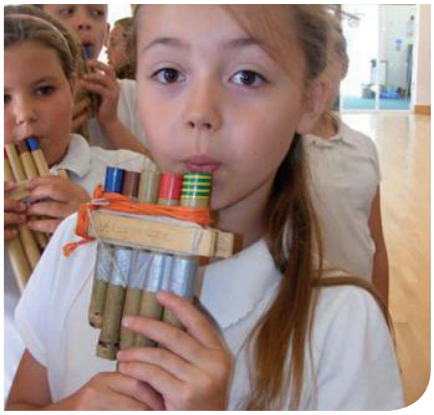
Growing Music



Including:
How to make panpies,
Growing Bamboo,
Science Planning & Learning Objectives,
Teacher Tips,
Cross-Curricular links,
& Background Science Knowledge

Growing Music is a WOMAD Foundation project which brings together music, science and design technology within a cultural context.

It was developed by Annie Menter and Mauricio Velasierra supported by Anne Goldsworthy. The detailed lesson plans were devised entirely by Carol Sampey with Kulvinder Johal.

The WOMAD Foundation

why & how?
PRIMARY SCIENCE TEACHING TRUST

Supported by the Primary Science Teaching Trust

GROWING MUSIC CONTENTS

INTRODUCTION

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The project is based on growing bamboo and making and playing Colombian 'sikus' or pan pipes. It features science, music and DT with other cross-curricular links. There are also details about how to bring a Colombian musician or other artists from across the world into your school. It is suitable for children in Key Stage 2.

AIMS & OBJECTIVES

Growing Music is a project which has run successfully in many schools. It engages children in a cycle of planting, growing and investigating bamboo and making and playing pan pipes from bamboo canes. The children 'grow' their own music.

You may want to take on the whole project or select specific sections such as:

- growing and investigating bamboo plants and the uses of bamboo as a material;
- understanding sound through making and playing a musical instrument;
- developing Literacy and Numeracy skills through the context of the bamboo plant;
- finding out about Colombia.

PROJECT AIMS

- To develop new pathways into music, science and technology.
- To create awareness amongst young people of how environment influences all aspects of their lives and how in turn they have the ability to influence their own environment.
- To explore the links between science, technology and music.
- To demonstrate the relationship between plants, culture and music.
- To support young children's creativity and natural desire to interact with the world.
- To demonstrate how creativity leads to innovation and enterprise.
- To encourage children to be actively involved in the cycle of planting, growing, harvesting, making and playing an instrument.

LEARNING OBJECTIVES

SCIENCE

- To identify the requirements of the Bamboo plant for growth.
- To observe, measure and record the growth of Bamboo and use patterns in the data to make predictions.
- To compare Bamboo with, and contrast Bamboo to, other plants such as trees and other grasses.
- To explore the properties of Bamboo and the many ways it is used.
- To use Bamboo to investigate how sound is made through vibration and how to change pitch and volume.
- To understand how sound waves work.

MUSIC

- To play an end blown Bamboo pipe with control and rhythmic accuracy.
- To improvise and explore the sounds that can be made with a Bamboo pipe.
- To explore sounds that can be made with different combinations of Bamboo pipes.
- To listen to detail and to internalise and recall sounds.
- To practise, rehearse and present performance.
- To play music as part of a group.
- To become aware of the range of music that is produced throughout the world using Bamboo.

DESIGN TECHNOLOGY

- To explore the sensory qualities of Bamboo and recognise how the characteristics of Bamboo influence how it can be used for making a musical instrument.
- To measure mark out, cut and shape the Bamboo.
- To use finishing techniques to strengthen, decorate and improve their musical instrument.
- To look at the design and making opportunities for Bamboo and how it is used around the world.

SCIENCE PLANNING

The activities below can be used in teaching the topics of: Plant growth, sound and the properties of Bamboo as a material as well as 'Working Scientifically'. Teaching sequence suggestion: teaching about Bamboo as a plant or as a material can be done in any order but, in the project, it worked best finding out about these aspects BEFORE the teaching about sound as the children are able to apply their knowledge of Bamboo and its properties when making the pan pipes.

The Learning Objectives relate to the English National Curriculum but they can be adapted to fit in with the National Curricula of Scotland, Wales and Northern Ireland. Some of the content on plants goes beyond the requirements of the primary science curriculum.

1 INTRODUCTION TO TOPIC

(Teach as one lesson or break into two lessons.)

Part A: Use a "WOW" starting point

E.g. Mystery Bag containing roots from a Bamboo plant (bag could contain Bamboo cane or leaves –anything which stimulates discussion)

Look closely at the contents of the bag e.g. the mystery roots.

- What conclusions can we definitely reach about the roots and what are we not sure about?

Identify the contents as being Bamboo roots and challenge children to find out what "culms" /"rhizomes" are.

Part B: What did you discover about Bamboo culms/ rhizomes?

- Show some Bamboo canes. Look closely at the different sections.
- Identify the different parts of the plant: Culm/rhizomes/leaves.
- Produce a labelled diagram showing the parts of Bamboo.

Teach it is a member of the Grass Family.

Tell the children that during this topic they will learn more about Bamboo as a plant (comparing it with other plants) and its uses as a material.

LEARNING OBJECTIVES

Working Scientifically (WS):

- Observe closely.
- Ask questions which could be investigated.
- Use prior knowledge to draw conclusions.

WS Enquiry: Find out things using secondary sources.

- Report on findings.
- Record observations using a labelled diagram.

Learn specific characteristics of grass family.

TEACHER TIP!

A WOW starting point is good to fire up the children's interest!

"What can we definitely conclude/are unsure about?" activity works well to focus minds and stimulate questions.

2 BAMBOO AS A MATERIAL - "BAMBOO, WHY ARE YOU SO STRONG?"

Look at Bamboo artefacts – develop awareness/ awe and wonder that Bamboo is such a versatile material.

- How many uses of Bamboo are there? (101 uses of Bamboo Home Learning challenge)
- Produce research in an interesting way to teach others about how AMAZING Bamboo is.

LEARNING OBJECTIVES

We use different materials for different functions because of their properties.

Working Scientifically WS:

- Use precise scientific vocabulary to explain suitability of materials to function.

Discuss the properties of Bamboo and how these affect its uses.

- Investigate the strength of different shapes (e.g.. Test strength of A4 paper made it into different shaped towers –how much weight can they hold?
- Use results to relate back to the structure of Bamboo cane –why is Bamboo used for scaffolding in some parts of the world?
- Harder challenge: Why is Bamboo used for clothing?

ICT:

- Use of search engine to research information.
- Researching to understand (rather than just using copy and paste).

TEACHER TIP!
Having a range of Bamboo artefacts really engages children! **Assessment** opportunity: Can the children link their learning from these activities to the strength of Bamboo as a material?

3 PLANTS - "BAMBOO – HOW DO YOU STAY ALIVE?"

Bamboo is a plant and a member of the Grass Family.

- What do all living things need?

Plant seeds (eg. radish/beans/ Bamboo*) and plan a series of Fair Tests to prove that all plants need water, light and warmth (i.e. the right conditions) **Compare/contrast with Bamboo.**

LEARNING OBJECTIVES

Working Scientifically (WS):

- Plan a Fair test
- Decide what to do, what kind of evidence to collect and what equipment and materials to use.

What are the right growing conditions needed for Bamboo?

Decide on best location to grow Bamboo in school grounds:

- Consider light levels (use data logger to take accurate measurements of LUX)
- Type of soil/ mineral nutrients needed
- Is there plenty of room for growth of root system? (Beware rampant rhizomes! Choose Clumping varieties wherever possible)
- Decide on correct amount of water to give

TEACHER TIP!
Planning fair tests in groups provides a good assessment opportunity
*Radish/Bean seeds work well but Bamboo seeds need more care and attention than the average classroom can provide!

4 PLANTS - "BAMBOO – HOW FAST DO YOU GROW?"

Measuring Growth.

- Plant Bamboo (try different types of Bamboo if budget allows) and set up routine for watering, measuring and recording the growth of the Bamboo plants over time. (See Ways To Measure Bamboo).
- Set up a time delay camera if you have one.
- Draw a line graph and use to predict future growth.

LEARNING OBJECTIVES

Working Scientifically (WS):

- Measure accurately, record data and produce a line graph.

