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Y Drindod Dewi Sant
University of Wales
Trinity Saint David

Yr Athrofa
Centre for Education
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**Trawsnewid Addysg,
Trawsnewid Bywydau**

**Transforming Education,
Transforming Lives**

*Trawsnewid Addysg, Trawsnewid Bywydau
Transforming Education, Transforming Lives*

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ECAD6051P Science and Technology Lecture 1

LAU EMANUEL

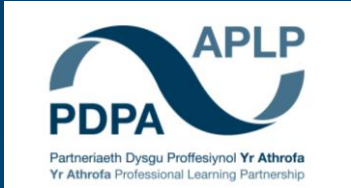
laura.emanuel@uwtsd.ac.uk

- Thanks to Helen Williams



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Aims:

Considering Science and Technology within Foundation Learning - Curriculum for Wales 2022. (i.e., What am I teaching?)

Pedagogical considerations in the teaching of Science and Technology (Ideas about how I teach)

Identify and apply resources to support the teaching of Science and Technology .

Beth mae Gwyddoniaeth a Thechnoleg yn meddwl i chi?

What does Science and Technology mean to you?



Cwricwlwm

2022

Curriculum



<https://hwb.gov.wales/cwricwlwm-i-gymru/gwyddoniaeth-a-thechnoleg/>

Gwyddoniaeth a Thechnoleg / Science and Technology



Clare Hoey

Dirprwy Bennaeth, Ysgol Gymraeg Ifor Hael,
Maes Dysgu a Phrofiad Gwyddoniaeth a Thechnoleg
Deputy Head, Ysgol Gymraeg Ifor Hael,
Science and Technology Area of Learning and Experience group

<https://www.youtube.com/watch?v=Q9fhUoVLs44>



<https://hwb.gov.wales/curriculum-for-wales/science-and-technology/>

Gwyddoniaeth a Thechnoleg / Science and Technology



Yr Athro / Professor Tom Crick

Cadeirydd,
Maes Dysgu a Phrofiad Gwyddoniaeth a Thechnoleg
Chair,
Science and Technology Area of Learning and Experience group

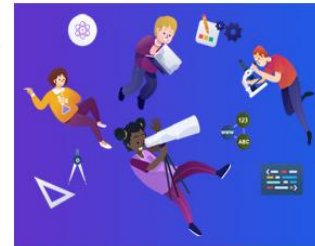
[Curriculum Design: Science and Technology](#)

Curriculum for Wales 2022

- [AoLE Science and Technology](#) - What Matters

- Being curious and searching for answers is essential to understanding and predicting phenomena.
- Design thinking and engineering offer technical and creative ways to meet society's needs and wants.
- The world around us is full of living things which depend on each other for survival.
- Matter and the way it behaves defines our universe and shapes our lives.
- Forces and energy provide a foundation for understanding our universe.
- Computation is the foundation for our digital world.

[Descriptions of learning - Hwb \(gov.wales\)](#)



Science and Technology

Task :

Take 10 minutes to familiarise yourself with the Area of Learning and Experience

What are the key concepts?
From where do they derive?

Curriculum for Wales 2022: Progression

Progression in learning is a process of developing and improving skills and knowledge over time'.

Principles of progression

These are the overarching principles of each Area of Learning and Experience and the curriculum in general. They are about progress across the whole curriculum.



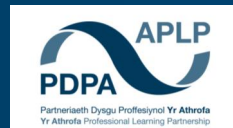
Science and Technology

[Science and Technology: Principles of progression - Hwb \(gov.wales\)](https://gov.wales/science-and-technology/principles-of-progression)



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Curriculum for Wales 2022: Descriptions of Learning

A description of how learners should make progress in each statement of what matters .

They are reference points to progress.

SOWM 1: Scientific Enquiry

Progression step 1

I can show curiosity and question how things work.

I can explore the environment, make observations and communicate my ideas.

Progression step 2

I can ask questions and use my experience to suggest simple methods of inquiry.

I can recognise patterns from my observations and investigations and can communicate my findings.

I can use my [knowledge](#) and understanding to predict effects as part of my scientific exploration.

I can recognise that what I do, and the things I use, can have an impact on my environment and on living things.

I can explore relationships between living things, their habitats and their [life cycles](#).

I can observe and describe ways in which materials change when they are mixed together.

I can investigate different forms of energy and how it can be transferred.

I can explore and communicate the basic properties of light, sound, electricity and magnetism.

I can identify things in the environment which may be harmful and can act to reduce the risks to myself and others.

SOWM:Design Technology

Progression step 1

I can design while I make and communicate about what I am making.

