Structuring the Science Curriculum

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- https://www.stem.org.uk/
- https://forms.office.com/r/he3vXQDyEN

Intended Learning Outcomes

By the end of this session you will:

- Be familiar with what a high quality curriculum means
- Understand how to structure your science curriculum for progress

What is Curriculum and Why is it important?

Intent: Curriculum design, coverage and appropriateness (The What)

Implementation (The How***)***

- Curriculum delivery
- Teaching (pedagogy)- contribution to delivering the curriculum as intended
- Assessment (formative and summative)

Impact

Attainment and progression (including national tests and assessments

- Reading
- Destinations

The What

- It shapes and determines what all learners of all ages will get out of their education
- It is the heart of “ the quality of learning” OFSTED judgement

Why is curriculum important?

What people can **know, remember and do**, dictates their ability to achieve well.

Have you got a Broad and Balanced, Ambitious and Well Sequenced Science Curriculum?

End Points:

Lets start at the very beginning?

Intended Outcome?

Why do we teach Science?

STEM LEARNING

Why do we teach Science?

- For UK workforce?
- To be able to wire a plug?
- To think like a scientist? Dewey (1910)
- Scientific method?

Science Curriculum

“For the science curriculum to have value, it needs to have a value for all students, not just the few that will go on to become scientists……

A single science curriculum for all should focus on a set of core powerful ideas that are unique to science”
Jasper Green 2021

STEM LEARNING

Why do we teach Science?

So that pupils are able to explain the material world and ‘develop a sense of excitement and curiosity about natural phenomena’.

So pupils learn how scientific knowledge becomes established through scientific enquiry

So that they also learn about its uses and significance to society and their own lives.

So that pupils will also learn about the continuing importance of science in solving global challenges

Science education also provides the foundation for a range of diverse and valuable careers that are crucial for economic, environmental and social development.

Why do we learn science?

STEM LEARNING

Distinguishing curriculum from teaching and assessment

Curriculum:
WHAT is taught

Pedagogy: Teaching activities or HOW curriculum content is taught

Assessment
Desired high level outcomes and measures of those outcomes

Bought Scheme of work?

https://www.gov.uk/government/publications/early-years-foundation-stage-framework--2

https://www.gov.uk/government/publications/national-curriculum-in-england-science-programmes-of-study

‘Since there are a variety of ways that schools can construct and teach a high-quality science curriculum, it is important to recognise that there is no singular way of achieving high-quality science education’. Ofsted, 2021

STEM LEARNING

Curricular Thinking

- Most of us have not been trained to think deeply about curriculum
- There are key words, phrases and concepts which are new
- These key words, phrases and concepts are not only important in and of themselves, but they help clarify and sharpen our curricular thinking
- Knowing more about curriculum leads to richer curricular conversations

Deep thinking

Your Curriculum isn't

- **Just the subject or qualification offer**
- **Just what is assessed**
- **The same as teaching activities**
- **devising extra or elaborate creative activities**
- **Narrow**
- **Vague**

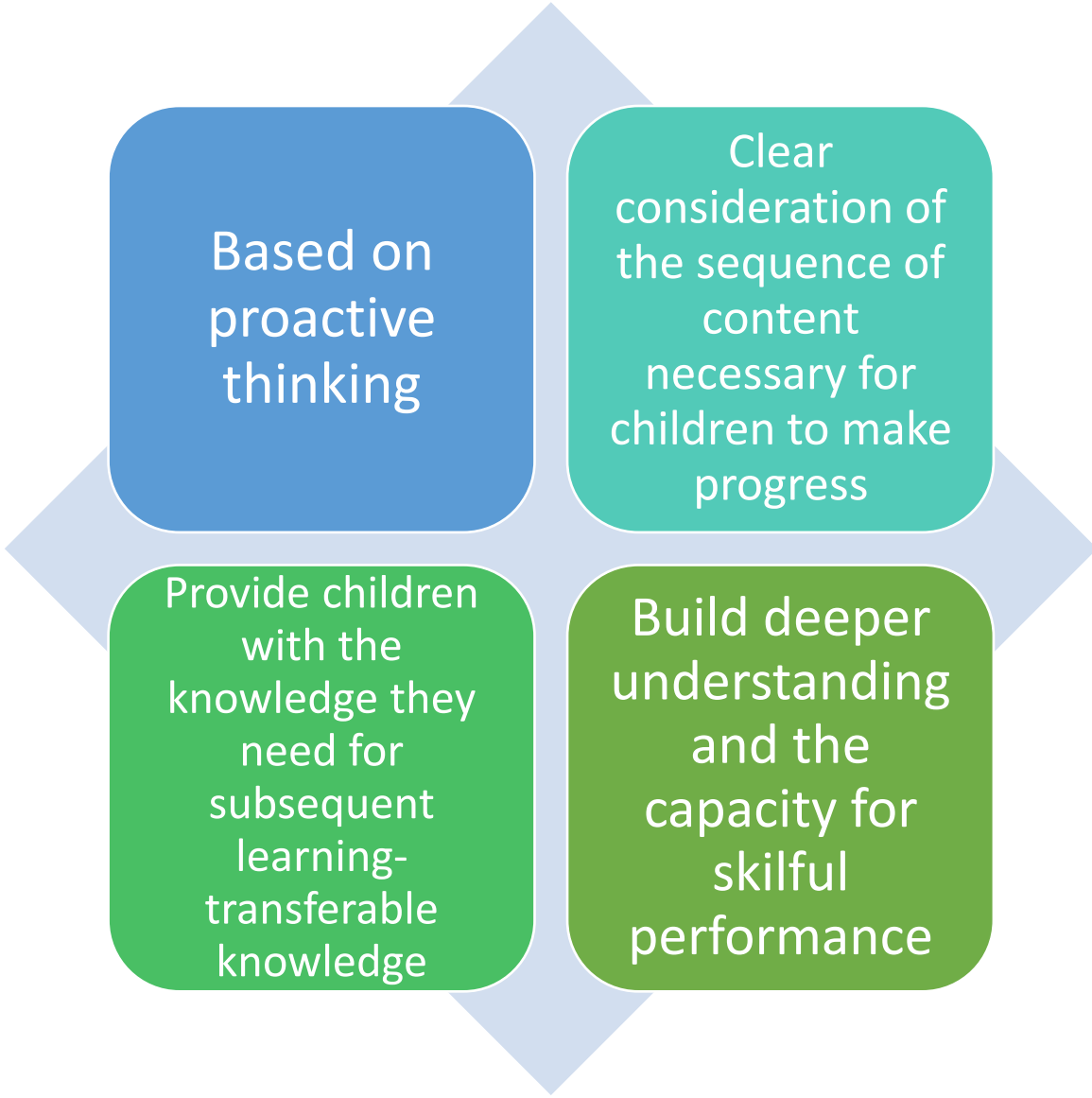
The curriculum is *"not the timetable. Nor is it what we think might be on the exam."*

It is ***"the yardstick for what school leaders want their pupils to know and to be able to do by the time they leave school."***

Amanda Spielman, Ofsted Chief Inspector, Sept 2018

STEM LEARNING

Outstanding?



……. takes into account how we learn

Primary Science findings by OFSTED 2019

- Very little Science content
- Low levels of challenge
- Not enough thought about key concepts and skills and how to sequence them
- The science lead might have good plans, but those plans were not being implemented across the school.
- It was still based on one off lessons with limited progress
- Working scientifically is not the mechanism to teach knowledge and concepts.
- Headteachers being to find how weak their science curriculum really was.

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/936111/Intention_and_substance_findings_paper_on_primary_school_science_110219.pdf

Definitions of keywords, phrases and concepts

Knowledge and progress

“Learning is defined as an alteration in long-term memory. If nothing has altered the long-term memory nothing has been learned.”

Sweller, J, Ayres, P, and Kalyuga, s. (2011)

Knowing more and remembering more.

Acquisition of knowledge

Ofsted

Knowledge does not sit as isolated 'information' in pupils' minds.

Experts in every subject depend on rich and detailed structures of knowledge stored in their long term memory

STEM LEARNING

Scientific Knowledge

Parts are highly connected.

There is a logic to how parts are assembled.

Some parts are much more important than others.