TEACHER TIP!
Measuring Bamboo accurately is difficult for children- where to measure and how to measure Bamboo plant accurately needs to be taught - see Maths links in Topic Web.

5 WHY DO PLANTS NEED LEAVES? "BAMBOO, WHY DO YOU NEED SO MANY LEAVES?"

LEARNING OBJECTIVES

Working Scientifically (WS):
- Communicating scientific ideas.
- Use scientific word & and symbols appropriately.

Describe how a plant makes food using the terms light, carbon dioxide and water (and energy from the sun/photosynthesis).

Look closely at a Bamboo leaf under the magnifying glass/ viewers/microscope

Look closely at:
- Veins = support for leaf and carry food and water between leaf and other parts of plant.
- Stalk and veins = tough material - strong to stand up to wind/rain
- Bulk of leaf (Blade) = softer.
- How the leaf is attached to the culm or branch.

Look at different types of leaf/size/shape etc and compare to Bamboo.

Tip: Try putting leaves on the photocopier –it takes amazing photos and is a good way to record findings. How do plants get energy? (food).
- Share ideas in groups and feedback ideas about how green plants get their food. Discuss what food is – (a source of energy).
- The Leaf makes food for the plant = needs air and water and light. (Chemical Food Factory) The secret to how they do this is the green substance in leaves (chlorophyll) + energy from sun (process = photosynthesis)

Plants often face the sun - Why?
- The plant uses the food to grow and make more plants.

Humans eat plants because the food in the leaves is also a source of energy for us. Bamboo is eaten by pandas for same reason.
- *This food is sugar and is used by the plant to help it grow. The plant can store this sugar in other parts (roots and stem) and that the plant can use this store of energy at a later date.*

Science/Literacy Link Activity:- With a partner, research more about how plants produce food and produce a double page spread to teach other children about Photosynthesis.

Focus on:
- Where do the raw materials come from?
- How do they get to the leaf?
- What happens to them once they get to the leaf?
- What does the plant do with the food once it's made?

TEACHER TIP!
An opportunity for very focussed learning!
Children learn lots of new vocabulary and are usually surprised at how amazing leaves are!
Discuss not putting too much info. on a page and the value of good clear diagrams. (communication skills).

6 WHY DO PLANTS NEED ROOTS? "BAMBOO, WHY DO YOU HAVE ROOTS?"

LEARNING OBJECTIVES

Working Scientifically (WS):
- Use evidence to explain/ describe what has been found out with reasons.
- Link the structure of the root to its function (Stability, storage of food and taking in water.)
- Explain why roots have lots of little hairs on them.

Either remind the children of the Bamboo roots we saw at the beginning of the project/or look closely at some Bamboo roots (rhizomes) under a microscope.

Discuss the function of the roots.

Teach: Soil contains nutrients(minerals) Nutrients are not needed to make food but they are needed to help the plant to stay healthy.

Group work

Compare Bamboo roots with dandelion/daisy roots.
View roots of plants using hard lenses and microscopes.
How are plant roots suited to:
- Anchoring the plant?
- Taking in water and nutrients?

Pupils decide how to present their findings and compare with Bamboo rhizomes.

What will happen to a plant if you accidentally chop off the roots? Discuss the small root hairs – what are they for?

- What sort of roots would a tree have?
- How does a Bamboo root differ?

(Roots have a large surface area over which they can absorb lots of water and nutrients. Bamboo roots also store the food that the leaf makes. The size of the roots is in relation to the size of the plant.)

Where does the water go inside the plant?

- Put celery stem into food colouring.
- Predict what might happen and observe results.
- Explain where the water goes and how the evidence tells you this.

(Water and minerals enters from the soil, moves into the root and moves up the centre part of the root to the stem where the water and minerals are used during photosynthesis and transport.)

Why is the stem of the Bamboo plant (or a tree) so large?

TEACHER TIP!
Assessment opportunity: Can the children apply their knowledge to explain why a Bamboo plant needs so much water?

7 PLANT REPRODUCTION AND SEED DISPERSAL - "BAMBOO, HOW DO YOU REPRODUCE?"

(NB. Bamboo plants use rhizomes to reproduce and so do not rely on seeds for new growth. If not studying plants in detail, only teach content relevant to Bamboo plant.)

Refer to characteristics of all living things (Mrs Gren) and stress the importance of reproduction in life processes.

Bamboo plants flower infrequently and some species die after flowering so Bamboo flowers to observe are not readily available.

Teach:

Main parts of the flower and their functions.

Teach plant cycle pollination-fertilisation-seed production-seed dispersal

Activity:

- Look at some flowers in close up e.g. Alstromaeria. Take apart (dissect) carefully. Encourage children to be very scientific in their approach use tweezers/magnifying equipment etc.
- Count how many of each part there are and stick them onto paper in way they think is best. Remembering to label each part and the number found + any other observational notes they wish to make.
- Photocopy the result and stick in their books.

Do all the flowers have the same number of petals, stamens etc.?

Highlight the fact that in different plant species the number, shape and size of each flower part may be different.

Research Bamboo flowers and compare structure of its flower with those studied.

What is Pollination?

Teach the process and the importance of insects.

Teach that after pollination has occurred the plant can create its seeds, each seed has the "potential" to grow into an adult plant, although not all seeds are lucky. Plants like to spread their seeds over a wide area so that the new plants that grow don't compete for the same food. They do this in many ways.

LEARNING OBJECTIVES

- Link structure of the flower with its function and that petal colour attracts insects etc.
- Describe plant cycle pollination to fertilisation to seed production to seed dispersal to germination.
- Concept: Use the word germination (the point at which seed begins to grow into a young plant).

Working Scientifically (WS):

- Develop close observational skills and a systematic approach.
- Look at: seed structure to show how they are dispersed. *Different seeds can be dispersed in different ways.*
- Sort and classify into dispersal groups.

Challenge:

- How do you think seeds get from where they are made to other places? How are seeds adapted to get from one place to another?
- Look around the school grounds and collect seeds, How many can you find?
- They come in many shapes and sizes and so look carefully. Sometimes the seeds are hidden inside 'fruits' or pods). Encourage children to only collect an example of each for the classroom, remember these seeds are important.
- Sort the seeds into ways that they are dispersed. Use reference books to identify each of the fruits and seedpods/research methods of seed dispersal
- Extra challenge: think about how structure of seed is linked to its method of dispersal.
- Useful Resource:-http://www2.bgfl.org/bgfl2/custom/resources_ftp/client_ftp/ks2/science/plants_pt2/dispersal.htm

TEACHER TIP!
Alstromaeria works well as they have easy to see stamens and it is not too fiddly to dissect (not as messy as a Lily which some people are allergic to).
Dissecting a real flower leads to much more effective learning than filling labels on a diagram!

8 SOUND

LEARNING OBJECTIVES

- Identify how sounds are made, associating some of them with something vibrating.

WS Enquiry Skill:

- Notice patterns between the volume of a sound and the strength of the vibrations that produce it.

Teach after content on Bamboo as a Plant and as a Material. Teach to coincide with the making of the Pan pipes.

Sound – what is it?

Assess children's initial understanding through use of a mind map.

How can sound be produced?

- Different materials make different sounds e.g. wood, glass, plastic
- Play guess the material I am hitting –children close eyes. Musical instruments make particular sounds – high / low –some are pitched and some unpitched e.g. drum. In this lesson we will investigate unpitched instruments
- How does a drum make a sound?

Test with lentils/rice on drum what is happening to the lentils?
Teach vibration produces sound.
What does vibrate mean? How can you make sound louder? Quieter?

- Explore effect of hitting the drum harder (with greater force)
- Exploration should lead to the hypothesis that the stronger the vibration, the louder the sound.
- Explore other unpitched instruments.
- Can you see/feel the vibrations as you play?

Activities for younger children:

- How many different ways can you make sounds using Bamboo? (Blow, hit, drop,scrape, shake.
- Put two of your favourite sounds together and give it a name (eg. Whoomp-thump, Screech-rattle)
- "Bamboozle" your friends! Children sit in a group. One child, chosen to be the sound maker, leaves the group so they can heard but not seen) They make a sound with their Bamboo. Others try to reproduce the sound. Sound maker returns and hows how they made the sound.