I can safely use simple tools, materials and equipment to construct and deconstruct.

I can explore the properties of materials and choose different materials for a particular use.

I can identify, follow and begin to create sequences and patterns in everyday activities.

Progression step 2

I can produce designs to communicate my ideas in response to particular contexts.

I can make design decisions, using my [knowledge](#) of materials and existing products, and suggest design improvements.

I can explore how different component parts work together.

I can safely use a range of tools, materials and equipment to construct for a variety of reasons.

I have experienced using basic prototyping techniques to improve outcomes.

I can identify things in the environment which may be harmful and can act to reduce the risks to myself and others.

I can explore and describe the properties of materials and justify their uses.



Science and Technology

Curriculum for Wales 2022: Descriptions of Learning

A description of how learners should make progress in each statement of what matters .
They are reference points to progress.

SOWM3: Biology

Progression step 1

I can recognise that plants and animals are living things which grow.

I can identify, follow and begin to create sequences and patterns in everyday activities.

Progression step 2

I can recognise patterns from my observations and investigations and can communicate my findings.

I can use my [knowledge](#) and understanding to predict effects as part of my scientific exploration.

I can recognise that what I do, and the things I use, can have an impact on my environment and on living things.

I can explore relationships between living things, their habitats and their [life cycles](#).



Science and Technology

SOWM4: Chemistry

Progression step 1

I can explore the properties of materials and choose different materials for a particular use.

I can identify, follow and begin to create sequences and patterns in everyday activities.

Progression step 2

I can recognise patterns from my observations and investigations and can communicate my findings.

I can use my [knowledge](#) and understanding to predict effects as part of my scientific exploration.

I can make design decisions, using my [knowledge](#) of materials and existing products, and suggest design improvements.

I can explore and describe the properties of materials and justify their uses.

I can observe and describe ways in which materials change when they are mixed together.

Curriculum for Wales 2022: Descriptions of Learning

A description of how learners should make progress in each statement of what matters .
They are reference points to progress.

SOWM5: Physics

Progression step 1

I can identify, follow and begin to create sequences and patterns in everyday activities.

Progression step 2

I can recognise patterns from my observations and investigations and can communicate my findings.

I can use my knowledge and understanding to predict effects as part of my scientific exploration.

I can investigate different forms of energy and how it can be transferred.

I can communicate the effect forces have on myself and on objects.

I can explore and communicate the basic properties of light, sound, electricity and magnetism.



Science and Technology

SOWM6: Computer Science

Progression step 1

I can identify, follow and begin to create sequences and patterns in everyday activities.

I am beginning to follow a sequence of instructions.

I can experiment with and identify uses of a range of computing technology in the world around me.

Progression step 2

I can safely use a range of tools, materials and equipment to construct for a variety of reasons.

I can use computational thinking techniques, through unplugged or offline activities.

I can create simple algorithms and am beginning to explain errors.

I can follow algorithms to determine their purpose and predict outcomes.

I am beginning to explain the importance of accurate and reliable data to ensure a desired outcome.

I can follow instructions to build and control a physical device.

ASSESSMENT & PROGRESSION in Curriculum for Wales

@ImpactWales

PROGRESSION STEPS



Age 5



Age 8



Age 11



Age 14



Age 16

At each progression step there will be

ACHIEVEMENT OUTCOMES

these are:

- * Short statements in learner friendly language
- * Reference points for each pupil's learning journey
- * Cover the AoLE What Matters Statements
- * Address the 4 Purposes of the curriculum
- * A sequence of learning across the curriculum

The cross curricular responsibilities of Literacy, Numeracy & Digital Competency will be subsumed into the new Areas of Learning & Experience.

Areas of Learning & Experience

What Matters / 4 Purposes

Knowledge, skills, experience



Achievement Outcomes

Foundation Phase Framework

Foundation Phase

Part of [Curriculum for Wales 2008](#)

CONTENTS

[Framework](#)

[Assessment](#)

[Guidance](#)

[Resources](#)

[Information for parents/carers](#)

i The Curriculum for Wales is being implemented in schools and settings from September 2022. This guidance for the 2008 curriculum will continue to be used for some learners until all schools and settings are using the Curriculum for Wales with all their learners in the 2026 to 2027 academic year.

