'Together we grow'

Emmaville Primary School

Science Policy

Science Co-ordinator: Sophie Thompson

Rationale

Science is an important core subject in our school as it provides the foundations for understanding the world. Through building key knowledge, concepts and skills, pupils should be encouraged to develop a sense of excitement and curiosity about natural phenomena. They should be encouraged to explain what is occurring through conceptual models and practical activities that progressively build a deep understanding of the science curriculum and 'Working Scientifically'.

Through the teaching of science we aim to encourage our children to develop inquisitive and enquiring minds through the use of scientific investigations. We want the children to understand how science has changed our lives and is vital to the world's future prosperity. We aim to develop 'Science Capital' within the school – the measure of the school's engagement with science; how much we value it and how much it connects to our lives. This in turn supports our 'STEM Capital', and how our children will engage with, and aspire to careers within, Science, Technology, Engineering and Maths as they grow older. This, of course, directly helps to build our 'Cultural Capital', giving our children the greatest possible knowledge, experiences and aspirations within the world around them.

Children will study a number of different scientific topics; science will often take them outdoors into the local environment where they will be able to develop and practice investigational and observational skills. They will record and interpret findings and form and test hypotheses. Emmaville's Science Curriculum is built on National Curriculum coverage, and throughout their time at our school, pupils will acquire knowledge and understanding of the world around them.

Aims and Objectives - Intent

The national curriculum for science aims to ensure that all pupils:

- develop scientific knowledge and conceptual understanding of science
- develop understanding of the nature, processes and methods of science through different types of science enquiries that help them to answer scientific questions about the world around them

- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future

At Emmaville Primary School, our aim is to enthuse, develop and challenge pupils through an engaging and progressively structured science curriculum and teaching approaches where pupils:

- Develop lively and enquiring minds through their ability to question and argue rationally and to apply themselves to tasks
- Attain competency and confidence in science that will enable them to contribute to our local and global communities
- Acquire the knowledge and skills relevant to subsequent stages in their education, adult life and employment

Approaches to learning - Implementation

At Emmaville, teachers provide balance in teaching approaches, and the planned sequence of work throughout the school encourages pupils to use prior knowledge when approaching new work. The National Curriculum for Science is used as a framework for science content, skills and pupil expectations at our school. To support our key principles, we will deliver this curriculum through:

- A skills-focussed approach to teaching that ensures an appropriate and flexible challenge within the classroom. This approach is called '**dual objective planning**' in which the key scientific skills are taught alongside the contextual content of lessons. The Science National Curriculum states that "*Working and thinking scientifically … must always be taught through the substantive science content*". This is supported by the explicit use of dual objective planning.
- Conceptual threads called 'science models' that link topics and support progressively deeper learning. There are four science models that span the curriculum: Energy Transfer, Force Arrows, Particles and 'Big Picture' models (Advanced Organisers)
- Five key science skills that support both knowledge / conceptual development and Working Scientifically to match pupil performance to national Key Stage expectations -
    - Explaining Science (the language, information and key scientific models used to explain ideas and thinking in science)
    - Classification (the sorting, grouping and categorising of the world around us, in order to make links in our scientific thinking)
    - Designing experiments (the skills needed in order to make predictions, select equipment and design suitable ways to test our ideas)
    - Data, Table & Graphs (making sense of our observations through organising data in tables and graphs)
    - Making Conclusions (the ability to see patterns and use them to describe and explain what have observed, and suggest ways to improve)

(See Appendices 1-4)

In order to help children to organise their thinking and to introduce the key vocabulary, concepts, scientific models and ideas behind each Science unit, each child will have access

to a **topic cover sheet**, detailing the relevant information. A more detailed teacher version of this will aid planning, as will a topic break-down of each unit, together with relevant dual objectives and possible ideas for practical investigations.
(See Appendix 5 for a Year 1 example)

The children will be able to work independently, in mixed ability pairs, and in groups, allowing all children access to the curriculum. A variety of teaching methods best suited to activities and interests of the pupils will be used, including teacher demonstrations, whole-class/group/paired discussions, role-play activities, video clips and animations, focused investigations and experiments, close observations and many practical experiences.