STEM LEARNING

Powerful Knowledge

Michael Young

- **Specialist Knowledge that gives students the ability to think about and do things that otherwise they couldn’t.**
- **Gives power to the students**
- **Takes students beyond their everyday experiences by giving them knowledge of Biology, Chemistry and Physics**

STEM LEARNING

Types of Science Knowledge

Substantive knowledge

- knowledge of the products of science, such as concepts, laws, theories and models
- in the national curriculum: referred to as ‘scientific knowledge and conceptual understanding’

Disciplinary knowledge

- knowledge of how scientific knowledge is generated and grows
- in the national curriculum: referred to as ‘working scientifically’ and it includes knowing how to carry out practical procedures

OFSTED research review; Science HERE

Types of Science Knowledge

The 'parts' of a science curriculum

- Substantive knowledge (the 'backbone')

- Disciplinary knowledge

Aspects of disciplinary knowledge

Knowledge of scientific methods	Knowledge of apparatus and techniques, including measurement	Knowledge of data analysis and presentation	Knowledge of how science uses evidence to develop explanations
• Models • Classification • Pattern-seeking • Fair tests	• Apparatus • Safety • Procedures	• Graphs • Tables	• Evidence • Validity • Conclusions • Peer review

Is this organism a plant or an animal?

Knowledge of plants

Knowledge of animals

Knowledge of classification

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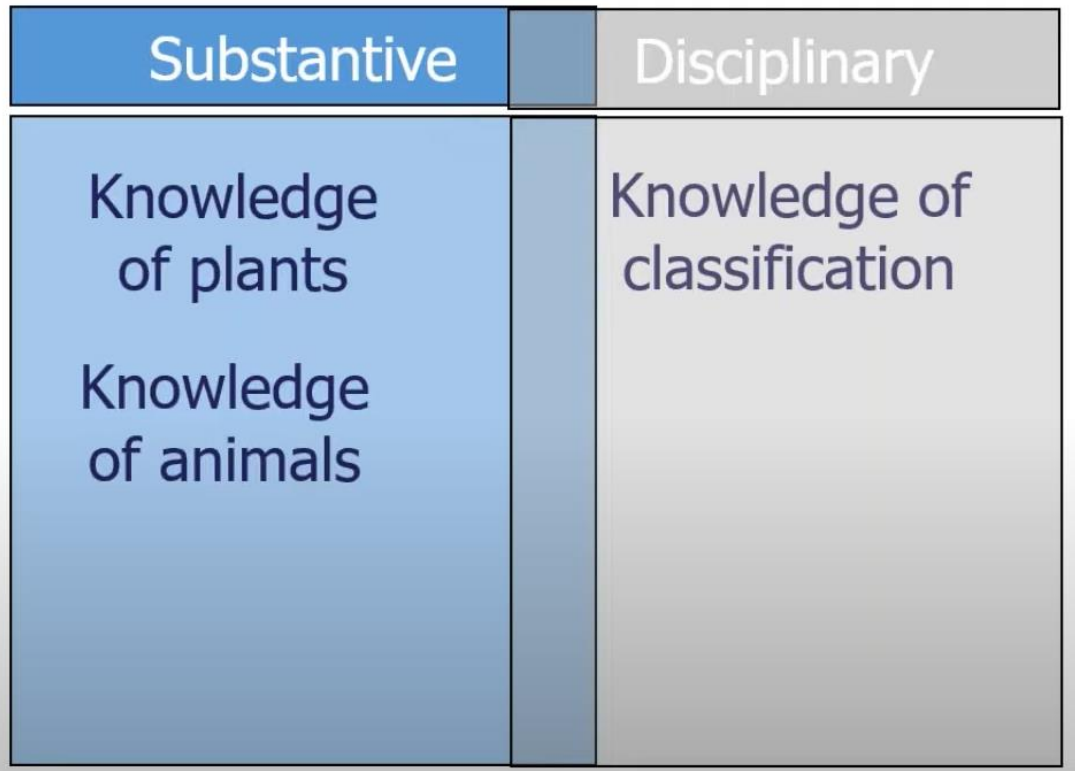
Importance of interplay



Knowledge for understanding

Activity: Can you understand this passage?

'The procedure is actually quite simple. First you arrange items into different groups. Of course one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many.'

STEM LEARNING

Knowledge for understanding

Knowledge allows **understanding**

Activity: Can you understand this passage?

'The procedure is actually quite simple. First you arrange items into different groups. Of course one pile may be sufficient depending on how much there is to do. If you have to go somewhere else due to lack of facilities that is the next step; otherwise, you are pretty well set. It is important not to overdo things. That is, it is better to do too few things at once than too many.'

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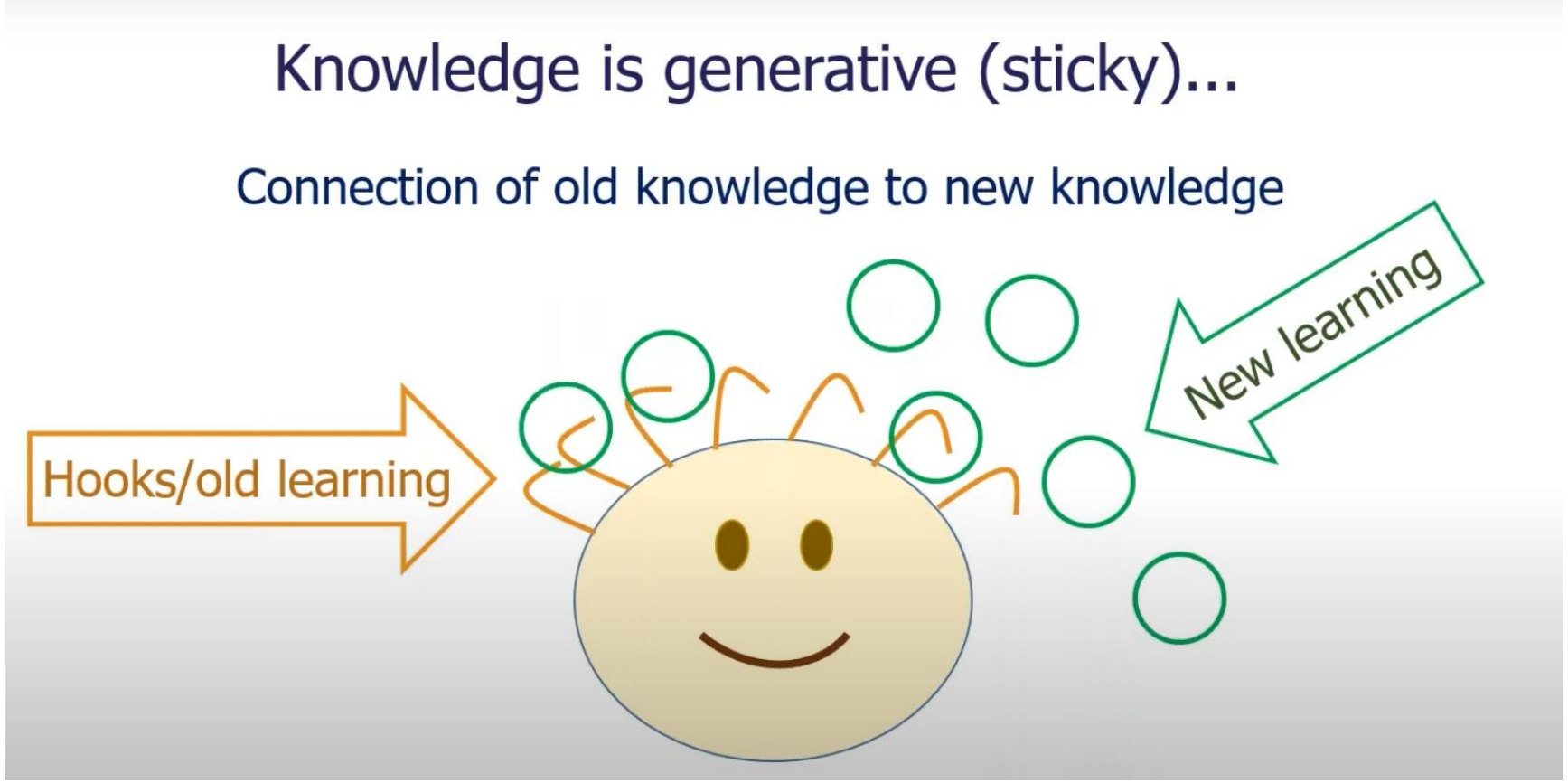
"Priming" Peps McCrea
Motivational Teaching

Prior Knowledge



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Prior Relevant Knowledge

“Language is surrounded by a cloud of taken for granted unsaid knowledge without which the said cannot be understood”

- **Our prior knowledge enables us to comprehend new material.**
- **Knowledge is highly transferable between context**

Why don’t students like school
By Daniel Willingham

Not all knowledge is equal!