Framework



Foundation Phase Framework

03 August 2015 Statutory guidance

Assessment

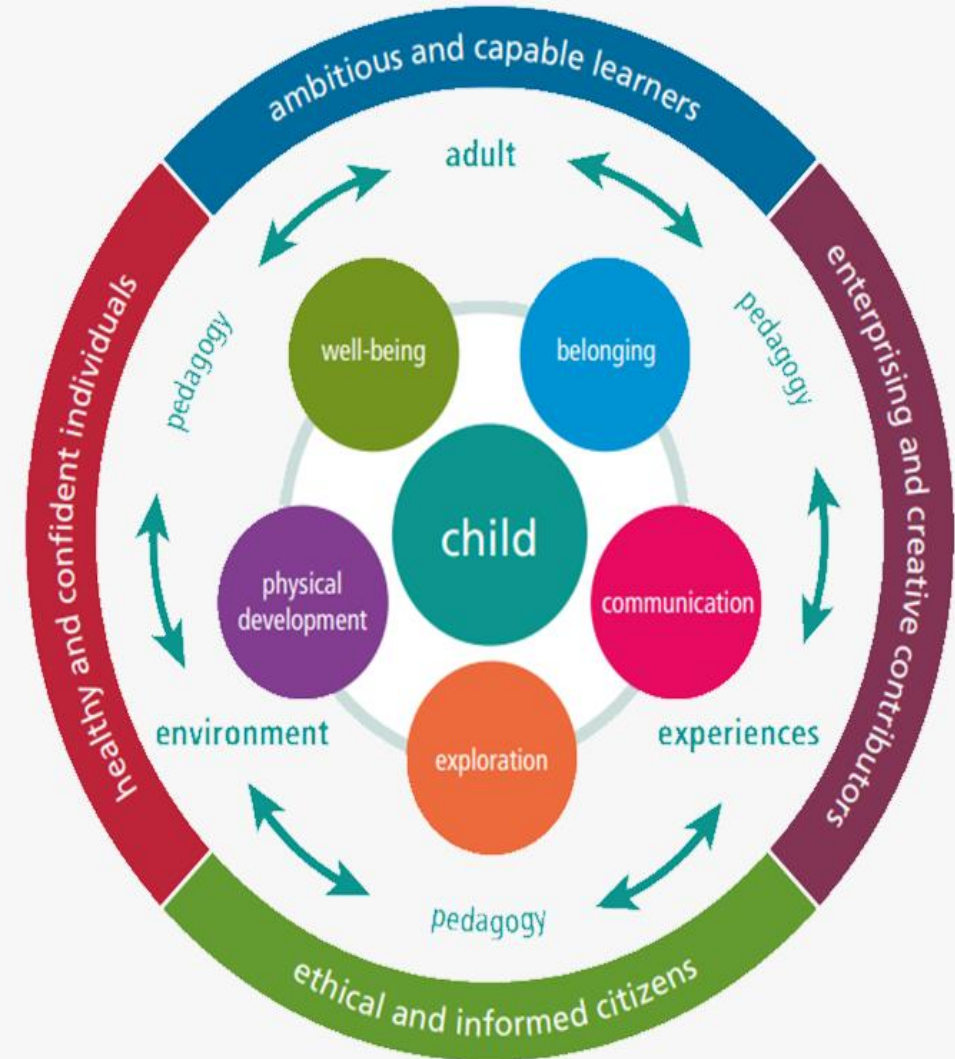


Foundation Phase profile: guidance for practitioners

Foundation Phase Framework

(Revised 2015)