- **At Foundation Stage**, children engage in active learning experiences to ensure that they develop skills and knowledge that will later be useful in the study of Science.
- **At Key Stage 1**, pupils observe, explore and ask questions about living things, materials and physical phenomena. They begin to work together to collect evidence to help them answer questions and to link this to simple scientific ideas. They begin to evaluate evidence and consider whether tests or comparisons are fair. They use reference materials to find out more about scientific ideas. They share ideas and communicate them using scientific language, drawings, charts and tables with the help of ICT if it is appropriate.
- **At Key Stage 2**, pupils learn about a wider range of living things, materials and physical phenomena. They make links between ideas and explain things using simple models and theories. They apply their knowledge and understanding of scientific ideas to familiar phenomena, everyday things and their personal health. They think about the effects of scientific and technological developments on the environment and in other contexts. They carry out more systematic investigations, working on their own and with others. They use a range of reference sources in their work. They talk about their work and its significance, using a wide range of scientific language, conventional diagrams, charts, graphs and ICT to communicate their ideas.

<u>Science Across the Curriculum</u>

- English – the skill of Explaining Science links very closely to English curriculum: speaking and listening to learn, discuss and explain; reading scientific information and vocabulary; writing coherently and with confidence to describe, predict and explain
- Mathematics – observations within science lessons often result in the collection of data, and the formulation of graphs and charts
- Computing – data logging and graphing programmes are used from the creation of simple pictograms to more complex scatter graphs. In upper KS2, knowledge of circuits and control is extended with the use of Raspberry Pi units
- Foundation subjects – History is integral to understanding how our scientific perception has changed in many topics, including Forces, Micro-organisms and the Solar System. It also underpins the work done by pioneering scientists, such as Isaac Newton and Jane Goodall. Geography is supported by science in many ways too – the water cycle, rocks and soil, comparing habitats in different locations, etc. Art has links via the exploration of light, colour and shadows, while Technology draws

from scientific understanding of electricity and materials, and Music has close links to our understanding of sound.

Assessment - Impact

Science assessment is on-going and formative. It happens in the classroom as part of the normal teaching process. It informs lesson pitch, differentiated intervention and future planning. The key document to support this process is the Science Assessment Boards which provide criteria matched to year group expectation (see Appendices 1-4).

Topic based oral/activity/classwork/homework are used to inform on science knowledge and areas of individual/group misconception. Marking should comply with the school policy and should include:

- 'short-term' topic-specific comments to correct misconceptions/errors and to drive progress within that topic. Work should then show short-term improved knowledge and accuracy within that topic.
- 'long-term' skill-specific comments to match work to skill criteria (see Assessment Board) and to drive progress between topics. Work should then show improved skill/model development, matched to expectations, over time. Progress will be recorded using '*Science Rockets*' (see Appendix 6).