9 SOUND - HOW DOES THE SOUND TRAVEL FROM THE INSTRUMENT TO OUR EARS?

LEARNING OBJECTIVES

- Sounds travel through a substance as vibration.
- Sounds travel through solids better than through liquids and gases.
- Recognise that sounds get fainter as the distance from the sound source increases.

WS Enquiry Skill:

- Carry out comparative tests.
- Record using annotated diagrams.
- Apply Knowledge and Understanding to explain findings.

Activities to recognise that sounds get fainter as the distance from the sound source increases.

Younger children: Set up hall with two or three marker cones in a line down the centre of the hall. Children sit in a group facing an end wall. One person comes out the group and makes the same sound as they walk past the markers and towards the back of the group of the children. Children put up their hand when they think the sound maker is at a marker nominated by the teacher. (E.g. put your hand up when you think the sound has reached the nearest marker.)

Older children:

Will sound travel through solids? Liquids? Gases? Discuss ideas.

Activities to appreciate that sounds travel through a substance as vibration.

- Ask them to make a loud sound with their instrument. Ask for ideas – how did the sound reach our ears? (vibrations travelled through the air (gas).
- Tell the story of the vibration's (sound's) journey from source to ear e.g. vibrations start at the Bamboo or material of the instrument, passed on to the molecules in the air in the corridor, vibrations passed to wall/door of classroom, vibrations passed to air in classroom and then to my ear drum.

Activities to help children understand sounds travel through solids better than through liquids and gases.

- String telephone – test which material does sound travel through best?(or use fishing line – it is better than string)
- Does length of string make a difference? Can sound travel round corners?
- Balloon – blow up balloon and talk with lips on balloon whilst partner feels other side of balloon. Why do you feel the balloon vibrating? Try again using balloon full of water. Explain difference between them.

TEACHER TIP!
Harder challenge: opportunity for older children to make the link with particle theory to explain how sound travels through solids and through air.

10 SOUND - PITCH

LEARNING OBJECTIVES

- The faster the vibration the higher the note (pitch).

WS Enquiry Skill:

- Carry out comparative tests.

Remind of different instruments looked at in earlier lesson (i.e. drum, woodblock, tambourine, shaker) How are sounds produced? The pitch in these instruments can't be changed. These are unpitched instruments.

What is PITCH?

- Examine 2 chime bars or xylophone etc. How are sounds produced? How are these instruments different to the woodblock? Can make low /high sounds = pitched
- Play 'guess the length' – using either pipes of different lengths or xylophone bars of different lengths. Children given 3 or 4 pipes/xylophone bars of different lengths. Out of sight, someone else makes a sound with a pipe/ bar of a different length. Children have to guess the length of the instrument.
- Order small group of chime bars lowest to highest notes. How are low sounds made? What do you notice about length of bars? - long bar produces slow vibration and a low note / short bar produces fast vibration and a high note.
- Look at a guitar. What happens when you pluck a string? What would happen if you pluck strings of different thickness or make string slacker/tighter?

Harder Challenge:

- If you increase/decrease the frequency of the vibrations what happens to the sound? What do you think the word frequency means?

Other Activities:

- Give each child an instrument – play in turn but do not start the next instrument until the sound produced from the previous one has stopped. Teach that the vibrations continue for a while even after you have stopped playing.
- Make a Bamboo soundscape or sound story. Tell a simple story e.g. Walking through the wood, going down a high street, going round a farm and add sound effects with Bamboo. Make sounds of different pitch and volume in the story.

TEACHER TIP!
Lots of experimentation leads to a good understanding of pitch which can then be applied easily to the size of the pan pipes and notes produced. The bottle and water experiment works well to help children make the link with how air vibrates in pan pipes.

11 MAKING PAN PIPES FROM BAMBOO

LEARNING OBJECTIVES

- Construct the pipes following the instructions.
- Tune the pipes.

Working Scientifically (WS):

- Carry out comparative tests.
- Use Scientific Knowledge and understanding to explain why Bamboo is used to make pitched Pan Pipes.

Assessment opportunity:
Apply the knowledge gained about SOUND to the pan pipes.

- How is the sound produced?
- Why does the longer pipe make a lower note?
- What is vibrating – the Bamboo or the column of air?

Apply knowledge about Bamboo as a material when making the pipe.
Apply knowledge of Bamboo as a plant to understand why the structure of the stem of the Bamboo plant is useful to make the pan pipes.
(It is no longer a living thing but of great use to man - Link to Chinese Proverb story).
See the video link for evidence of the enormous amount of learning which resulted from this project: https://vimeo.com/70731185
Contact the WOMAD Foundation if you would like more information and support with making the Growing Music Project and performing as a Sikuri orchestra.

TEACHER TIP!
Learn to tune using a tuning App. (see how to make panpies section)
NB: Tuning the pipes is DIFFICULT and time consuming.
A musical expert is needed to ensure that they are tuned properly if the pipes are to be used in a Sikuri orchestra.

GROWING BAMBOO

GROWING BAMBOO IN YOUR SCHOOL GARDEN

Some of the key science elements in this project include identifying requirements of the Bamboo plant to grow; observing, measuring and recording the growth of Bamboo; and comparing and contrasting Bamboo with other plants. If you are lucky enough to have outside green space in your school, planting a Bamboo plant can be an exciting element to this project and really bring it to life for the children, Bamboo is also very easy to care for. You cannot plant Bamboo in the hope of cultivating Bamboo canes strong enough to make panpies, but you can use it for the children to learn more about the plant and the material. Bamboo is either classed as running or clump-forming. It's important you know the difference between the two before buying a plant for your school.

Running Bamboos, also known as invasive Bamboos, produce long rhizomes (underground stems), which grow away from the main plant and will spread rampantly if not contained. The following are running Bamboos[1]: *Arundinaria, Bashania, Chimonobambusa, Clavinodum, Hibanobambusa, Indocalamus, Phyllostachys (note: may remain clump-forming in poor or dry soils but can become invasive in warm, moist or favourable conditions), Pleioblastus, Pseudosasa, Sasa, Sasaella, Sasamorpha, Semiarundinaria, Sinobambusa and Yushania.*

Clump-forming Bamboos grow in tight clumps and are less invasive and include[1]: *Bambusa, Chusquea, Dendrocalamus, Drepanostachyum, Fargesia, Himalayacalamus, Schizostachyum, Shibataea and Thamnocalamus.*

[1] *www.rhs.org.uk*


Digging the ground


Measuring our Bamboo


Large Bamboo arrives!

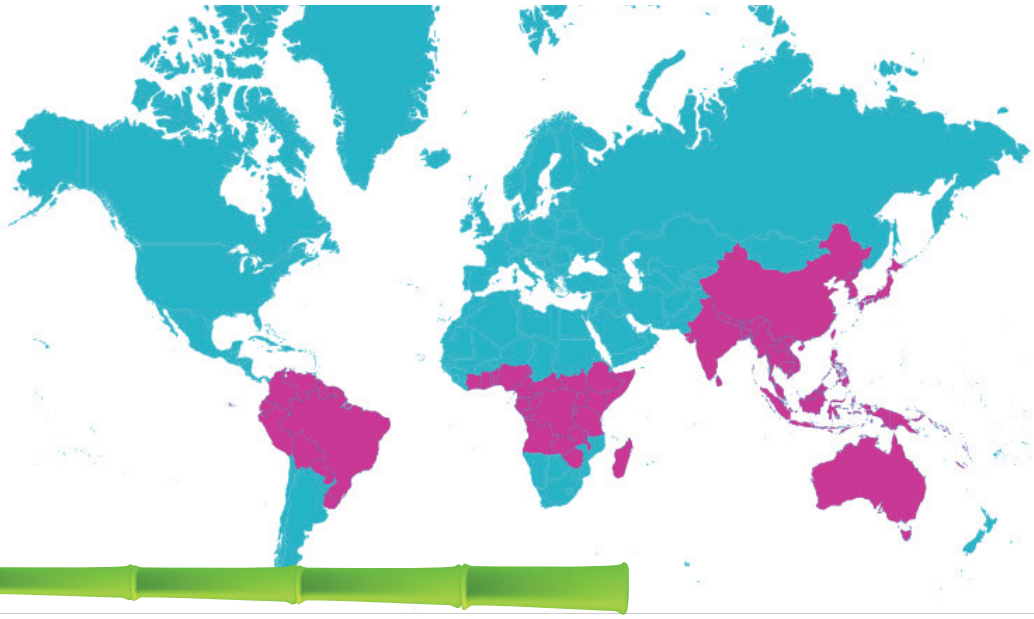

Our Bamboo 3 years later!