Curriculum Pedagogical Practice



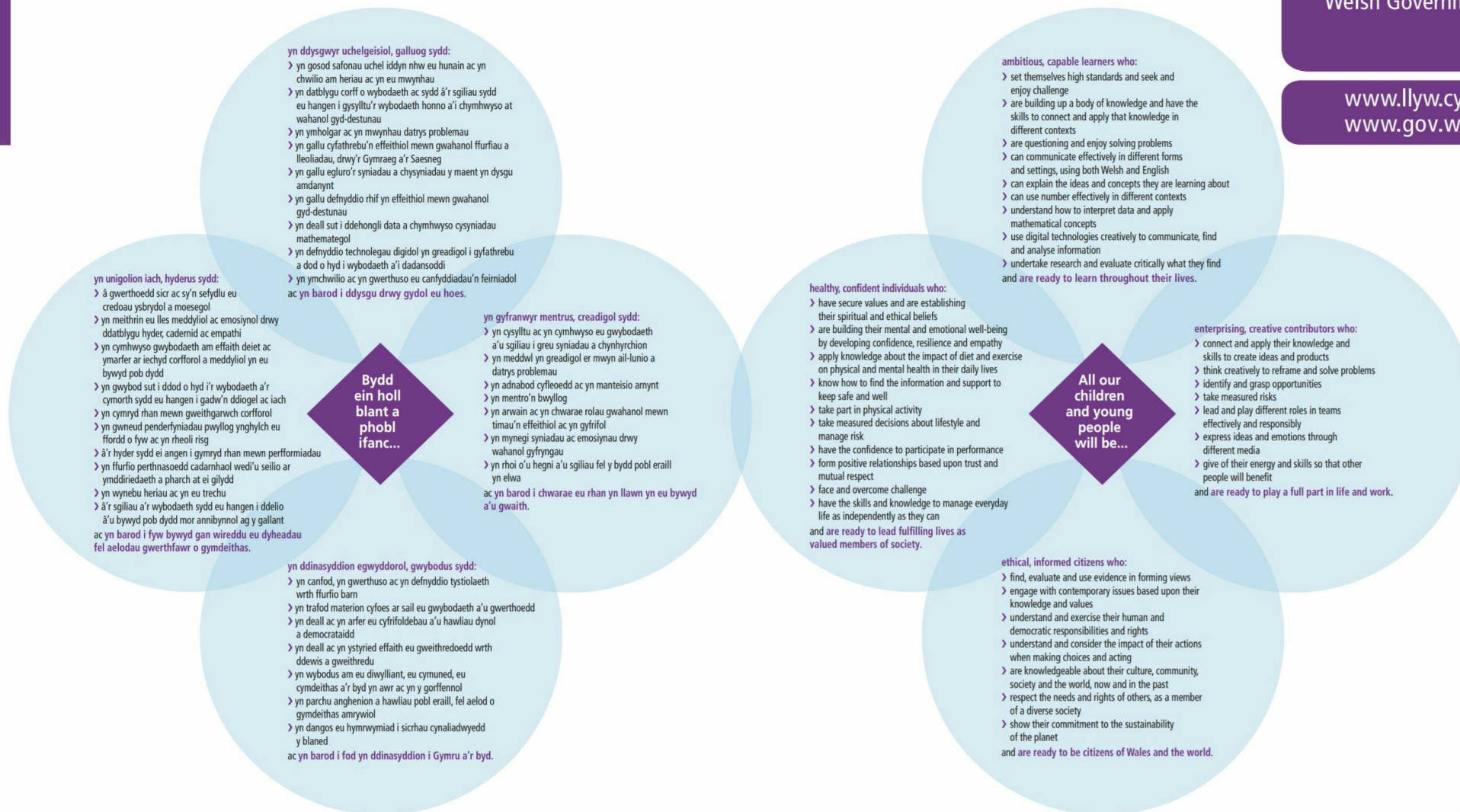
Pedwar diben y cwricwlwm i Gymru

The four purposes of the curriculum for Wales



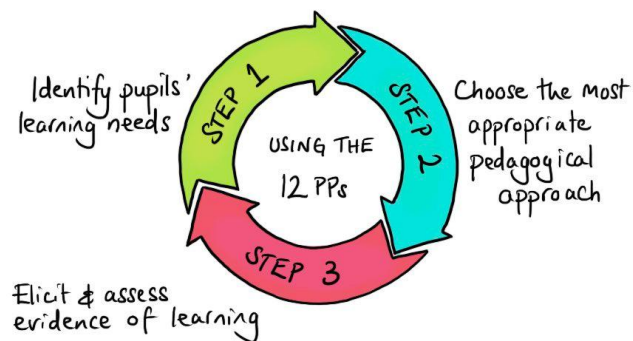
Llywodraeth Cymru
Welsh Government

www.llyw.cymru
www.gov.wales



"The recommendations of this Review do not imply an emphasis on any particular teaching approaches: decisions about teaching and learning are best taken by teachers themselves."

Prof G. Donaldson, *Successful Futures* (2015)



Good teaching & learning...

Focuses on the 4 Purposes

Supports sustained effort to reach high but achievable expectations

Employs a range of pedagogical approaches including direct teaching

Promotes wider skills including problem solving creative & critical thinking

Builds on previous knowledge and experiences

Creates authentic contexts for learning

Uses assessment for learning

Makes connections within & between AoLEs

Reinforces cross curricular skills of LNF, DCF etc.

Supports learners to take responsibility for their own learning

Supports social and emotional development & positive relationships

Encourages collaboration

Foundation Learning:

Development of skills

The following skills are essential to this Area of Learning and can also be developed across the curriculum.