Threshold Concepts

STEM LEARNING

Powerful ideas (Jasper Green)

Biology

- The cell is the basic structural and functional unit of life from which organisms emerge
- Organisms reproduce by passing down their genetic information from one generation of organisms to another
- Organisms compete with, or depend on, other organisms for some basic material and energy that cycle throughout ecosystems
- The diversity of organisms, living and extinct, is the result of evolution by natural selection

Powerful ideas

Chemistry

- Objects are made from materials and materials are made from one or more substances built from atoms
- When substances react, atoms are rearranged and new substances form but mass is always conserved
- Substances are held together by electrostatic forces of attraction
- Chemical reactions only occur if they increase the disorder of the universe.
- Quantities in Chemistry are expressed at the microscopic and sub-microscopic scales using grams, volumes and moles

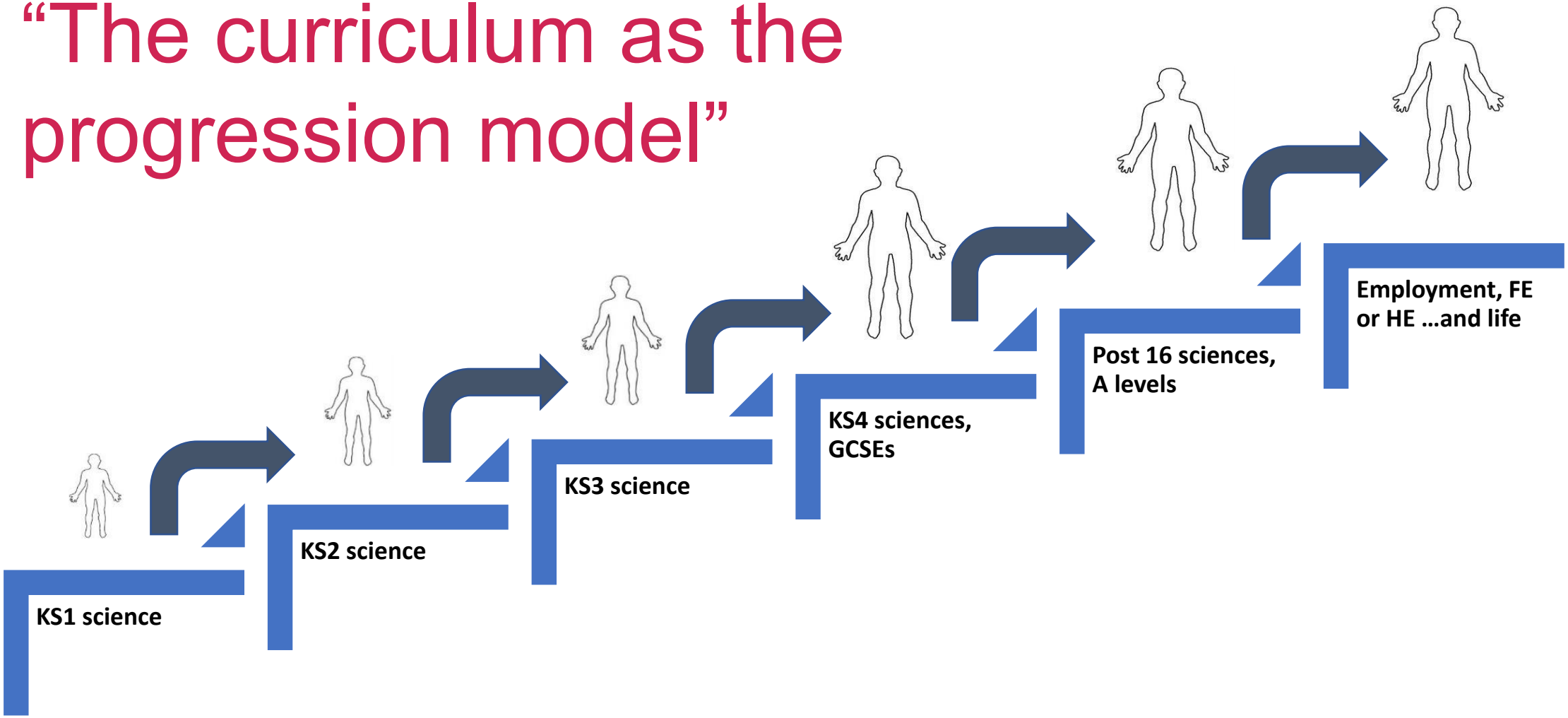
Powerful ideas

Physics

- Changing the movement of an object requires a net force to be acting on it
- The movement of charge forms electric current and causes magnetic fields
- Every particle in our universe attracts every other particle with a gravitational force
- The total amount of energy in the universe is always the same but can be transferred from one energy store to another during an event

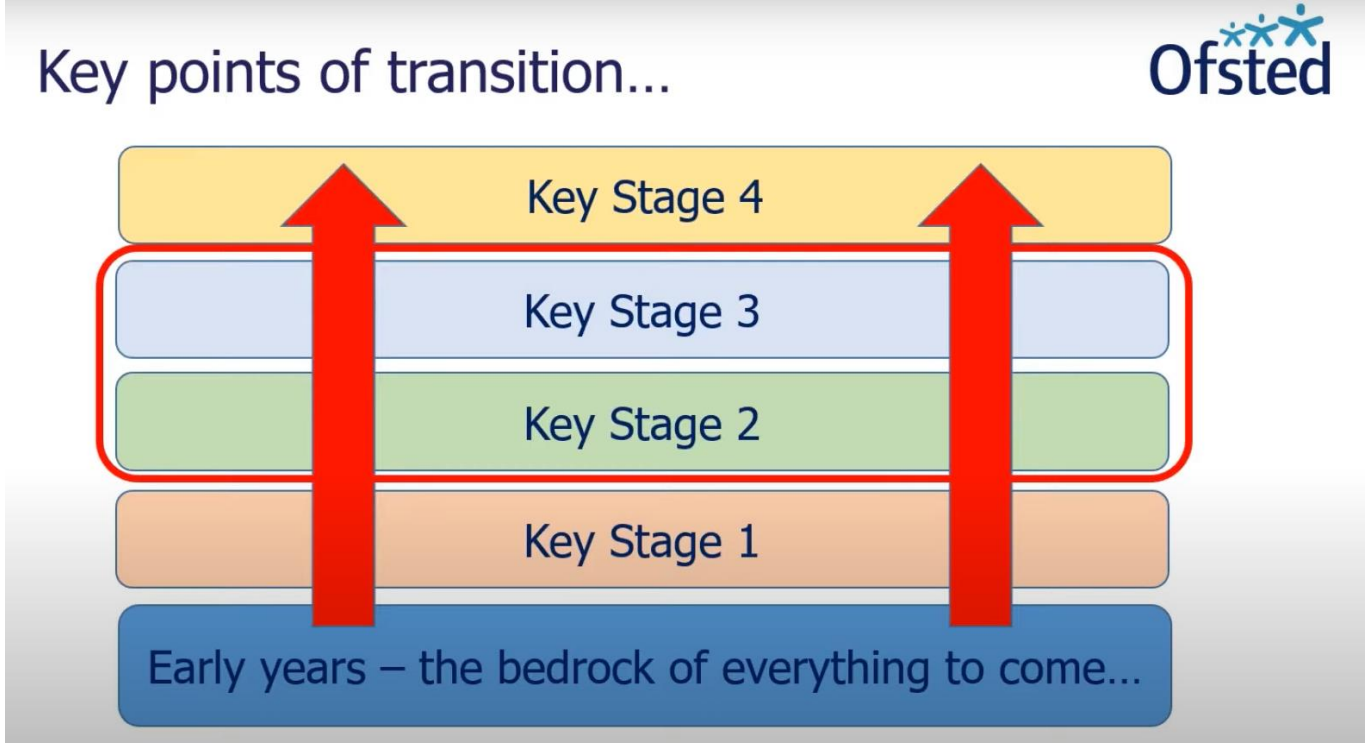
How to sequence the Curriculum

“The curriculum as the progression model”