Node up close

ABOUT THE BAMBOO PLANT

BAMBOO is the largest member of the grass family, and is one of the most successful species of plants on earth. It is also one of the fastest growing; up to 41 cm in 24 hours under appropriate climate conditions. Unlike other woody plants, Bamboo reaches maturity after only 3 to 5 years. Its composition and cell structure make it an incredibly versatile raw material. It is stronger than steel and sometimes referred to as 'vegetable steel' with a tensile strength of 28,000 per sq inch compared to that of 23,000 for steel.

Although the 1,450 species of Bamboo are grasses, many of the larger woody bamboo species are very tree-like in appearance.



WHERE DOES BAMBOO GROW?

All continents except Antarctica and Europe have Bamboo. Bamboo can grow in diverse climates, anywhere from at the top of cold mountains to hot tropical regions around the equator.

BAMBOO FACTS!

The needle in Alexander Graham Bell's first phonograph was made of bamboo

Various animals on the planet used bamboo in their diet. Panda's diet is based on bamboo exclusively, while mountain gorilla and lemurs of the Madagascar eat bamboo to enrich their regular diet.

The shade from a bamboo grove or canopy can lower light intensity and reduce ultra violet rays. There is a belief in Asia that sitting within the shade of the bamboo, can restore calmness and stimulate creativity.

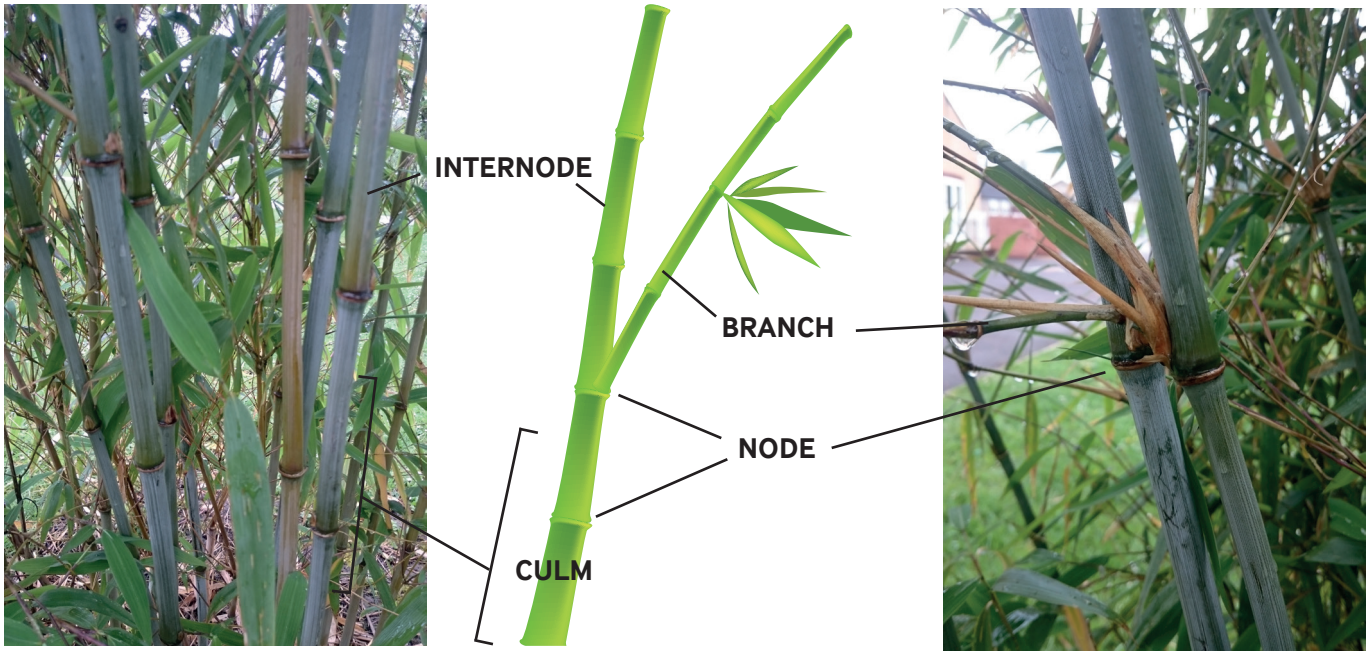
It is a highly suitable building material for earthquake zone areas because of its flexibility and resilience.

Bamboo plants survived the Hiroshima atomic blast and provided the first re-greening after the blast in Hiroshima in 1945. The incinerating heat destroyed all trees and other plant life, except for one bamboo grove. The grove has since been removed, but culms from the grove are preserved in a museum in Hiroshima.

Thomas Edison who invented the first successful light bulb used a filament of carbonized bamboo. It was patented in 1880 and is still alight today in the Smithsonian Museum in Washington DC, USA.

STRUCTURE OF BAMBOO

- Bamboo is characterised by a jointed stem called a **CULM** which is usually **hollow**.
- Each **CULM SEGMENT** starts and ends with a **solid joint** called a **NODE**.
- **NODES** are characterised by a swelling at the end of the **CULM** segments.
- **NODES** are the strongest part of the Bamboo.
- Leaves and branches grow from the **NODES**.
- Bamboo's roots have a very similar structure to the **CULM** and they grow horizontally just underneath the soil.
- Underground, a **CULM** is called a **RHIZOME** and from **RHIZOMES** grow roots and shoots (the same way branches and leaves grow from a **NODE**).
- Each **CULM** will grow to its maximum height in its initial growing period, and **will not grow any thicker or longer in subsequent growing seasons**.
- Flowers of bamboo are rarely seen. Some species of bamboo only develop flowers after 65 or 120 years.



101 USES OF BAMBOO

As a home learning project, children at Shaw Primary School were asked to find 101 uses of Bamboo. Some returned to school with over 150 uses for Bamboo! Examples included:

- Bridges
- Medicine
- Building houses
- Clothes
- Food
- Musical instruments
- Furniture...and much more! How many can you find?

Children's thinking could be stimulated by creating a 'Bamboo display' in the classroom, where children are encouraged to bring in things which are made from Bamboo, or share photos of Bamboo that they have found.

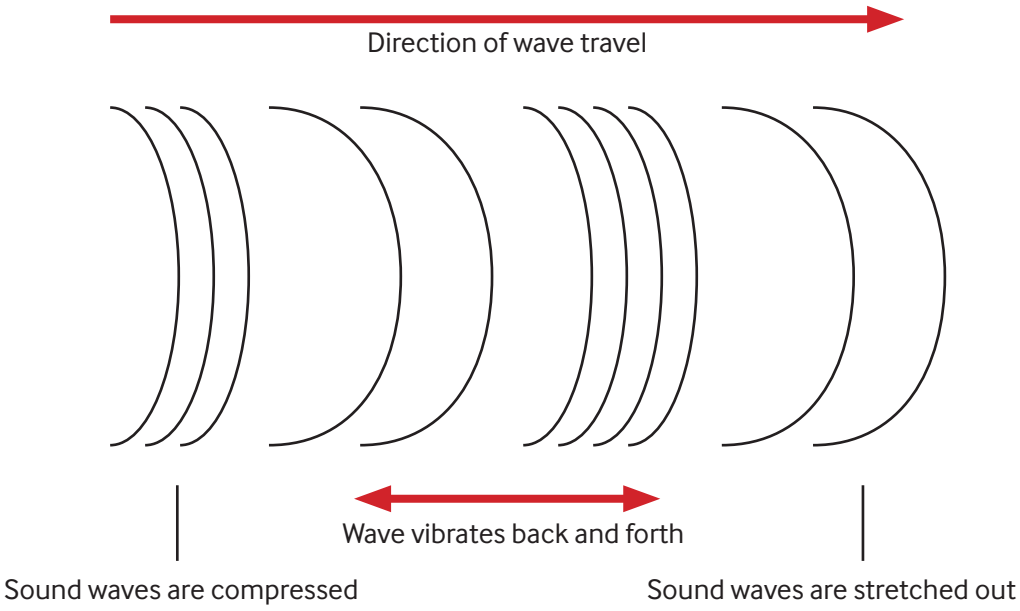
SOUND

Sound is the **energy** produced when molecules vibrate (move back and forth very quickly). For example, when the skin of a drum is struck, the skin vibrates very very quickly, causing the air around it to also vibrate. The moving air carries energy to your ears where it causes the air inside your ears to start vibrating. Once the vibrations reach your ear, its up to your brain to process the incoming sound energy and convert it into the familiar sounds and noises we know.