- Observing
- Comparing
- Classifying
- Enquiring
- Exploring and experimenting
- Listening
- Making decisions
- Predicting and testing
- Reflecting
- Describing
- Sorting and grouping
- Sequencing
- Asking/answering questions
- Investigating
- Thinking
- Solving problems
- Recording
- Communicating
- Evaluating

Odd one out!

<https://pstt.org.uk/?s=odd+one+out>



large white butterfly



hedgehog



badger



otter

Foundation Learning Pedagogy

#1

Foundation Phase Pedagogy

Continuous provision

'Practitioners set the environment and ensure that the appropriate resources are available to enable children to practise, repeat and refine their skills in a purposeful way.'

Adults support by:



– playing alongside

– responding and suggesting ideas, using open questioning



– observing and identifying skills and the interests of each child



– planning for the next steps in learning.

Focus task – involves direct teaching

Enhanced provision – practitioners and children can introduce new ideas through practical resources. Adults model, encourage, question and challenge

Continuous provision – allows children to explore, practice, repeat and refine their skills while developing their communication skills. Children take ownership of their learning



Find out more:



Online at bit.ly/fpaplan



#FoundationPhase

Foundation Learning Pedagogy

#2

Foundation Phase Pedagogy

Enhanced provision

'Enhanced provision is where resources are added to continuous provision which match the class topic or the interests of the children in order to inspire, extend and challenge learning. This will allow children to practise, embed and consolidate the skills they have developed.'

Adults support by:



– playing alongside



– observing and identifying skills and the interests of each child



– planning for the next steps in learning.

– responding and suggesting ideas, using open questioning

Focus task – involves direct teaching

Enhanced provision – practitioners and children can introduce new ideas through practical resources. Adults model, encourage, question and challenge

Continuous provision – allows children to explore, practice, repeat and refine their skills while developing their communication skills. Children take ownership of their learning



Find out more:



Online at bit.ly/fpaplan



#FoundationPhase

Foundation Learning Pedagogy

#3

Foundation Phase Pedagogy

Focused provision

'Practitioners introduce and teach new skills using a range of methods and ideas that children can then transfer and use in a range of contexts. Adults model, challenge and link to previous experiences.'

Adults support by:

– responding and suggesting ideas, using open questioning



– observing and identifying skills and the interests of each child



– planning for the next steps in learning.

Focus task – involves direct teaching

Enhanced provision – practitioners and children can introduce new ideas through practical resources. Adults model, encourage, question and challenge

Continuous provision – allows children to explore, practice, repeat and refine their skills while developing their communication skills. Children take ownership of their learning



Find out more:



Online at bit.ly/fpaplan



#FoundationPhase

Foundation Learning Pedagogy

#4

Foundation Phase Pedagogy

Outdoor learning

'The learning environment should include both indoors and outdoors, and involve experiential play-based learning. It should promote independence and choice making, encourage responsibility and self-regulation and reflect all areas of learning.'

Adults support by:



– playing alongside



– observing and identifying skills and the interests of each child

– responding and suggesting ideas, using open questioning



– planning for the next steps in learning.

Outdoor provision takes place through a variety of continuous, enhanced and focused activities.

Focus task – involves direct teaching

Enhanced provision – practitioners and children can introduce new ideas through practical resources. Adults model, encourage, question and challenge

Continuous provision – allows children to explore, practice, repeat and refine their skills while developing their communication skills. Children take ownership of their learning



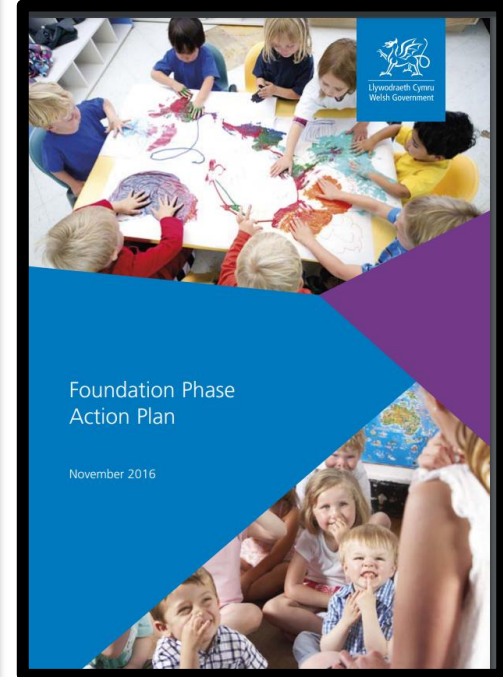
Find out more:



Online at bit.ly/fpaplan



#FoundationPhase



HOW TO SUPPORT AN ENQUIRING MIND...