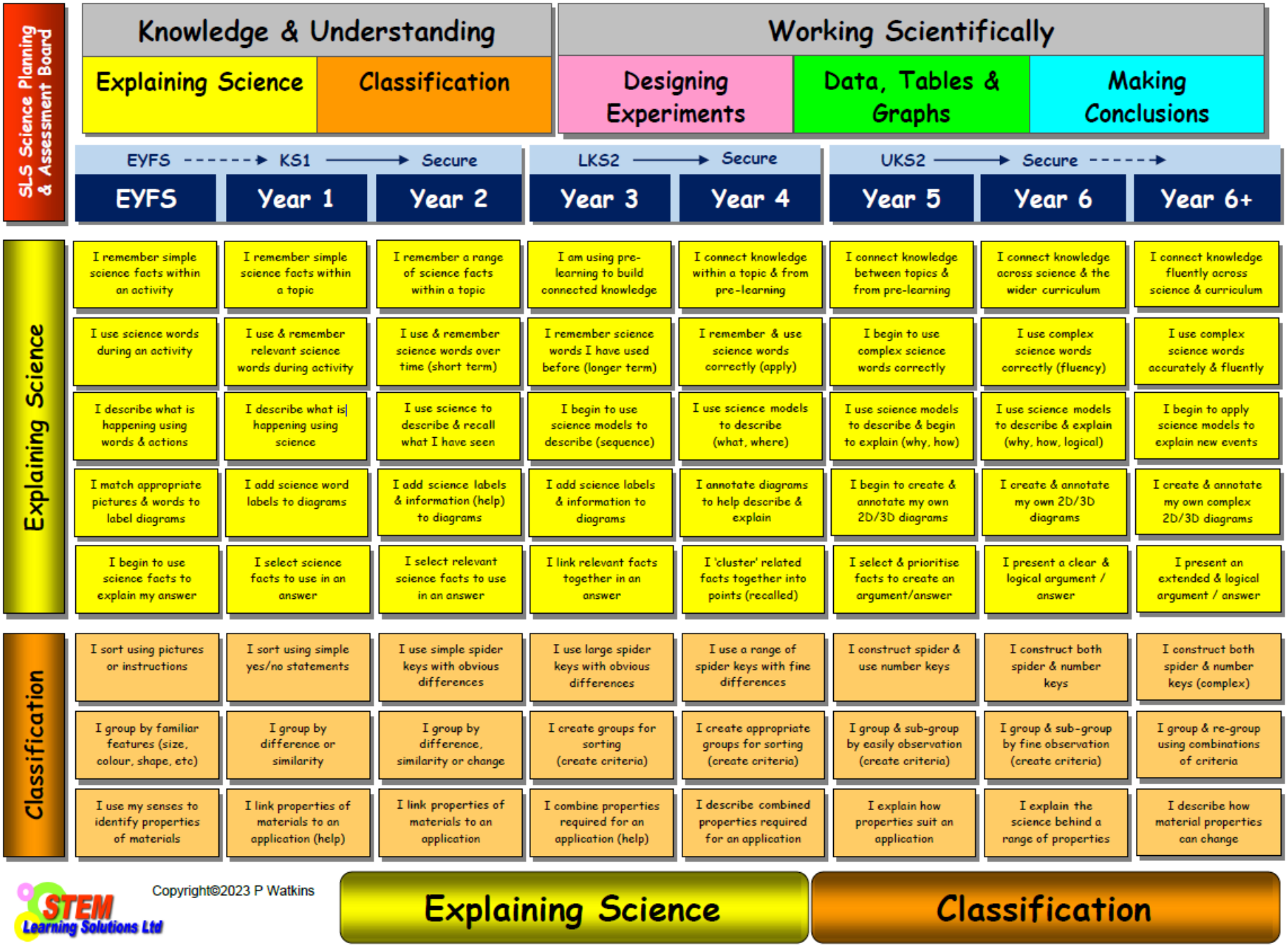
The Role of the Co-ordinator

- To take the lead in curriculum development in consultation with the headteacher, staff and governors;
- To monitor the teaching of Science in the school, ensuring that there is sufficient coverage and progress in the subject;
- To lead curriculum meetings;
- To attend Science network meetings and relevant courses, including links with cluster schools, to improve science provision;
- To support staff by providing information, training and advice;
- To ensure that there are appropriate resources to support the Science curriculum.