Sound travels in **waves**, but unlike light, cannot travel through a **vacuum** (a space with very little matter in it, we cannot say it is a space with NO matter in it as even the best vacuum may have a few atoms bouncing around in it!). Sound needs a **medium** (a substance that makes the transfer of energy from one location to another possible) to travel through, such as air, water, glass etc. As a sound wave more forwards, it makes the air bunch together in areas (see diagram above) and in other areas, the sound waves are stretched out. Sound pushes and pulls the air back and forth.

The further a sound wave travels, the more energy it loses, this is why sounds with a **source** (where the sound starts, e.g. a siren) which is far away sound so faint (or we cannot hear them at all). Things like wind can also effect the energy of the sound wave.

All sounds are different; there are quiet ones, loud ones, and things we call 'high pitched' or 'low pitched', all of this is determined by two important characteristics:



AMPLITUDE: this is the size of the wave. Big waves have a high amplitude and we hear them as louder sounds. Small waves have a lower amplitude and we hear them as quieter sounds.

FREQUENCY (also called **PITCH**): this is the number of waves produced in one second and effects how 'high' or 'low' we perceive a sound to be. A high pitched noise has a high frequency (lots of individual waves being produced each second), whereas a low pitched noise produces fewer waves per second.

Instruments can produce sound waves with the same amplitude and frequency, but why do guitars and a pianos sound so different? This is because of **harmonics**. Although the instruments (remember your voice is an instrument) produce the same basic sound wave, on top of that wave they produce harmonics or **overtones** in a pattern which is unique to that instrument (timbre).

HOW DO PANPIPES PRODUCE SOUND?

Panpies produce sound by vibrating a column of air inside a tube. If you were to blow across the top of a tube with two open ends, the air would simply go straight through from one end to another, and there would be little vibration within the tube. By having one closed end (the **NODE**), the air is bounced back up and down the tube creating a sound wave.

By changing the length of the tube, we change the length of the air column inside the tube; the **shorter the tube, the higher the frequency (pitch), the longer the tube, the lower the frequency.** You can experiment with pitch by blowing across the top of glass bottles filled with varying volumes of water; a glass bottle with more water in it will produce a higher pitch as there is less air in the bottle for the wave to vibrate within.

The amplitude (how loud or quiet a sound is) can be varied simply by changing the amount of air; blowing less air across the pipe will mean a softer sound and less amplitude. Blowing hard across the pipe using more air will produce a sound with greater amplitude (it will be louder).

EXAMPLE OF HOW SOUND WAVES TRAVEL IN A PIPE

- If a ball is thrown against a wall, it bounces back. The distance it travels is twice the distance between you and the wall.
- If you take the wall away, the ball will continue to travel through the air (until other forces cause it to slow and drop to the floor).
- The ball is the sound wave, the wall is the node in the panpipe.

MATERIALS AND EQUIPME N T

MATERIALS (BASED ON 15 CHILDREN)

- Bamboo canes - 6ft x 15 (+ spares)
- 7 x Light Hardwood Strip Wood (baton) 18 mm x 6 mm x 2.4 m
- Duct Tape (Silver)
- Insulation Tape 20 m (you need a pack of each colour: Red, Brown, Blue, Green/Yellow, Black)
- Cotton Twine
- 10 x Light Hardwood Dowel 9 mm X 2.4 m
- Felt tips, Crayons or Paint
- Examples of Colombian patterns on textiles and artefacts
- A4 white paper
- Plasticine
- (optional) Coloured wool, String or strips of plastic, beads

EQUIPMENT (BASED ON 15 CHILDREN)

- 15 Mini hack saws
- 15 pairs of scissors
- 1 Stanley knife
- Bench hook or G clamps
- Pencils
- Rulers

MAKING THE SIKUS (PAN PIPES)

This section includes a step-by-step guide on how to make the pipes. Children make panpies based on traditional Andean (South American) panpies called Siku. Siku are traditionally split across two rows of pipes; the ARCA (female part) and the IRA (male part) and are played by two musicians. Children can choose to make ARCA or IRA pipes, the only difference between the two being the length of the individual pipes as shown here.

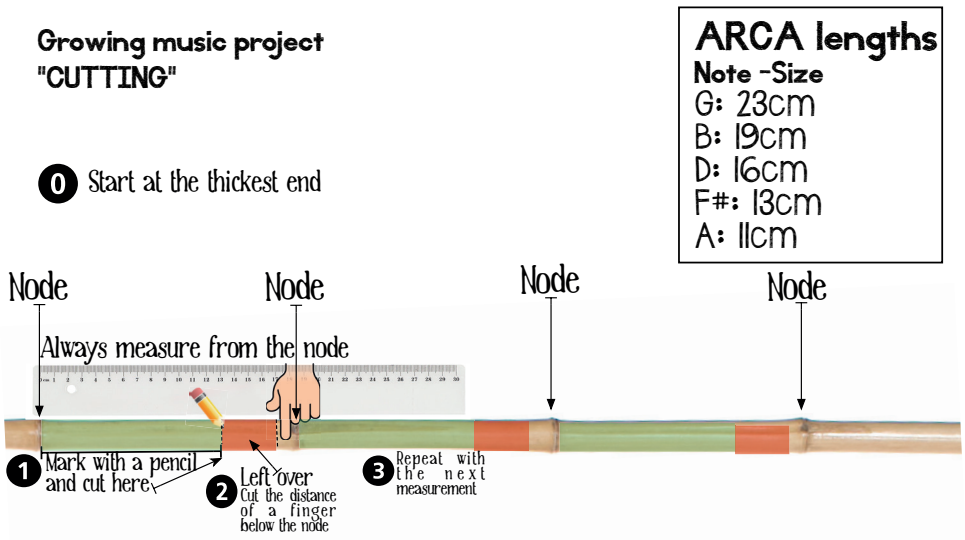
The first step in the process is to purchase lengths of Bamboo. You will require one 6ft length of mature Bamboo per child (for one ARCA or IRA), with a diameter of between 1-2 cm; it is best to purchase these from a local garden centre where you can choose you own.

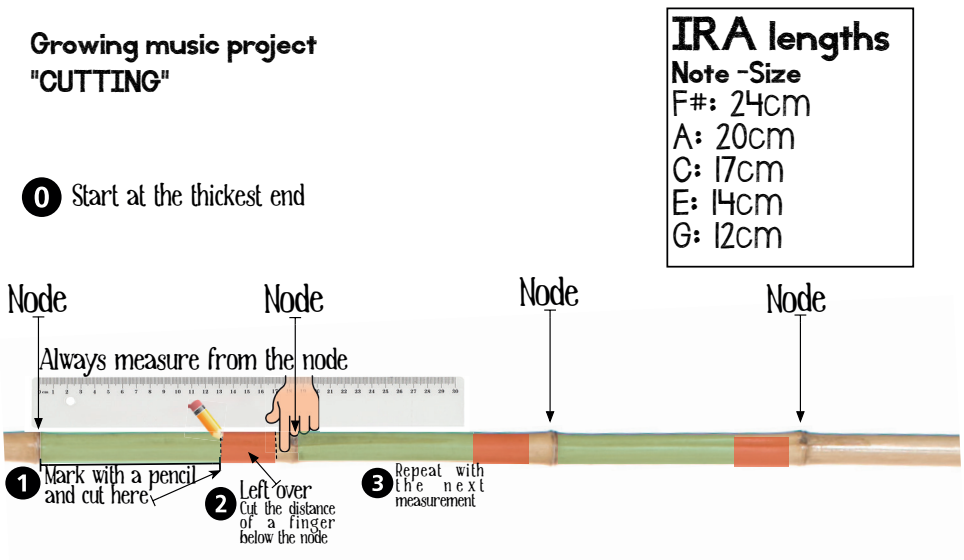
ASK CHILDREN TO MAKE THEIR OWN 'STEP-BY STEP GUIDE' TO MAKING BAMBOO PANPIPES.