- Answer questions with questions (Socratic questioning)
- Base on what they know already (Piaget -Constructivist)
- Playful
- Safe ...no wrong answers
- Co-construction / Scaffolding
- Learning through discourse (talking)



- IDEAS?

[Summary_of_recommendations_poster.pdf](#)
 [\(educationendowmentfoundation.org.uk\)](http://educationendowmentfoundation.org.uk)

Support this by encouraging questions, creating a safe learning environment, scaffold on real world experiences, and talk about them. This develops metacognitive skills that are essential in learning science and technology later.

Developing Science and Technology

- ▶ Curiosity
- ▶ Explore
- ▶ Observe
- ▶ Communicate
- ▶ Materials
- ▶ Connect properties to their use
- ▶ Sequences
- ▶ Patterns
- ▶ Grow
- ▶ Instructions
- ▶ Explore computing technology

Use Youtube / Pinterest/ twitter to research some the following ideas:

Sink or float
Will it dissolve
Magnet maze
Discovering magnification
Homemade marble runs
Weather station
How do plants grow
Pooter (bug trap)
Water cycle
Light (shadows)
Life cycles of plants
Life cycle of creatures
Filtering
Magic dancing milk

**These are great ideas and allow pupils to have fun yet also ask lots of questions.
Encourage talking. Increase descriptive vocabulary.
Encourage sorting and pattern making.**

Developing Science and Technology



Weavers, G., Keogh, B., & Naylor, S. (2008). Made you look, made you think, made you talk. Sandbach: Millgate House

MYL_Chap_Worksheets.pdf
In Foundation Learning
resources file on Moodle .

LET ME OUT! 6



What it is

In this exciting activity children handle a foil-wrapped object. They are encouraged to think about what might be inside. They discuss the possibilities with each other and their teacher. When it's opened up, they find a small figure, such as a Lego® person, trapped inside a block of ice! How can they get him out of his icy prison?

You could even turn this into a news report and weather forecast with spacemen arriving on Earth in giant hailstones!

Getting started

- Put a small amount of water in a yoghurt pot or similar and add a plastic figure. Put this in the freezer. Try little Santa figures at Christmas time!
- When it is frozen, top up the water and freeze again so that the figure will be inside the ice, not floating on top.
- Wrap the ice in foil.
- Collect some bowls and any other resources that they may request to release the figure, such as little hammers.



Take care if children do try to hammer the person out. Ice and hammers can both be very mobile!

Teaching through stories : Example: Progression Step?

https://pstat.org.uk/resources/play-observe-ask/?sftage_ranges=three-five

EARLY YEARS SCIENCE PROVISION MAP

Play, Observe & Ask



Sensory Play

Learn: to name and describe a variety of everyday materials

You need: tray/box, hay/grass, straw, pine cones, shells, feathers, sensory objects (small bells), fabric pieces, stones, leaves, sticks, etc. Make a scarecrow 'sensory bin' with a variety of related materials.

Play, observe & ask:

- Can you name these objects?
- Where do you think they came from?
- How would you describe the objects?
- Are they natural/not natural?
- Can you sort these objects? How?

Malleable Play

Learn: to name features of the animals in the story

You need: modelling clay (e.g. Play-Doh[®]), tools, feathers, fur, eyes, etc.

Play observe & ask:

- What was your favourite living thing from the story? Why?
- Can you make a model?
- What are the features of this creature?
- How is your animal different to the other animals in the story?
- How is your animal the same as the other animals in the story?

Water Play

Learn: that materials may change over time

You need: straw, tray, water, a variety of fabrics and materials (some waterproof, e.g. plastic bag), string (to make small bundles of straw) Recreate the pool from the story and make some small bundles of straw to represent scarecrows. (The children could help to do this.)

Play, observe & ask:

- What is straw? Where does it come from?
- How does it feel when it is dry?
- How does it feel when it is wet?
- What happens to a straw scarecrow if it is left in water?
- How could you keep a scarecrow dry? How can we test this? (Encourage children to wrap straw bundles in different materials).
- Which fabrics are waterproof? How do you know?

Construction

Learn: to compare the suitability of materials for a particular purpose (for building a scarecrow that will stand up)

You need: card, straw, rope, string, fabric, elastic bands, buttons etc...

Play, observe & ask:

- Where do you see scarecrows?
- What do you think they are made of?
- What materials will you use? Why?
- How will you make your scarecrow stand up?