Effective Progression Model

- **Early years is the bedrock of everything to come**
- **Transition is key**



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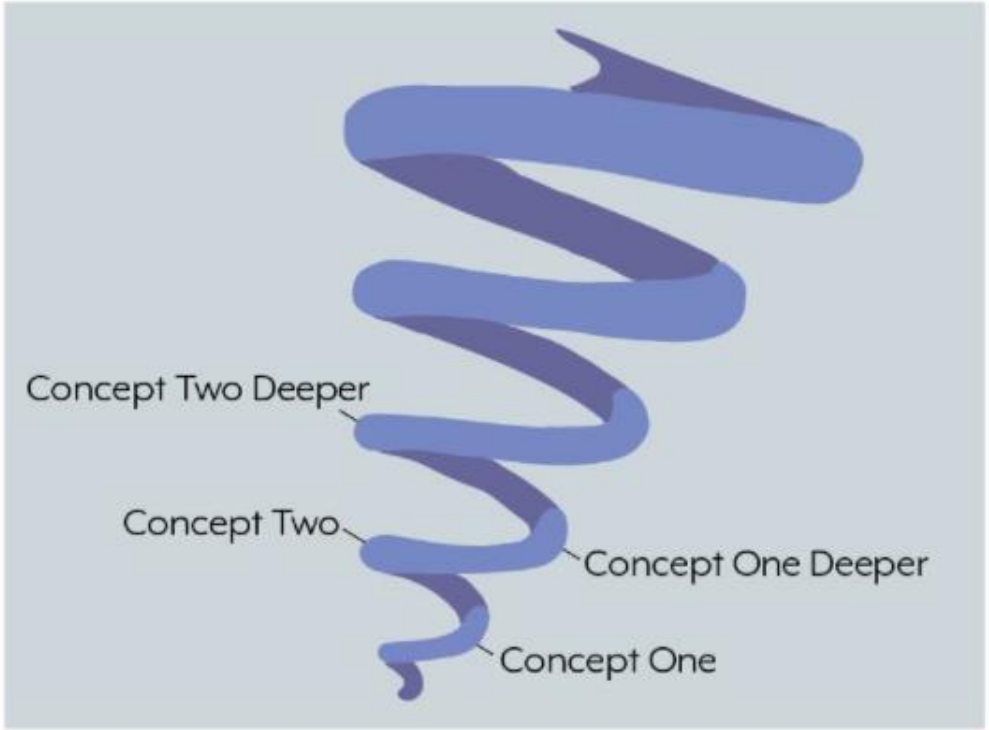
Sequencing the Curriculum

- Macro: Which topics when
- Meso: What to include in each topic
- Micro: What to include in each lesson

Spiral Curriculum

A curriculum where the core concepts are revisited regularly and further developed

Spiralling can be used to promote long term memory techniques like retrieval practice and interleaving, but the real importance is showing the relationship between the topics



STEM LEARNING

Sequencing Knowledge

Macro Topics: progressing

	Part 1		Part 2		Part 3		Part 4	
Forces	Gravity	Contact forces	Pressure	Speed	Vectors & scalars	Resultant forces	Acceleration	Momentum
Electromagnet-ism	Current	Voltage & resistance	Magnetism	Electro-magnetism	Mains electricity	Electrical power	Electricity generation	Circuit calculations
Energy	Energy transfer	Energy costs	Heating & cooling	Work	Calculating energy	Efficiency	Power	Heat capacity
Waves	Light	Sound	Wave properties	Wave energy	Wave equation	E.M waves	Wave model	Wave uses
Matter	Separating Mixtures	Particle model	Elements	Periodic table	Atomic structure	Bonding	Properties and structure	Quantitative chemistry
Reactions	Acids & alkalis	Metals	Types of reaction	Chemical energy	Reactivity	Rates of reactions	Redox	Chemical analysis
Earth	Universe	Earth structure	Earth resources	Climate	Atmosphere	Sustainable development	Using hydrocarbons	Organic chemistry
Organisms	Cells	Movement	Digestion	Breathing	Cell function	Exercise	Disease	Control systems
Ecosystem	Plant reproduction	Inter-dependence	Photo-synthesis	Respiration	Plant transport	Plant growth	Cycling materials	Human impacts
Genes	Human reproduction	Variation	Inheritance	Evolution	DNA	Diversity of life	Inherited disorders	Biotechnology

Sequencing Knowledge

10 Key Idea units each divided into 4 topics. Two per year.

	Part 1 Taught in year 7 or year 7/8*		Part 2 Taught in year 8 or year 8/9*	
Forces	Gravity	Contact forces	Pressure	Speed
Electromagnets	Voltage and resistance	Current	Electromagnets	Magnetism
Energy	Energy costs	Energy transfer	Work	Heating and cooling
Waves	Sound	Light	Wave effects	Wave properties
Matter	Particle model	Separating mixtures	Periodic table	Elements
Reactions	Metals and non-metals	Acids and alkalis	Chemical energy	Types of reaction
Earth	Earth structure	Universe	Climate	Earth resources
Organisms	Movement	Cells	Breathing	Digestion
Eco-system	Interdependence	Plant reproduction	Respiration	Photosynthesis
Genes	Variation	Human reproduction	Evolution	Inheritance

BIOLOGY CURRICULUM MAP

FURTHER STUDY
A-level or IB Biology, A-level maths

CAREER PATHS
Biologist, zoologist. Botanist, Field Scientist, Engineer,, Doctor, Pharmacist, Biochemist, Science lab Technician, Teacher, Toxicologist,, Forensic Scientist, Nanotechnologist, Biotechnologist, Science journalist.

SKILLS
Problem solving, analytical thinking skills, mathematical skills, the ability to think clearly and logically.

INTEREST
A continued passion and love of learning about the living world and understanding how our bodies and the bodies of other animals and plants work together.

YEAR 11

Ecology in action
- Ecosystems
- Abiotic factors
- Predator-prey relationships
- Trophic levels
- Pyramids of biomass
- Competition
- Field investigations
- Adaptation
- The water cycle
- The carbon cycle
- Decay
- Land use
- Global warming
- Pollution and waste management
- Maintaining biodiversity
- Food security
- Biotechnology

P.P.E. EXAMS — Assessment 2

Revision + GCSE EXAMS

P.P.E. EXAMS — Assessment 1

Variation and Evolution
- Variation
- Theory of evolution
- Natural selection
- Fossil evidence
- Species

P.P.E. EXAMS — Assessment 3

Plant biology
- Photosynthesis
- Sugars
- Food production
- Transpiration and translocation

Cell biology
- Recap cells
- Growing microorganisms
- Testing antibiotics
- Investigating disinfectants

Assessment 2

Genetics
- DNA and genes
- Proteins
- Meiosis
- Asexual and sexual reproduction
- Genetic crosses
- Gregor Mendel

Reproduction
- Human reproduction
- IVF
- Contraception
- Auxins

YEAR 10

Options Assessment — Assessment 2

Atomic structure
- Structure of the atom
- Radioactive decay
- Properties of radiation
- Nuclear equations
- Half-life
- Irradiation

The atmosphere
- Earths atmosphere
- Greenhouse gases
- Climate change
- Atmospheric pollutants

End of Year Assessment — **Sustainable development**
- Sustainability
- Potable water
- Water treatment
- Metal extraction
- Recycling

Health matters
- Non-communicable disease
- Pathogens
- Viral, Bacterial and fungal disease
- Malaria
- Body defence mechanisms
- Immunity
- Drug development
- Monoclonal antibodies
- Plant disease and defence

Assessment 1 — **Coordination and control**
- Homeostasis
- Nervous system
- Reaction time required practical
- The eye
- Controlling body temperature
- Endocrine system
- Diabetes
- Kidneys

YEAR 9

Energy changes
- Endothermic and exothermic reactions
- Reaction profiles
- Bond energies

Assessment 1 — **Moving and changing materials**
- The digestive system
- The circulatory system
- The heart
- Blood
- Gas exchange

End of Year Assessment — **Cycling materials**
- The water cycle
- The carbon cycle
- Land use
- Global warming
- pollution

Ecology
- Ecosystems
- Predator-prey relationships
- Adaptation

Assessment 3 — **Particle model of matter**
- Changes of state
- Density
- Specific heat capacity
- Particle motion

Assessment 2 — **Science of Materials**
- Solids, liquids and gases
- Ionic bonding
- Covalent bonding
- Metallic bonding
- Properties of matter

YEAR 8

Assessment 3 — **Energy**
- Energy stores
- Energy transfers
- Heat transfer
- Work done
- Power
- Paying for electricity
- GPE
- KE

Health matters
- Communicable and non-communicable diseases
- Pathogens
- Protecting the body
- White blood cells

End of Year Assessment — **Space**
- Day and night
- Seasons
- The moon
- The solar system
- Earth Structure
- The universe

Assessment 1 — **Plant science**
- Photosynthesis
- Leaves
- Stomata
- Transpiration

Assessment 2 — **Fundamentals of chemistry**
- Atoms, elements, compounds and mixtures
- Separating mixtures
- The periodic table
- Metals and non-metals