STEP ONE - CUT THE BAMBOO

Children mark and measure the five lengths of Bamboo needed for their pipe.

- They need to cut 2 cm (or two fingers) **below the 'node'**.
- They need to start measuring from the **thicker** end of the Bamboo.
- Measure twice, saw once!
- It is crucial that each section of pipe contains a node (so the pipe is therefore closed at one end). If the pipe is open at each end the air simply travels through and will not make the correct sound.





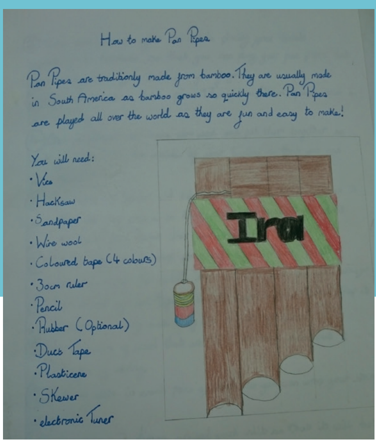
STEP TWO - CLEANING AND SANDING THE PIPES

- Using a simple tool made of a stick with wire wool attached, each pipe is cleaned by passing the stick into the pipe and twisting it around.
- Any dust or dirty from the inside of the Bamboo must be shaken out.

WHY? It is important to do this as the soft dusty surface that lines the inside of the Bamboo 'muffles' the sound. The difference in sound when you blow into a pipe that has been cleaned and one that hasn't is obvious. The clean pipe has a clearer sharper sound.

- When all the pipes are cleaned, each pipe has to be sanded at the end where you blow into the pipe. The end of the pipe needs to be smooth a slightly rounded.

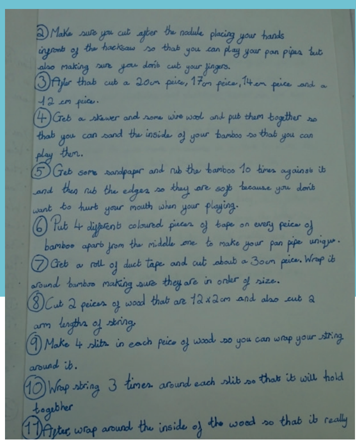
WHY? Where the pipes have been cut they will have a rough edge and it is important to carefully sand the edges so that they don't cut your lips when you are playing them.



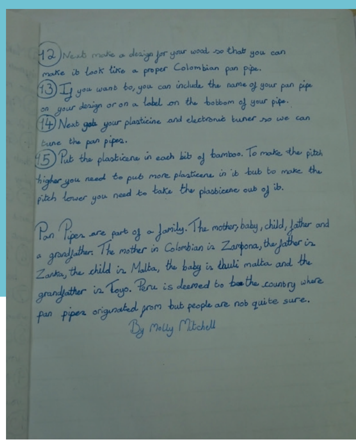
How to make Pan Pipes

Pan Pipes are traditionly made from bamboo. They are usually made in South America as bamboo grows so quickly there. Pan Pipes are played all over the world as they are fun and easy to make!

You will need:
- Vice
- Hacksaw
- Sandpaper
- Wire wool
- Coloured tape (4 colours)
- 30cm ruler
- Pencil
- Rubber (Optional)
- Duct Tape
- Plasticene
- Skewer
- electronic Tuner



2) Make sure you cut after the nodule placing your hands infront of the hacksaw so that you can play your pan pipes but also making sure you don't cut your fingers.
3) After that cut a 20cm peice, 17cm peice, 14cm peice and a 12 cm peice.
4) Get a skewer and some wire wool and put them together so that you can sand the inside of your bamboo so that you can play them.
5) Get some sandpaper and rub the bamboo 10 times against it and then rub the edges so they are soft because you don't want to hurt your mouth when your playing.
6) Put 4 different coloured pieces of tape on every peice of bamboo apart from the middle one to make your pan pipe unique.
7) Get a roll of duct tape and cut about a 30cm peice. Wrap it around bamboo making sure they are in order of size.
8) Cut 2 peices of wood that are 12x2cm and also cut 2 arm lengths of string.
9) Make 4 slits in each peice of wood so you can wrap your string around it.
10) Wrap string 3 times around each slit so that it will hold together
11) After, wrap around the inside of the wood so that it really



12) Next make a design for your wood so that you can make it look like a proper Colombian pan pipe.
13) If you want to, you can include the name of your pan pipe on your design or on a label on the bottom of your pipe.
14) Next get your plasticine and electronic tuner so we can tune the pan pipes.
15) Put the plasticene in each bit of bamboo. To make the pitch higher you need to put more plasticene in it but to make the pitch lower you need to take the plasticene out of it.

Pan Pipes are part of a family. The mother, baby, child, father and a grandfather. The mother in Colombian is Zampona, the father is Zanka, the child is Malta, the baby is chuli malta and the grandfather is Toyo. Peru is deemed to be the country where pan pipes originated from but people are not quite sure.

By Molly Mitchell

How to make panpipes from a year 6 pupil at Shaw Primary School

STEP THREE - COLOUR CODE THE PIPES

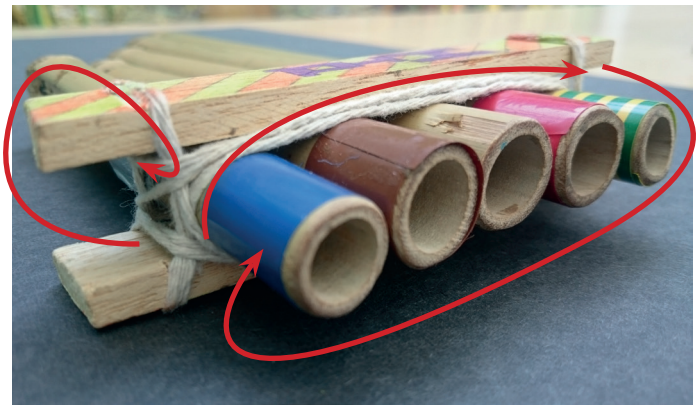
- Colour code the pipes so that you know which notes to play when you are learning the tunes. A different colour tape is stuck around the end of each length of pipe to differentiate between notes.
- It is important that all children use the same colour coding system.
- The pipes are then laid down in the correct length sequence and are bound together with duct tape.

STEP FOUR - DECORATING AND BINDING THE PIPES

- Each child now cuts two lengths of flat baton a little wider than their set of pipes. Each width of baton has a notch cut into it top and bottom, 2 cm (2 fingers) in from the end. This can be done using a Stanley knife or craft knife .
- These pieces of baton will hold the pipe together by creating a 'sandwich' and be decorational, with colourful designs using inks, felt tips or paint.
- Children can further decorate their instrument by plaiting coloured string, wool, or strips of plastic to hang from the sides of the set of pipes. These can also be threaded with beads, buttons or any other small decorative objects, which add to the attractiveness of the pipes.

WHY? The notches are there to hold the string in place when you are lashing your pipes together.

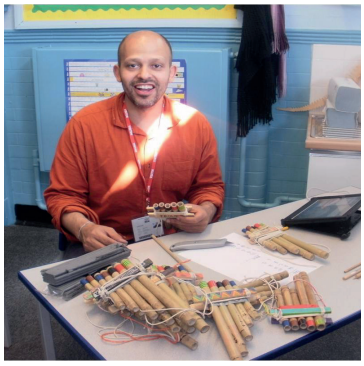
- Children can research patterns found on Colombian pottery, textiles and artefacts. Then combining a variety of simple geometric shapes and colours they can create their own designs. This is a very useful exercise in the use of repeated shapes to form patterns and how patterns can have a 'rhythm'.
- Once the flat sections of wood are decorated, measure out a length of string (approx 3 metres long).
- Tie a knot around one notch on one piece of baton before sandwiching the pipes between the two pieces of wood and holding tightly together. (Children may need some help with this to begin with).
- Then using a 'figure 8' technique, tie the string around one end of the flat section of wood then take it across to the other end of the pipes and repeat around the other end of the flat sections of wood. The notches at either end will help to tension the string as you continue winding around (3 times), finally knotting it tightly.
- You may leave a length of string which is long enough to make a loop to go around the neck so that the pipes can hang in front of you when not being played.