THE SCARECROW'S WEDDING by Julia Donaldson & Alec Scheffler



Outdoors

Learn: to identify animals and plants in different habitats

You need: access to some of the habitats in the story (a tree, field, lawn, flowerbed, pond, beach), magnifiers, pictures or toy animals from the story (crows, geese, cows, crabs, mice, bees, toad, snail), pictures of possible habitats (tree, field, grass, beach, flowers, pond, stones)

Play, observe & ask:

- Who do you think might live here? Why do you think that?
- Focus on one animal - Where do think this animal might live?
- Can you describe this habitat?
- Who else might live here?
- Back in the classroom, using pictures - can you place the animal in the correct habitat?

Small World

Learn: features of animals in the story; similarities and differences between animals

You need: toy animals - crows, geese, cows, crabs, mice, bees, toad, snail

Play, observe & ask:

- Can you name the animals?
- Can you name the body parts?
- How are these animals similar?
- How are these animals different?
- Can you group the animals?
- What facts do you know about each animal?

Key Science Vocabulary

animal names - crows, geese, cows, crabs, mice, bees, toad, snail
body parts - head, body, legs, tail, whiskers, claws, feathers, beak, wings, shell, etc.

habitats - tree, field, grass/lawn, flowerbed, pond, beach
materials - fabric, cotton, plastic, paper, wood, shell, stone, straw
properties of materials - rough, smooth, hard, soft, shiny, dull, bendy, stretchy, strong, stiff, waterproof, natural, non-natural, etc.

Further Science

Flowers - name and collect 'pink' flowers.

Habitats - What else lives in these habitats (farm, countryside, rock pool, etc.)?

Fire Safety - What burns easily? What should you do if you see a fire?

© Primary Science Teaching Trust 2021

* © Play-Doh

Teaching through stories

Task:

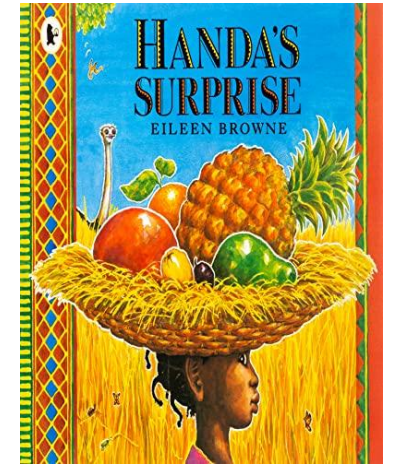
<https://www.stem.org.uk/teaching-science-through-stories>

Take 15 mins to look at the resources : 5-7

How do they link with science and technology? Stories are a fantastic way of stirring up imagination and creativity.

It is cross curricular with literacy and provides links helps you to create lessons that fulfil the four purposes.

Choose 1 of the resources and list ways in which you can use the story to link to learning of science and technology.



Teaching through stories

Jack and the Beanstalk



- Grow sunflowers
- Beans from seeds
- Measuring growth
- Seed sorting
- Can seeds grow without soil?
- Can plants only grow from seeds?
 - Growing a plant from a cutting or runner
 - Spider plants
 - Succulents
- Growing crops
- Sustainability

Enquiry Skills: Cartesian Squid



The science is important but in foundation learning it is about making, showing and asking questions.

Here are some questions that support enquiry.

- Is it floating or sinking?
- How do you think it is made?
- What other objects float?
 - Are you sure?
 - How can you tell?
- Why is it sinking when you squeeze it?

Can you think of anymore?

***Don't be afraid to say you don't know the answer.**

Have responses ready:

"I'm not sure. How do you think we can find out?"

Floating
or
sinking?

What skills
are being
developed?

ICT Precoding skills

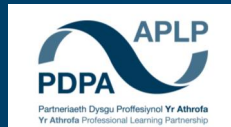
You don't need a computer to teach computer science skills.

- ICT Precoding skills include:
 - Sequencing stories or actions. How to make jelly? Re-tell story
 - Sort “bugs” to categorise
 - If...then
 - Treasure hunts
 - Solve mazes (trial and error)
 - Copying sequences.
- <https://www.yellow-door.net/blog/how-to-develop-pre-coding-skills-in-the-early-years/>



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Digital Competence?

<https://hwb.gov.wales/api/storage/d26af733-abd1-4d33-92fe-4ea8eb1d928f/dcf40620.pdf>

What is digital competence?