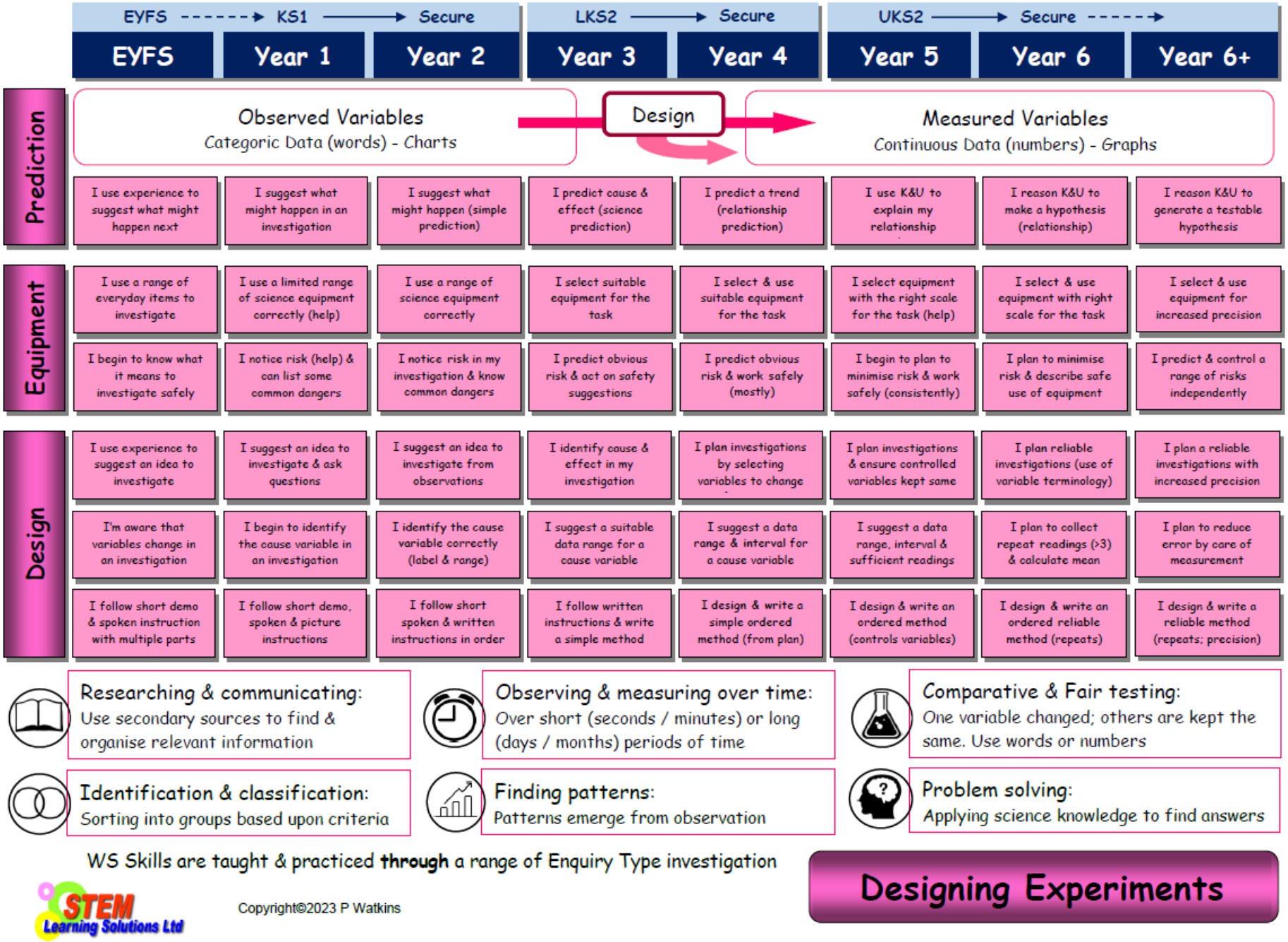
Date policy produced: July 2024

Review Date: July 2026

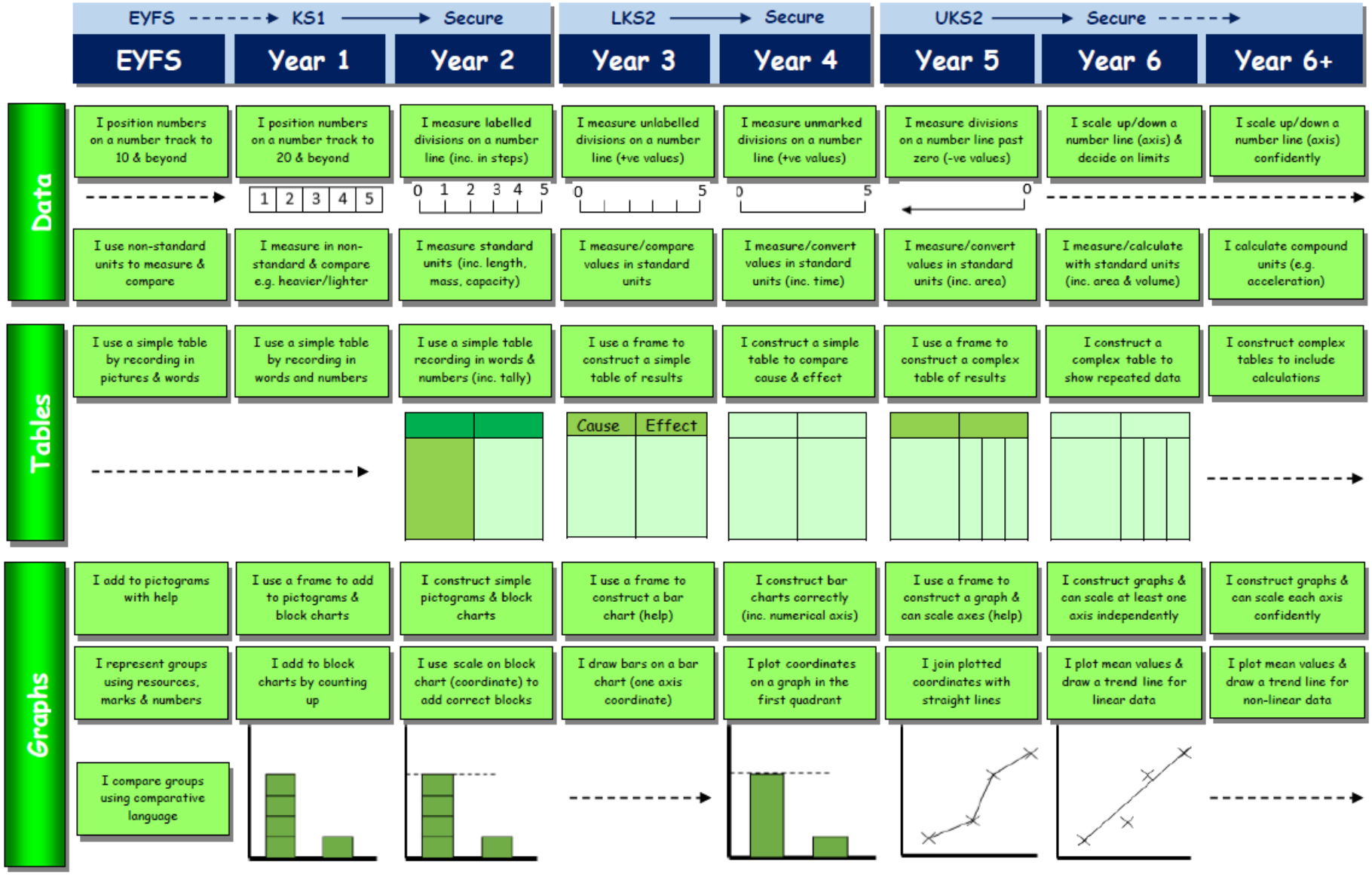
Appendix 1 – Dual Objectives Board: Explaining Science and Classification