Assessment 1 — **Reproduction**
- Female reproductive organs
- Male reproductive organs
- Fertilisation
- Development of the foetus
- Birth

Cells
- Animal cells
- Plant cells
- Specialisation
- The microscope
- Stem cells
- Respiration

YEAR 7

AO1 SCIENCE SKILL — Demonstrating knowledge & understanding

AO2 SCIENCE SKILL — Apply knowledge & understanding

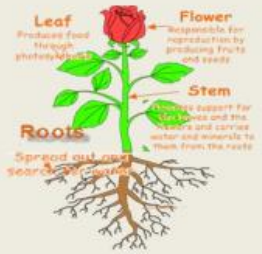
AO3 SCIENCE SKILL — Analyse information and Ideas

Sequencing Knowledge

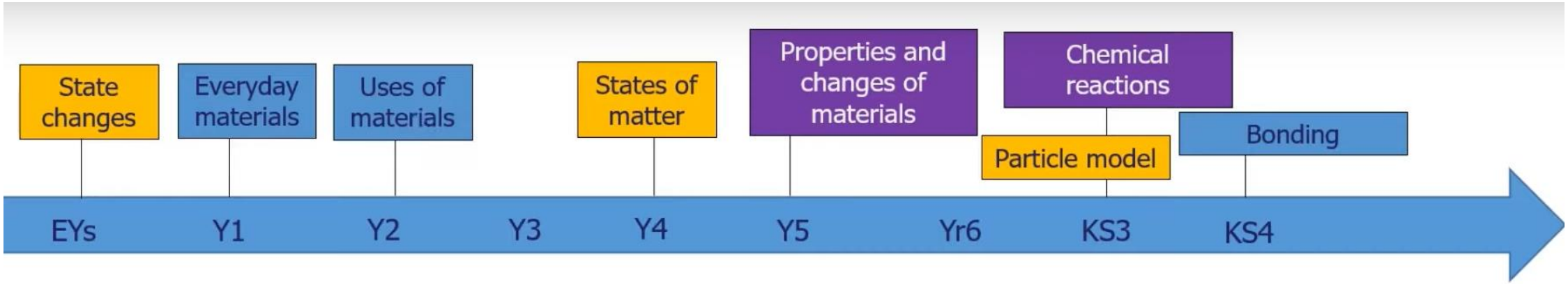
Thematic Overview '21-'22

Year	Autumn	Spring	Summer	Whole School Theme
Reception	My World & Celebrations 	Creature Comforts 	In a land far….. far….. away 	Going for Gold   
Year 1	Carnival of Animals 	Changes in Living Memory 	Journeys 	
Year 2	London's Burning 	Oceans & Explorers 	The Road to Sparkhill 	

Sequencing Knowledge

Year 3	**Rocks** 	**Forces and Magnets** 	**Animals Including Humans**  **Missed Y2 Objectives** Describe how animals obtain their food from plants and other animals, using the idea of a simple food chain, and identify and name different sources of food. Identify that most living things live in habitats to which they are suited and describe how different habitats provide for the basic needs of different kinds of animals and plants, and how they depend on each other.	**Light** 	**Plants** 
Year 4	**Missed Light objectives from Y3 will be weaved into the curriculum through Romans theme and Electricity**				
	States of Matter 	**Animals Including Humans** 	**Electricity** 	**Sound** 	**Living Things and their Habitats** 

Macro Sequencing



1. Takes a long-term view of progress.

2. Specifies what content pupils are learning in **enough detail** so that knowledge builds systematically over time.

STEM LEARNING

For each subject, teachers should know and be able to articulate:

- The purpose and rationale of their school's and subject's curriculum providing students with a sense of purpose for learning which can aid effort and motivation.
- The principles and values that underpin their curriculum (and how these link to the whole school curriculum principles and values).
- What their expectations are for student learning by the end of a unit, academic year, key stage etc.
- What the concepts and themes are that will be revisited throughout the curriculum narrative.
- What the core content is that all students need to have a solid grasp of at each stage of the journey (each unit, academic year or key stage etc.) It needs to be specified so that every student is taught it.
- How and why content has been selected and sequenced so there is coherence.

Meso Sequencing: Content within each topic

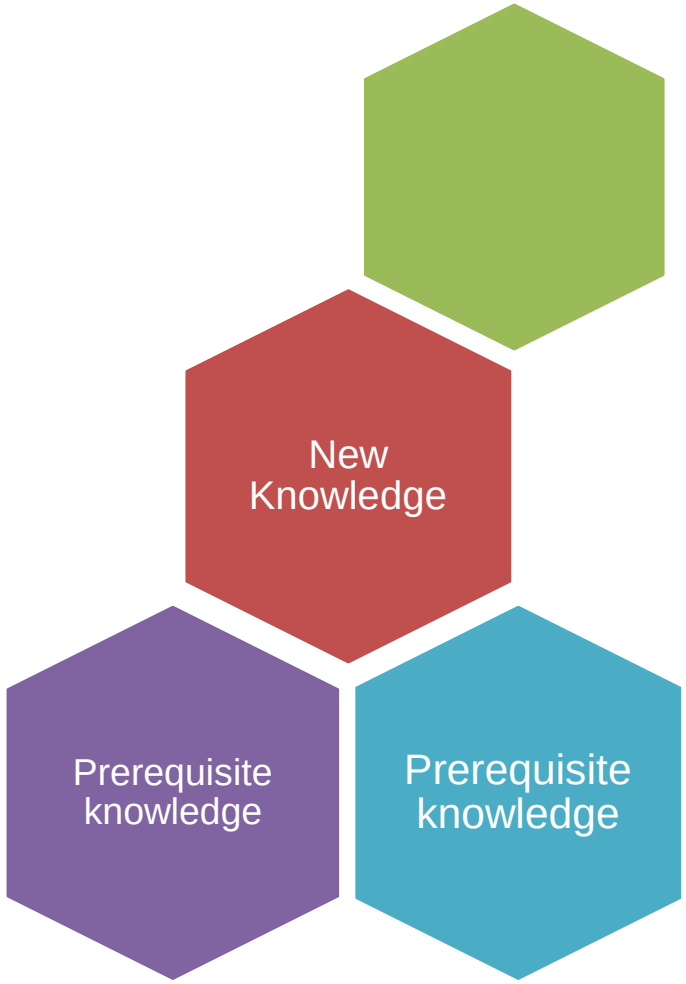
How do we go about ordering the content within each topic for progress?

Prerequisite knowledge

Is the foundation on which new knowledge is built.

Without it, you can't build!