It's a concept that describes technology-related skills (Lomami et al 2011). In *Successful Futures*, Professor Graham Donaldson highlighted the importance of our pupils developing their digital skills in order for them to adapt to the ever-changing technological world:

“

Full participation in modern society and the workplace already demands increasingly high levels of digital competence and that process can only continue into a future that we cannot imagine.

https://helda.helsinki.fi/bitstream/handle/10138/154423/Ilomaki_et_al_2011_What_is_digital_competence.pdf?sequence=1

Digital competence should not be confused with Information and Communication Technology (ICT) or Computer Science. Digital competence is one of three cross-curricular responsibilities, the others being literacy and numeracy. It focuses on digital skills that can be used in a wide variety of subjects and situations and that can be transferred to the world of work.



Learning new skills

It could be intrinsic, but we do model those around us.

We are not afraid of failure as a baby, we keep on trying.
As we become older, we become more afraid to try.

Help learners by maintaining that safe environment for learning, with plenty of opportunities to learn new skills.

With your support and encouragement, they will succeed.
They will pick up your enthusiasm for the subject;

Therefore, to be great at teaching science and technology, you yourself must embrace the subject and not be afraid of it!

BOTTOM LINE

- ← Keep it fun
- ← Increase demand through questioning
- ← Make it tactile
- ← Encourage group work
- ← Create a safe environment to be curious
- ← Don't be afraid to try



PRESENTING
the adventures of
PROFESSOR VONPOOPSINPINS

Ideas and Resources?

National Network For Excellence in Science and Technology



[Home](#) [Resources](#) [Events](#) [Networks](#)

[Repository - National Network For Excellence in Science and Technology - Hwb \(gov.wales\)](#)

Hwb

Menu

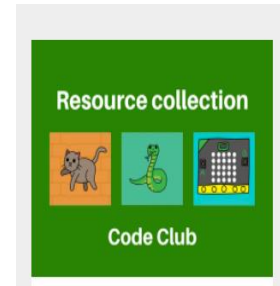
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Sign up

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Resources

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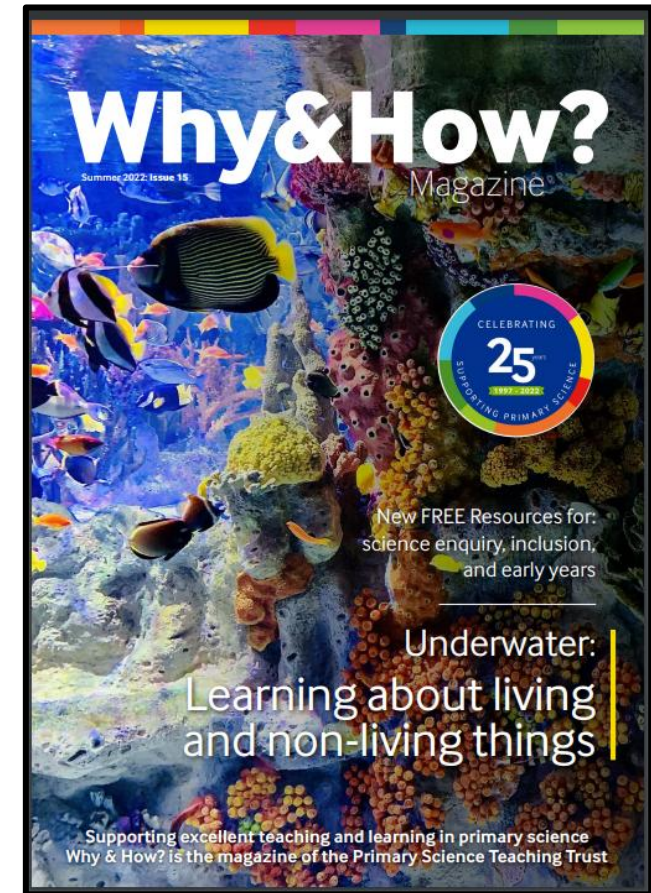
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Useful links:

- <https://www.stem.org.uk/resources/collection/3485/teaching-primary-science>
- <https://www.ase.org.uk/resources/primary-science>
- <https://wowscience.co.uk/>
- <https://www.tes.com/teaching-resources>
- <https://www.farmvention.com/>
- <https://explorify.wellcome.ac.uk/>
- <https://pstt.org.uk/>



<https://pstt.org.uk/what-we-do/why-how-magazine>

Let's experiment!

- What questions can we ask?
- Key vocabulary - write some on the post-its!
- What real life experience may they link it to?
- What might they notice?
- What are you hoping them to get out of this?
- How does it link to CfW?

Float or sink?

Test the objects in the bowl then sort them.



Speedy surfaces

Push the car along different surfaces to see how fast they go! What do you notice?



Shine through

Which materials let the light shine through, can you still see Stitch? How can you sort the materials?



Magnet fun

Test the objects to see which are magnetic and then sort them.