Appendix 2 – Dual Objectives Board: Designing Experiments



Appendix 3 – Dual Objectives Board: Data, Tables & Graphs



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Data, Tables & Graphs

Appendix 4 – Dual Objectives Board: Making Conclusions

EYFS ------> KS1 ——> Secure | LKS2 ——> Secure | UKS2 ——> Secure ----->

	EYFS	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 6+
Patterns	I recognise, create & describe simple patterns (e.g. size)	I recognise, create & describe simple number patterns	I describe simple features & patterns in data & charts	I describe simple patterns in data, charts & graphs	I describe simple patterns, trends & relationships in data	I describe patterns, trends & relationships in data	I describe changing patterns, trends & relationships	I compare changing patterns, trends & relationships
	I begin to use 'more or less' to compare observations	I use 'more or less' to compare numbers	I see obvious differences in sets of numbers	I see subtle differences in sets of numbers	I see differences (error) in repeated data	I spot anomalous data that doesn't fit the pattern	I spot anomalous data & explain from the method	I deal with anomalous data to increase reliability
Conclusions	I talk about changes through my senses during activities	I describe the changes that are happening	I describe the changes that have happened	I describe my results by linking cause & effect	I describe trends & begin to use science models to explain	I use data in my conclusion & science models to explain	I use primary & secondary data in my conclusions	I use a range of data in conclusions to support validity
	I explore 'what if ..' questions through talk & play	I explore different ways to do things through play	I suggest a different way to do things with help	I suggest improvements to my method	I suggest sensible improvements to my method	I identify strengths & weaknesses & improvements	I suggest limitations (data) & practical improvements	I suggest limitations (use data) & justify improvements

Working Scientifically - word lists

KS1

Axis = reference line drawn on a graph to show the range of data for each variable (shows values)
Block chart = visual toll to show data/counts as bars built up by adding component blocks. Used to compare data visually
Cause = the variable we chose to change in an investigation
Data = a measured or counted outcome for a variable (numbers)
Effect = the variable that changes when we change the cause
Experiment = investigation that looks for a link between variables (fair or comparative test)
Observation = sensed outcome for a variable (described in words)
Pictogram = chart that uses pictures to represent data
Prediction = suggests what might happen based upon prior knowledge or experience (not a guess)
Results table = way of presenting data from an investigation
Risk = dangers when doing an investigation, using equipment or working in an area
Standard units = a quantity of a variable that is used as a standard measure (e.g. litre, meter, gram, etc)
Variable = a factor that can change