STEP FIVE - TUNING THE PIPES

- The pitch of each pipe can be raised by inserting small pieces of plasticine into the pipe with a wooden rod (piece of dowel).
- You can check the pitch of the pipe by using an electronic tuner or phone app, e.g. Pano Tuner or DaTuner.
- **NB. Pitch** is a certain frequency that you sing or play and a **note** is simply a named pitch (A, F, F♯ etc.). The longer the pipe, the lower the pitch - the shorter the pipe, the higher the pitch

ARCA pipe lengths	ARCA note	IRA pipe lengths	IRA note
11 cm	A	12 cm	G
13 cm	F♯	14 cm	E
16 cm	D	17 cm	C
19 cm	B	20 cm	A
23 cm	G	24 cm	F♯



MAKING THE SIKUS (PAN PIPES)

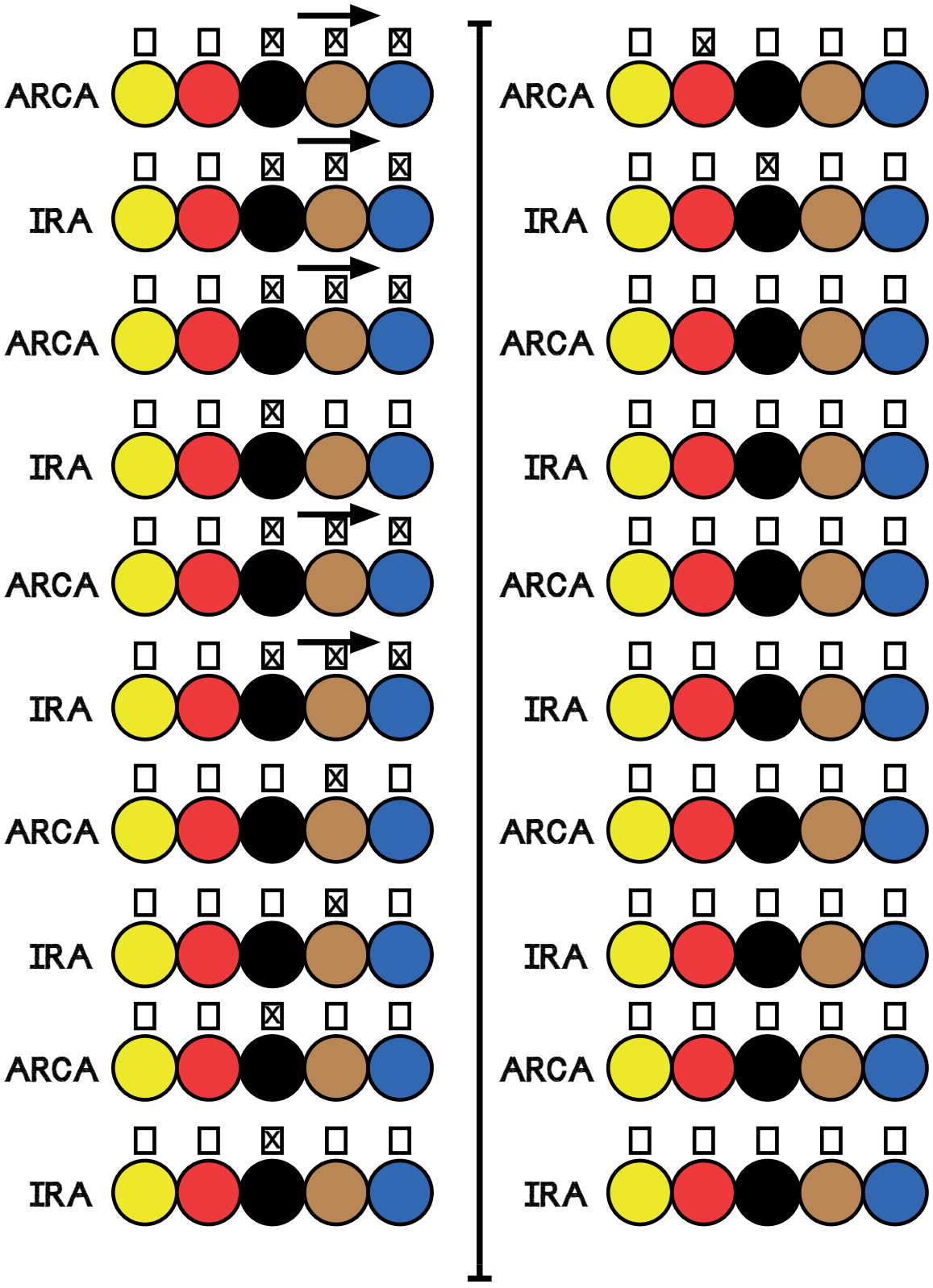
Below are details of the pipes to play for a South American Sikuri song. Play the pipes with a X in the picture. There is also a blank so you can develop your own tunes. If you wanted, you could also put in musical notation above the coloured dots to show how long to play the note.

- Children are divided into two 'teams', one playing a set of notes on the 'ARCA' and the other playing a set of notes on the 'IRA'.
- These can be bought together to make a tune.
- Depending on the amount of time for practice and performance, additional instruments can be incorporated into your 'Sikuri' (orchestra).
- More Bamboo can be used as percussion accompaniments!
- Children may also have learned a song, story or poem connected to 'Bamboo' and this too can be incorporated into the performance. Some children may be happier speaking rather than playing.

Table of note values:

American Name		European Name
Whole Note		Semibreve
Half Notes		Minims
Quarter Notes		Crotchets
Eighth Notes		Quavers
Sixteenth Notes		Semiquavers

SIKUS SCORE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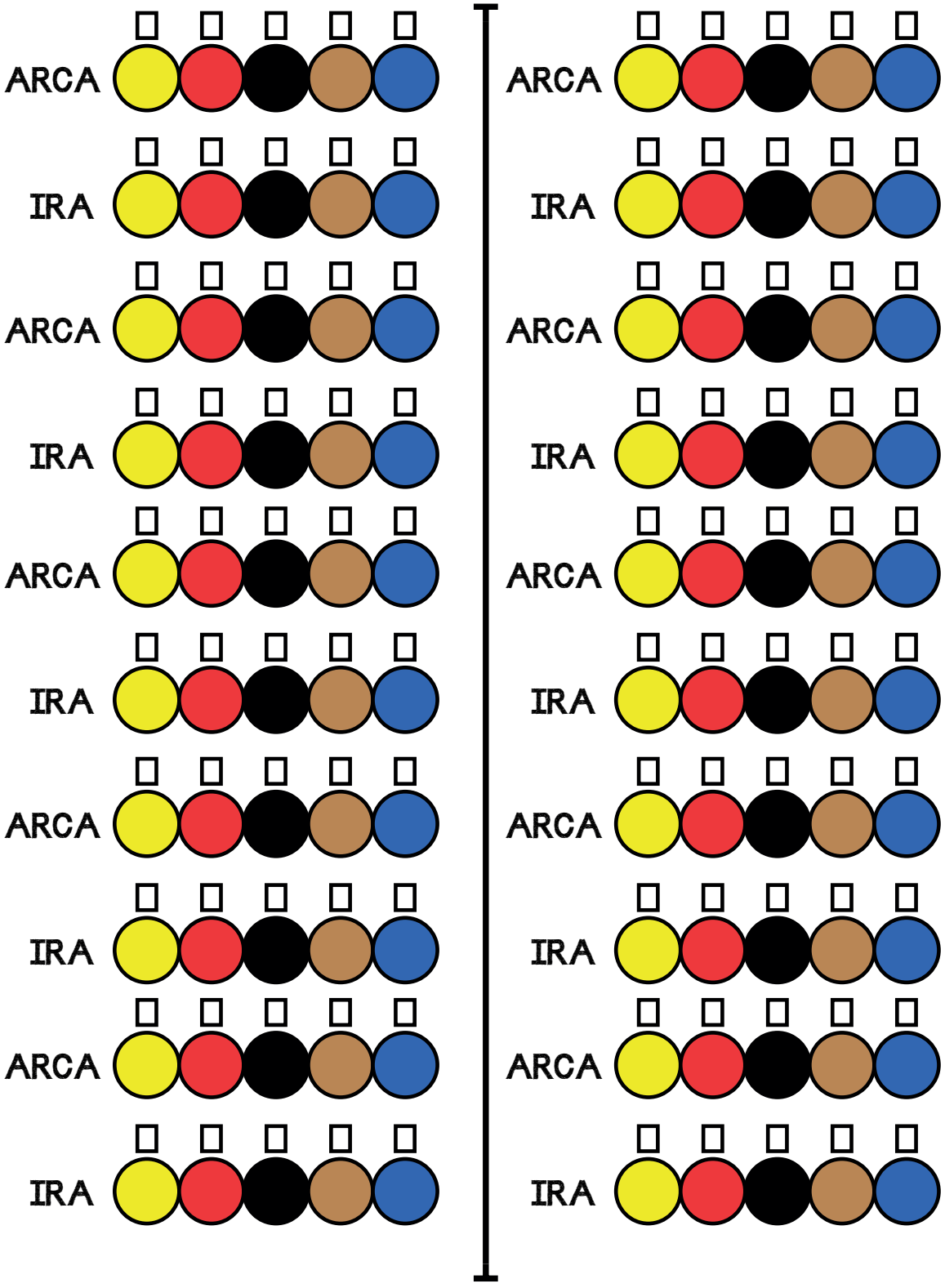
SIKUS SCORE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CROSS-CURRICULAR IDEAS

