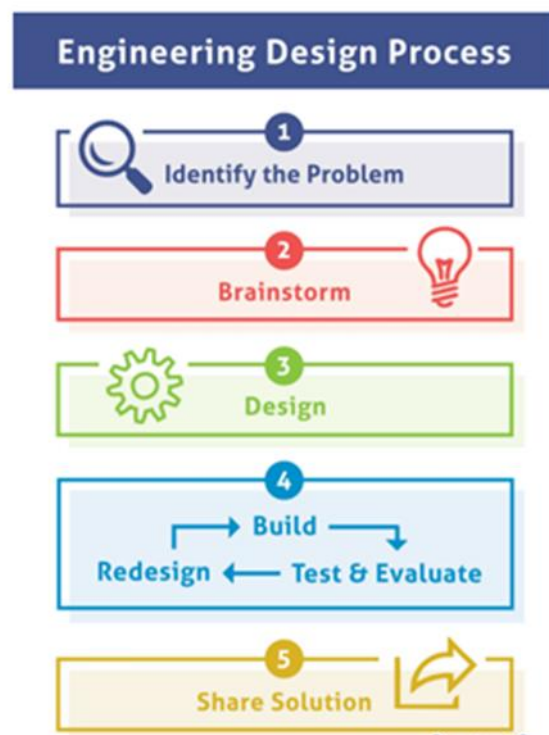
The children should be given time to brainstorm their ideas, and to be encouraged to listen to others and respect their ideas and to ‘back up’ and justify their own ideas.

Questions that arise during this stage might include “Do all sticks float whatever their size?” “If we use too many sticks, then the raft will be heavy, will that make it sink?” Part of the process is to encourage the children to find out the answers for themselves. The children might discuss how to make their rafts move quickly and might decide to add a sail to harness the power of the wind.

Design: the children need now to think about their actual design. This can be done verbally or drawn out on paper. They need to think about the materials they are going to use, the quantity, size, shape, features, how they are going to join the materials together etc.

Build/Test and Evaluate/Improve: now they have a go at building their raft. They may get a fully working result first time, but it is likely that their design will need tweaking/adjusting to improve it. This may include things like stabilising the structure, improving how the sticks are held together etc. (As children get older and their skills develop the Build/Test and Evaluate/Improve can be separated into three distinct areas of focus).

They should be encouraged to build a structure rather than just ‘bundling sticks’ and tying them together. If this happens, ask them then to incorporate a mast and a flag –



this will extend the problem-solving opportunities as this is difficult if the raft has been made by 'bundling' sticks' together.

This challenge can be extended to include things like keeping the raft floating for the longest, travelling the fastest, carrying the most weight etc.

There are different ways in which the sticks could be tied together:



The children might also construct a frame which to build their raft onto.



COLOUR CHANGE GUIDE & UV SUN INDEX