LKS2 (plus KS1)

Bar chart/graph = visual tool that uses bars to compare discrete data
Comparative test = fair test comparing discrete differences
Conclusion = the answer you give to a question (based upon data)
Continuous data = values are numbers (result from counting/measuring)
Coordinate = used to plot data (x/y) on a graph
Data interval =numerical gap between data points for a variable
Data point = a coordinate for a variable
Data range = maximum & minimum values for a variable
Discrete data = values are distinct/separate (e.g. male/female; counts)
Fair test = an investigation where only one variable is changed (cause); all others are kept the same and at their best value
Line graph = visual tool that shows a relationship trend between two continuous variables (it is essentially a scatter graph)
Method = ordered sequence of steps taken during an investigation. It can be written or in diagram form
Prediction (correlation/relationship) = describes the expected trend for two variables (cause & effect) that are linked
Prediction (scientific/causal) = suggestion as to what might happen based upon prior knowledge, experience or observation. Links the cause with the predicted effect. Does not have to describe the trend
Spider key = branching classification key where each branch has a yes/no choice (dichotomous key) leading to further choices
Trend = the outcome when two variables (cause & effect) are linked

UKS2 (plus KS1/LKS2)

Anomalous data = data that does not fit a pattern
Controlled variable = variables kept at the same value so they do not influence the dependent variable in a fair test

Making Conclusions

Data set = vales for repeated data
Data spread = variation of the data away from a mean (often due to imprecise measuring or when the controlled variable have not been kept the same)
Dependent variable = changed (effect) as a result of changing another. This is observed or measured and demonstrates a relationship in a fair test
Hypothesis = a reasoned prediction based upon theory, experience or direct observation
Independent variable = chosen variable (cause) changed in a fair test.
Mean = 'average' value from a data set
Number key = classification key that is a written, condensed version of a spider key
Precision = how similar your repeated data is (good technique & equipment choice)
Primary data = your experimental data or observations from an investigation
Reliability = if your data can be repeated (i.e. no error). Can be improved through collecting repeated values and calculating a mean
Results table (complex) = Table that contains multiple columns to show repeated data, calculations or a variety of features of a variable
Risk assessment = formal assessment of risk leading to improved safety recommendations or change in practice
Secondary data = researched data or observations. It can also be data gathered from others doing a similar experiment. Used to compare/support
Trend line = line drawn roughly between coordinates to show the trend (does not have to go through all data points)
Valid data = reliable, accurate & no bias or error (we are measuring what is expected)

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Appendix 5 – Topic Cover Sheet – Pupil sheet/Planning grid/Teacher sheet

Year 1 Animals Including Humans

Explaining Science

I use science words during an activity	I use & remember science words during an activity	I use & remember science words over time
I remember simple science facts within an activity	I remember simple science facts within a topic	I remember a range of science facts within a topic
I match appropriate pictures & words to label diagrams	I add science word labels to diagrams	I add science word labels & information (help) to diagrams

Classification

I sort using pictures or instructions	I sort using simple yes/no statements	I use simple spider keys with obvious differences
I group by familiar features	I group by difference or similarity	I group by difference similarity or change

Key Knowledge

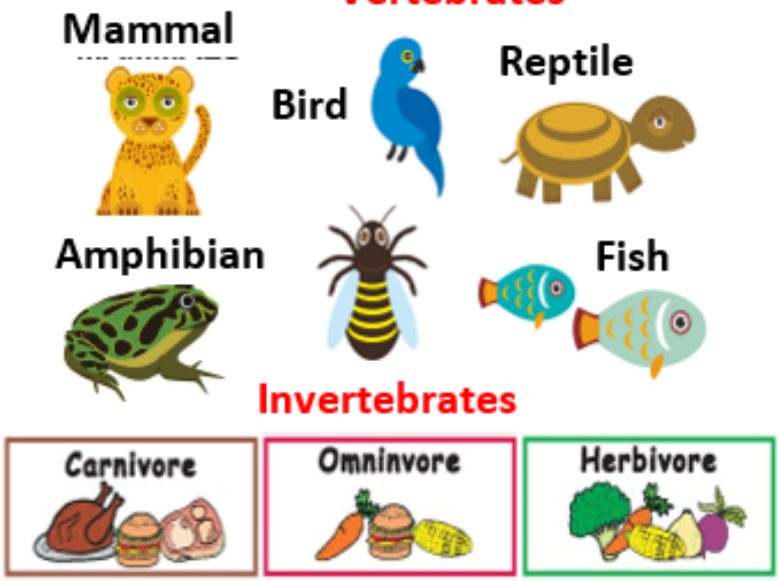
- Identify, name, describe features of and compare common vertebrates (fish, amphibians, reptiles, birds & mammals).
- *Explore, identify & answer questions about animals in their habitat. (Know how to care for pets & animals in a habitat).*
- Identify & name common carnivores, herbivores & omnivores (*including those identified from a habitat*).
- Identify, name, draw & label basic human body parts.
- Know the five senses and link these to human body parts.