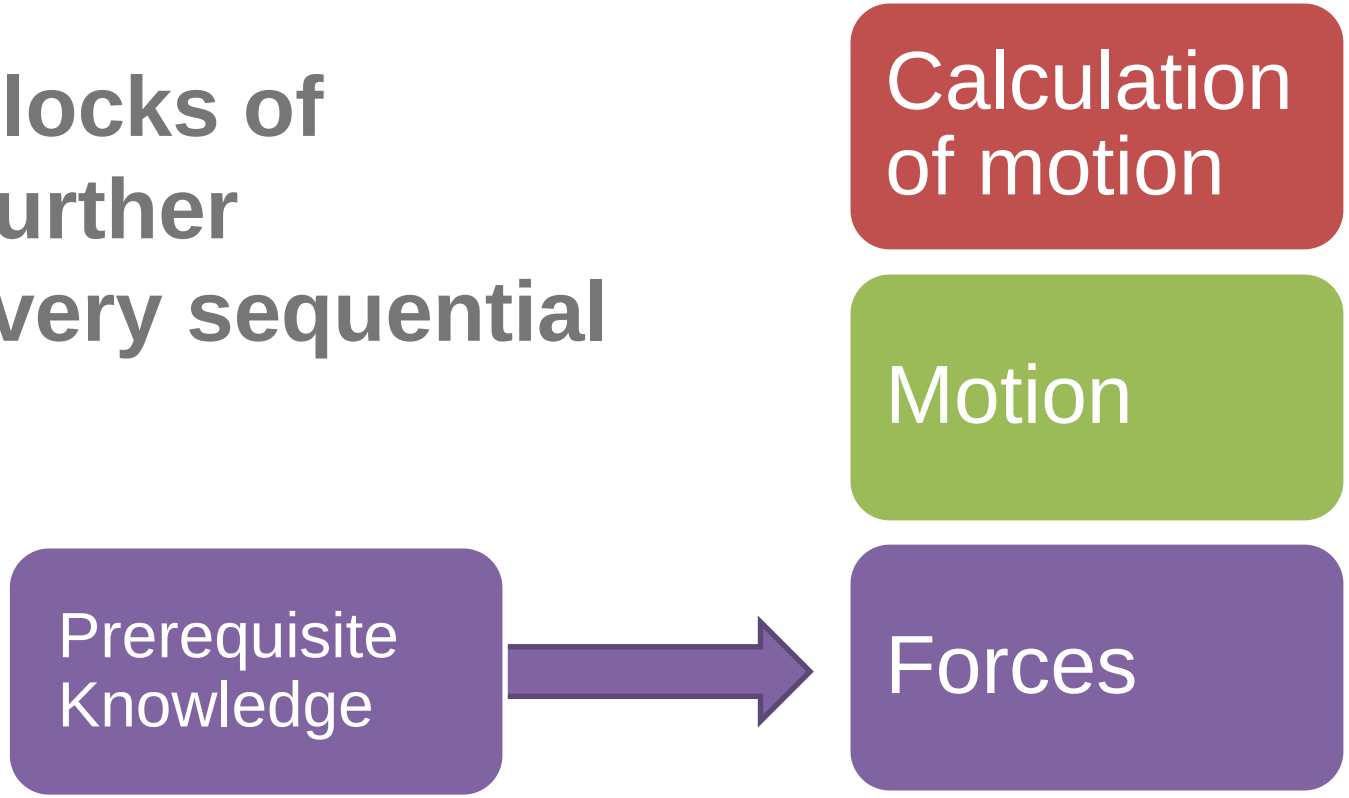
Foundational knowledge



STEM LEARNING

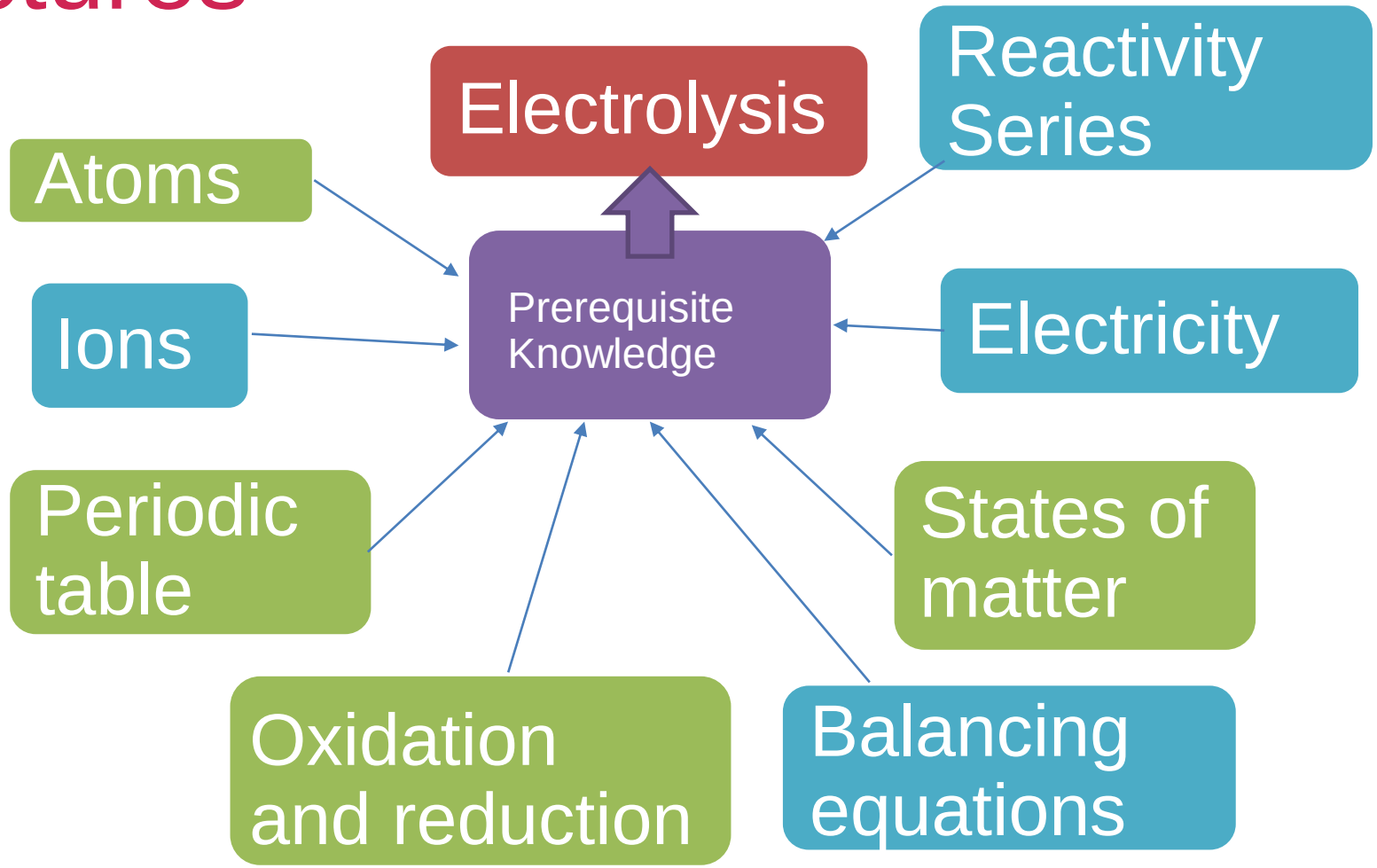
Knowledge Structures

Hierarchical; Large blocks of knowledge lead to further understanding in a very sequential route



Knowledge Structures

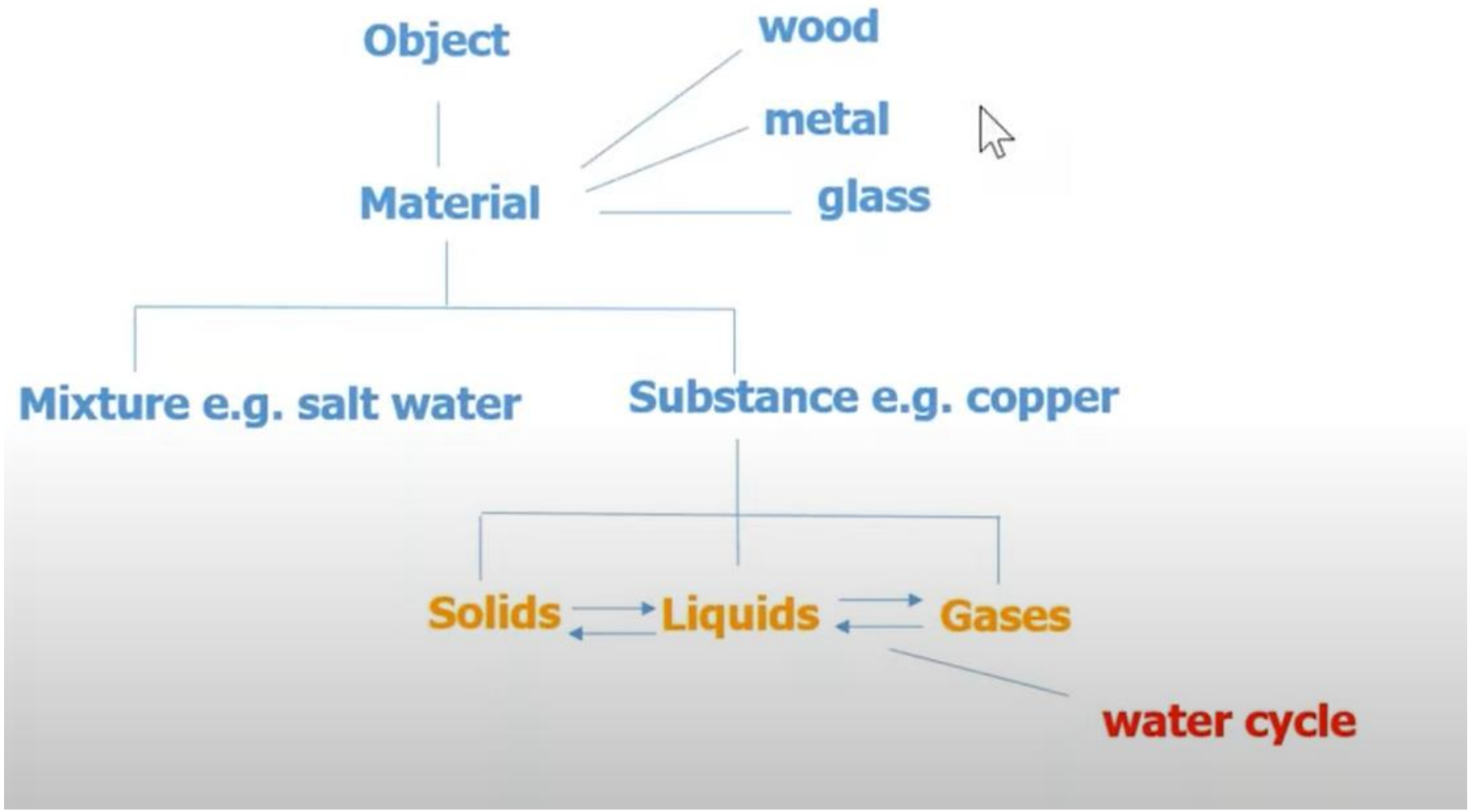
Cumulative: When large blocks of knowledge are related. Some might be reliant on each other for understanding



STEM LEARNING

Knowledge Structures

Matter at Primary School



STEM LEARNING

Meso Sequencing: Content within each topic

Progression in knowledge

National Curriculum statements in red are from other linked topics.