MATHS

WAYS TO MEASURE BAMBOO

1. Compact disc method

Draw two horizontal lines on the Bamboo so they are clear (quite thick) and measure the distance between then (call that A). Take a compact disc and get the students to walk back from the Bamboo until they can just see the two lines by closing one eye and looking through the hole in the middle. Make a mark where they are standing and measure the distance (actual, number of steps, number of whatever you like), let's call that distance B. Now keeping going backwards along the same line from the Bamboo until the top and bottom of the Bamboo can be seen. Measure the new distance, call that C. Height of Bamboo should be equal to AC/B.

2. Light pen method

Measure a distance from the Bamboo and mark it (A). The student stands at that spot and holds their arm out and points a light pen at the tree until they locate the top of the tree. Measure the angle made by their arm and the horizontal (angle B in degrees). Measure the height from the ground to the measurers' shoulder (C). The students won't know about the maths function tan, but they could be told and then the height is C + A*tanB. Alternatively they can make a scale drawing of the triangle and work out the height of the tree.

3. Direct measurement

If you have blocks to stand on, students measure the height of the blocks and stack them (safely) and then stand on the blocks and measure from the top of the highest block to the top of the Bamboo.

4. Photo method

Put an object by the Bamboo that is quite big and that you know the size of (A). Take a digital photo of the Bamboo with the object and print off. Measure the object (B) and the Bamboo (C) and either convert C into an actual height by height = (C*A)/B.

STORYTELLING

Stories from other cultures including South America. Link with history – origin of Pan pipes.
"The story of Bamboo"– choral performance of story & writing of own version.

PE

Dance – learn Salsa.

PSHE

Awareness of economic problems of developing countries.

NON-FICTION

Produce an information book on Bamboo for gardeners – 'Guide to Growing Bamboo'. Include photos (ICT link).

Instructions to make Pan pipes.

ART

Art in Nature -natural form and wonder!
Patterns seen in stems/ leaves/bark
Enlarge and repeat pattern
Texture
Explore the colour green

GEOGRAPHY

Study of less economically developed country (Colombia).
Compare & contrast Colombia & UK – landscape, industry, weather & climate, agriculture & way of life.

LITERACY LINKS

There are many traditional tales from around the world which can be used to inspire children. The children can be encouraged to reflect on Bamboo as a plant but also respond to the text as a stimulus to write stories of their own.
At Shaw "The Story Of Bamboo" from "A Year of The Heart" by Daniel O'Leary was used.
After discussing the text – its vocabulary, grammatical structure and the use of personification, the children learnt the story off by heart by adding actions to the words as an aide to learning.
(see ideas in Pie Corbett: www.talk4writing.co.uk)
In this way, the children quickly picked up the rhythm and challenging sentence structures and finally performed the story in front of their parents as a wonderful piece of choral speaking.
They went on to write the story in their own words.

DEVELOPING STORYTELLING

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COLOMBIA FAST FACTS

WHERE IN THE WORLD?

- Colombia shares a border with five countries – Panama, Venezuela, Brazil, Ecuador and Peru
- Colombia has rainforests, wide plains called Llanos, magnificent mountain ranges called The Andes, lush coastal regions and lots of islands in the Caribbean and Pacific Oceans.
- Colombia has two coastlines. One on the Pacific Ocean and one on the Caribbean Sea which is part of the Atlantic Ocean.
- Bogota is the capital. It is the second largest capital city in South America. At 2,640 metres, it is one of the highest capital cities in the world
- The official name for Colombia is 'The Republic of Colombia'. The name comes from the last name of the explorer Christopher Columbus
- Colombia doesn't have seasons because it is near to the equator. It has sunshine throughout the year.

PEOPLE IN COLOMBIA

- Colombia was originally inhabited by groups of people called Muisca, Quimbaya and Tairona. It was taken over, or colonised, by the Spanish in 1499.
- Most people speak Spanish. It is the official language of Colombia.
- There are 64 other languages spoken in Colombia. They are spoken by a small number of people.
- Colombia has a population of over 46 million people
- In 1975 Colombian women were given the right to vote
- The name for the money used in Colombia is the peso.
- People in Colombia grow a lot of coffee plants. They sell the coffee beans to other countries. They also grow lots of bananas, rice, cut flowers and sugarcane.
- People in Colombia make lots of clothes and footwear. They also mine for emeralds, gold, silver, platinum and coal.
- The most popular sports in Colombia are football, boxing, motorsport, cycling and baseball
- The Nobel prize winning author Gabriel Garcia Marquez and the popular singer Shakira both come from Colombia
- Most people in Colombia are Roman Catholic Christians.

PLANTS AND ANIMALS IN COLOMBIA

- Colombia is the second most bio-diverse country in the world. This means that Colombia has a huge number of different species of living things.
- There are at least 1,750 different bird species in Colombia.
- There are over 580 species of amphibians.
- There are more than 3000 species of butterflies.
- There are over 130,000 species of plants with over 4000 different types of orchid plants.

COLOMBIAN FLAG AND MOTTO

Libertad y Orden (Liberty and order)

COLOMBIA AND BAMBOO

COLOMBIA AND FOOD

People eat lots of different types of food in Colombia. Dishes often have a great deal of meat which are usually eaten with rice, beans or some form of potato. There are also exotic dishes like roasted ants (homiga culona), guinea pig, and fried intestines (chunchillos), as well as comfort foods like arepas (corn pockets) and chicken soup (sancocho de gallina). Many of the popular traditional dishes focus on meat such asbandeja paisa (different meats with fried egg and fried plantain), fritanga (fried meats and sausages) and lechona (whole roasted suckling pig).

BAMBOO has multiple uses from scaffolding to musical instruments, food, furniture, fencing and a million other things besides, and thus an ideal material to illustrate scientific principles, construction techniques and musical styles found within ancient cultural traditions as well as contemporary design technology.

The Growing Music project offers insight into its remarkable properties. Children have opportunities to explore, experiment and understand its musical potential and successful transformation into a variety of instruments from simple one-note pipes to a variety of flutes. Children grow Bamboo in their schools and make musical instruments from mature Bamboo sticks, investigating how sounds are made and changed. They learn to make and play a set of traditional Colombian 'sikus' pipes, coming together to play as a 'sikuri' orchestra.

This project engages young children in a cycle of planting, growing, investigating, making and playing with a number of cross-curricular opportunities for Literacy, Art, Geography and Design Technology lessons.

> *A really imaginative way of bringing science and music together and for the children to understand principles of sound waves and pitch as well as learning practical skills like measuring and sawing. Overall a superb experience.*

www.womadfoundation.org

ww.pstt.org.uk

The WOMAD Foundation

why & how?
PRIMARY SCIENCE TEACHING TRUST