Key Vocabulary

Animal, vertebrate (backbone), invertebrate (exoskeleton), fish, amphibian, , reptile, bird, mammal, scales, fins, gills, lung, scales, fur, carnivore, herbivore, omnivore, habitat, pet, head, hair, ears, eyes, nose, mouth, tongue, teeth, neck, arm, elbow, shoulder, hands, fingers, leg, knee, ankle, feet, toes, sight, hearing, touch, taste, feeling, sort, group, classify, feature (criteria), spider key.

Enquiry Types

Big Picture Models



Year 1 — Animals Including Humans

Prior Knowledge

Similarities and differences between themselves (e.g. senses) & others. Extends vocabulary. Looks closely at similarities, differences, patterns and change in nature. Makes observations of animals and why things occur & change (life cycles). Explores world around them, makes observations & drawings. Name & describe animals that live in different habitats. Observes living things throughout the year. (EYFS)

Important Scientists

Steve Backshall (1963-) British naturalist and TV presenter of 'Deadly 60'. He has brought wildlife awareness and science to a whole generation of children in a visual and engaging way.

Eugenie Clark (1922-2015) Japanese-American scientist known as the 'Shark Lady' for her research on shark behaviour and marine conservation. She was the first person to 'train' sharks and developed natural shark repellents.

Lesson	Knowledge Objective	Skill Objective	Enquiry Opportunities	Extension Opportunities
1	**What are the parts of our body?** • Can identify and name parts of our body. *Big Picture.* (Can begin to describe what each part does) • Begins to describe if other example animals have the same parts or if they are different.		Put together cut-out body. Playdough body. Draw around body on wallpaper. Verbally name parts. Match label cards. Fitness games exploring what parts of body can do (begin to include muscles/bones). Photos, models & real animals – compare. Games e.g. 'Simon says', songs & rhymes.	Begin to describe what each part of the body does (e.g. knee helps leg to bend, etc).
2	**What are our senses?** • Know our five senses (sight, hearing, smell, taste & touch). Can investigate. • Can describe our receptors (eyes, ears, nose, tongue & skin). Links body parts to each sense. *Big Picture.* • Our senses help us to survive and experience the world.		Is our smell better when we can't see? Is our taste better when we can't smell? Senses walk (outside, city, kitchen, etc). Flavoured milk taste test. How does it taste? 'Feely bag'. Describe texture. Name object. Paper clip game ('U' shape). Can you feel one/two points on different parts of body? Blind spot. Pupil constriction. Explore lenses (binoculars, magnifier, kaleidoscope, colours). Point to sound shaker. Make string telephone.	Make a list of favourite smells. Five types of taste test. Extend senses vocabulary. Who has the fastest reactions (reaction stick/ruler)? Explore senses in other animals.
3	**Can you sort animals by their features?** • Classification (classify) = sort living things into groups based upon observable features (criteria). • Can sort a range of animals by similarity or difference. • Know that certain features (criteria) are common to groups of animals (e.g. fish or mammals).		What is the same/different about us? Sort. (Develop features / 'criteria' for sorting). Sort a range of animals (models/photos/real) using agreed criteria (scaffold towards recognising that e.g. fish all have fins, etc). Play odd-one-out, find the feature, top trumps, 20 questions, match sound to animal.	Can sort less obvious differences. Sees similar features (e.g. fur) even when different colours, etc.
4	**What are the features of vertebrates?** • Vertebrate = has a backbone (includes humans). • Knows the groups of vertebrates (fish, amphibians, reptiles, birds & mammals) by criteria. • Can sort vertebrates by criteria.		How can we sort zoo/farm/pet animals? Use photos, video, models and/or real animals. Look at vertebrate skeletons (backbone). Feel your/live vertebrate backbone. Sort vertebrate groups using comparative key features/criteria. Matching activities.	Visit vets. Knows how to care for pets. Visit zoo. 'Adopt' zoo animal. Research. Keep & look after animals.
5	**Can you name some invertebrates?** • Know how to collect invertebrates safely in a habitat. • Able to use a range of collection equipment. • Able to identify collected animals to basic level (e.g. snail, spider, worm) within a habitat. • Can identify some collected common invertebrates to species (common name) by sight.		Use safe (no touching) methods to collect invertebrates in a habitat. Use equipment such as nets, pots, trays, pooters & catchers. Use picture guides to name (common animals named by sight). Improve over time. Which invertebrates are common in this habitat? Use pictures of invertebrate to name by sight. Do the (number of) invertebrates we catch change over time (month/year)?	Begin to organise invertebrates into groups by similarity and difference. Keep woodlice, worms, butterflies, etc, in classroom.
6	**Do animals feed in different ways?** • Herbivore = eats plants (examples) Carnivore = eats other animals (avoid 'meat') (examples) Omnivore = eats both plans & animals (examples) • Can sort animals into feeding groups. • Can identify collected invertebrates into feeding groups.		Watch videos / photos of animals eating. What do they eat? Observe live animals. Sort animals into carnivores & herbivores. Keep a food diary. We are omnivores. Sort a range of animals into feeding groups using 'Top Trumps' style cards. Play sorting & matching games. Animal (zoo/pet) diets.	Compare plastic skulls of carnivore, herbivore & omnivore (jaw structure & teeth). Sort with Venn & Carroll diagrams.