Plants

Birth to three	• Explore natural materials, indoors and outside.
Nursery	• Use all their senses in hands-on exploration of natural materials. • Explore collections of materials with similar and/or different properties. • Plant seeds and care for growing plants. • Understand the key features of the life cycle of a plant and an animal. • Begin to understand the need to respect and care for the natural environment and all living things.
Reception	• Draw information from a simple map. (Reception – Living things and their habitats) • Explore the natural world around them. (Reception – Living things and their habitats) • Describe what they see, hear and feel whilst outside. (Reception – Living things and their habitats) • Recognise some environments that are different to the one in which they live. (Reception – Living things and their habitats) • Understand the effect of changing seasons on the natural world around them. (Reception – Seasonal changes)
Year 1	• Identify and name a variety of common wild and garden plants, including deciduous and evergreen trees. • Identify and describe the basic structure of a variety of common flowering plants, including trees.
Year 2	• Observe and describe how seeds and bulbs grow into mature plants. • Find out and describe how plants need water, light and a suitable temperature to grow and stay healthy. • Identify and name a variety of plants and animals in their habitats, including microhabitats. (Y2 - Living things and their habitats)
Year 3	• Identify and describe the functions of different parts of flowering plants: roots, stem/trunk, leaves and flowers. • Explore the requirements of plants for life and growth (air, light, water, nutrients from soil, and room to grow) and how they vary from plant to plant. • Investigate the way in which water is transported within plants. • Explore the part that flowers play in the life cycle of flowering plants, including pollination, seed formation and seed dispersal.
Year 4	• Recognise that living things can be grouped in a variety of ways. (Y4 - Living things and their habitats) • Explore and use classification keys to help group, identify and name a variety of living things in their local and wider environment. (Y4 - Living things and their habitats) • Recognise that environments can change and that this can sometimes pose dangers to living things. (Y4 - Living things and their habitats)
Year 5	• Describe the life process of reproduction in some plants and animals. (Y5 - Living things and their habitats)
Year 6	• Describe how living things are classified into broad groups according to common observable characteristics and based on similarities and differences, including micro-organisms, plants and animals. (Y6 - Living things and their habitats) • Give reasons for classifying plants and animals based on specific characteristics. (Y6 - Living things and their habitats)
Key Stage 3	• Reproduction in plants, including flower structure, wind and insect pollination, fertilisation, seed and fruit formation and dispersal, including quantitative investigation of some dispersal mechanisms.

Plan resources

https://www.planassessment.com/

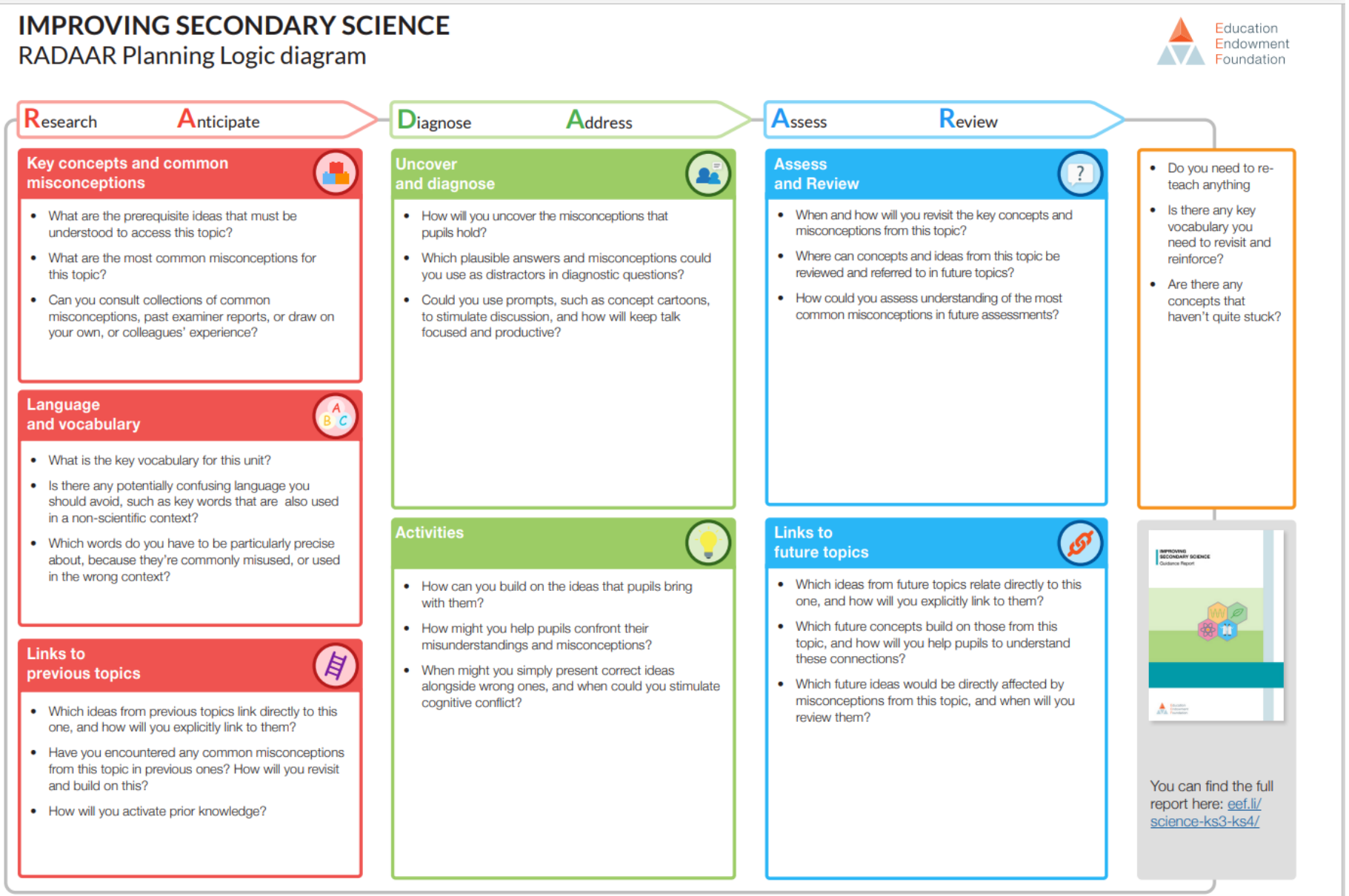
Things to include for each topic?

- Prior Learning
- What next
- Links with previous topics
- Links with other curriculum areas
- Core Substantive Knowledge
- What are the common misconceptions and difficulties
- What are the working Scientifically skills
- What are the maths skills
- What are the “real life” applications
- What are Literacy skills, oracy

Things to include for each topic?

- The steps to understanding
- Key Vocabulary
- Retrieval Practice
- Questioning and checking for understanding
- Formative and Summative assessment
- Models to scaffold learning
- Wider reading
- Linked Careers

RADAAR Planning sheets



IMPROVING SECONDARY SCIENCE
RADAAR Planning Logic diagram

Education Endowment Foundation

Research **Anticipate** | **Diagnose** **Address** | **Assess** **Review**

Key concepts and common misconceptions

- What are the prerequisite ideas that must be understood to access this topic?
- What are the most common misconceptions for this topic?
- Can you consult collections of common misconceptions, past examiner reports, or draw on your own, or colleagues' experience?