Useful Texts, Websites & Resources

Common Misconceptions

You only feel things with your hands. The sense of smell & taste are unrelated. Everyone experiences their senses in the same way. Whales and dolphins are fish. Bats are birds. Snakes and tortoises are invertebrates. We are not animals/mammals. Carnivores only eat herbivores. Carnivores must be big. We are herbivores if we are vegan.

Year 1 | **Animals Including Humans**

Enquiry Skills

Explaining Science

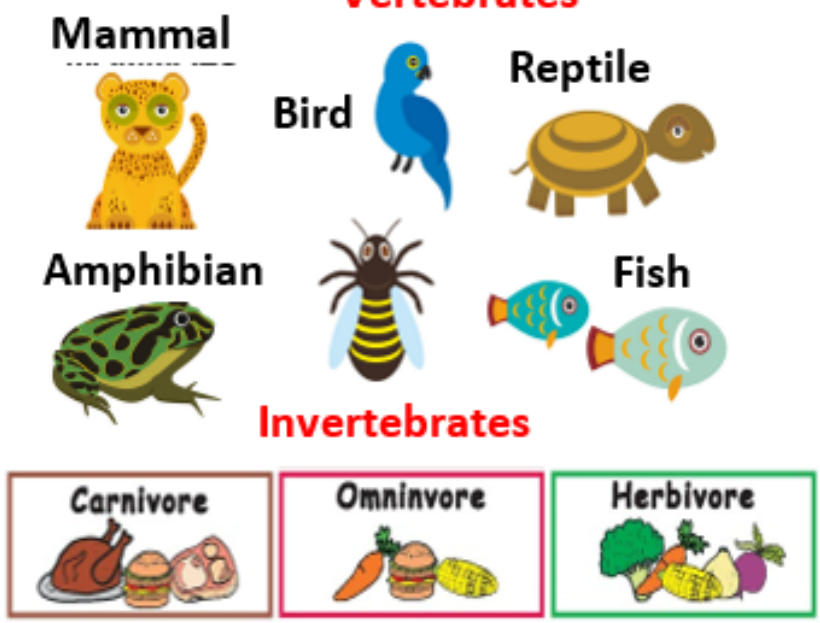
Classification

Enquiry Types

Key Knowledge

- Know types of vertebrate. Know examples of invertebrates in a habitat.
- Know examples of carnivore, herbivore and omnivore. Know what they mean.
- Know human body parts and our 5 senses.

Big Picture Models



Key Words

sort	group	classify	feature (criteria)
vertebrate	bird	gills	touch
invertebrate	mammal	lungs	smell
fish	scales	carnivore	taste
amphibian	skin	herbivore	hearing
reptile	fur (hair)	omnivore	sight

Appendix 6 – Assessment Rockets

Name .....

Science Rockets