Language and vocabulary

- What is the key vocabulary for this unit?
- Is there any potentially confusing language you should avoid, such as key words that are also used in a non-scientific context?
- Which words do you have to be particularly precise about, because they're commonly misused, or used in the wrong context?

Links to previous topics

- Which ideas from previous topics link directly to this one, and how will you explicitly link to them?
- Have you encountered any common misconceptions from this topic in previous ones? How will you revisit and build on this?
- How will you activate prior knowledge?

Uncover and diagnose

- How will you uncover the misconceptions that pupils hold?
- Which plausible answers and misconceptions could you use as distractors in diagnostic questions?
- Could you use prompts, such as concept cartoons, to stimulate discussion, and how will keep talk focused and productive?

Activities

- How can you build on the ideas that pupils bring with them?
- How might you help pupils confront their misunderstandings and misconceptions?
- When might you simply present correct ideas alongside wrong ones, and when could you stimulate cognitive conflict?

Assess and Review

- When and how will you revisit the key concepts and misconceptions from this topic?
- Where can concepts and ideas from this topic be reviewed and referred to in future topics?
- How could you assess understanding of the most common misconceptions in future assessments?

Links to future topics

- Which ideas from future topics relate directly to this one, and how will you explicitly link to them?
- Which future concepts build on those from this topic, and how will you help pupils to understand these connections?
- Which future ideas would be directly affected by misconceptions from this topic, and when will you review them?

- Do you need to re-teach anything
- Is there any key vocabulary you need to revisit and reinforce?
- Are there any concepts that haven't quite stuck?

You can find the full report here: eef.li/science-ks3-ks4/

https://www.stem.org.uk/resources/elibrary/resource/501373/radaar-framework-planning-documents

Research
Anticipate
Diagnose
Address
Assess
Review

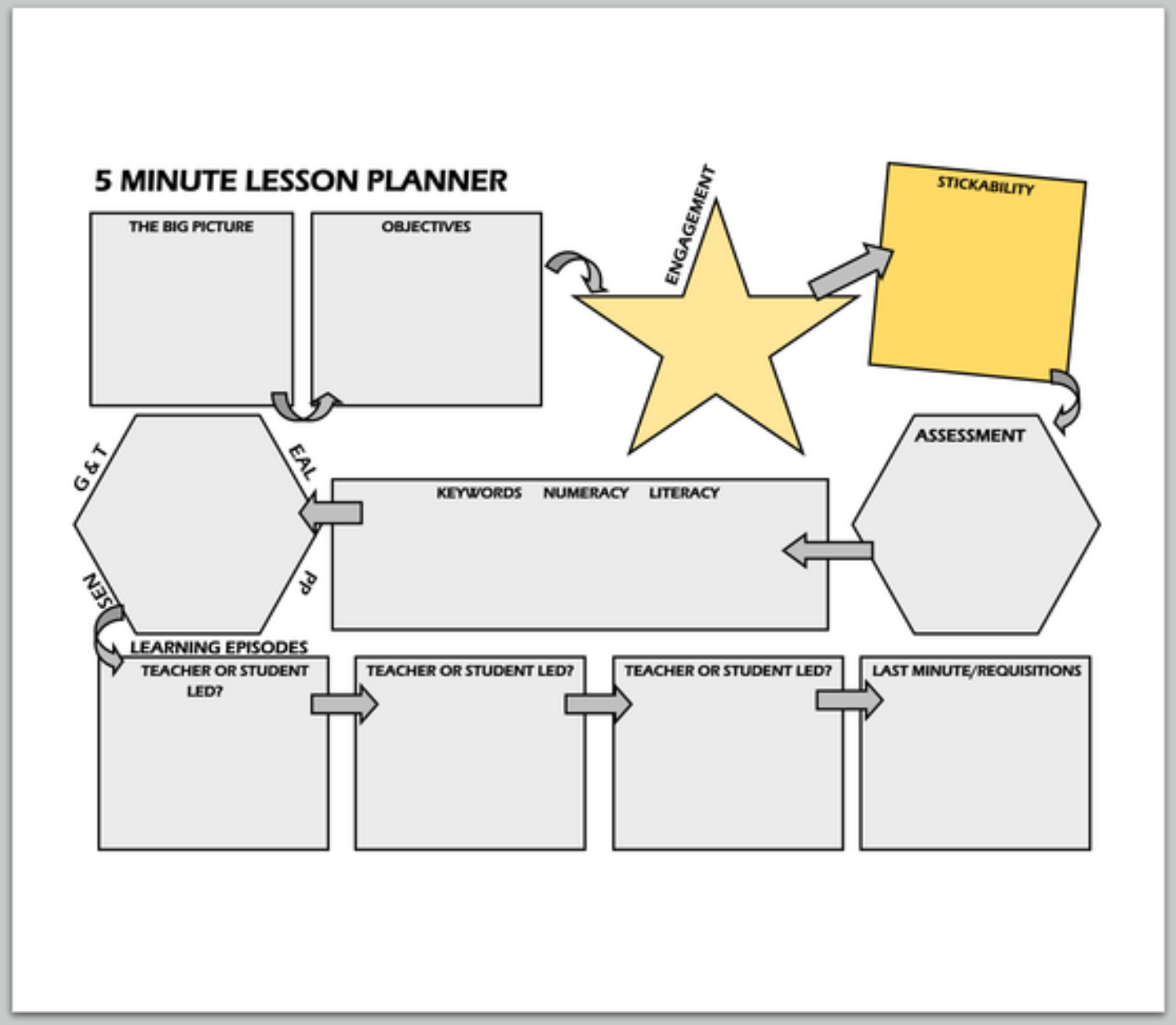
Topic Focus	
What is the core knowledge/skills students should know/be able to do?	**Static electricity.** How do electrons move from one object to another object. Effects of static electricity in different objects. Generating static electricity and displacement of charges. **(Lesson 1**). **Circuits and currents.** Definition of electric circuit. Definition of electric current. Predict how various components will act within a circuit; set up and draw simple circuits **(Lesson 2).** **Potential difference.** Definition of potential difference. Importance of potential difference as for causing electrons to move and flow. **(Lesson 3).** **Series and parallel circuits.** Set up and draw simple circuits. Differentiate series circuits from parallel circuits. Compare properties in term of Potential difference and current flowing. **(Lesson 4)** **Resistance.** Definition of resistance. Calculating resistance in a parallel and in a series circuit. Comparison of values of total resistance in parallel and series circuits. **(Lesson 5).** **Resistance of a wire.** Practical lesson for calculating the resistance of a wire. Stablishing independent, dependent and control variables in an experiment. Studying the relationship length of a wire/resistance of a wire. **(Lesson 6).** **I V characteristics.** Study of the I V characteristics of different Ohmnic conductors (filament lamp, diode and resistor). **(Lesson 7).** **Magnets.** Definition of magnet. Tracing a magnetic field using a permanent magnet. Strength of permanent magnets. Attraction and repulsion. Study of magnetic metals. **(Lesson 8).** **Electromagnets.** Definition of electromagnet as a non-permanent magnet. Components of an electromagnet. Current and Solenoids. Changing the strength of an electromagnet. **(Lesson 9).** **Using electromagnets.** Uses of electromagnets in everyday situations. **(Lesson 10).**
What are the major common difficulties &/or misconceptions?	**Current initially flows through empty wires; rearranging formulae for calculations; electricity is a form of energy.** **Batteries as sources of electrons, Confusion between pd and current – idea that pd flows.** **Idea that something called "electricity" flows.** **Idea that electrons gain kinetic energy from battery and deposit it in component, thereby slowing down.** **Conventional current vs charge flow. Lack of understanding of precise meaning of chemical store.** **Confusion between definition of resistance (R = V/I) and Ohm's Law (V = IR where R is constant)**
What are the major Practical skills in this topic?	**Calculation of the resistance in a circuit** **Calculation of the resistance in a wire**
What are the major Maths skills in this topic?	**Algebra.** **Rearranging equations (R = V/ I)** **Producing graphs from experimental data (I-V graphs)**
Real Life Applications of this topic	**Engineering.** **Design of electric circuits for enterprises, buildings and households.** **Electricity technician/repair**

Micro Sequencing: Content within each lesson

How do we go about ordering the content within each topic for progress?

Lesson plan

- Resources needed for lesson
- **SEN members: How you are going to scaffold the learning for them**
- Hinterland: What stories, hooks to tell
- Starters?
- Lesson objectives?
- Plenary?
- Questions
- Assessment



Assessment

- High stakes testing dominates and skews teaching.
- Teachers focus on what it takes to get the best marks rather than the substantive and disciplinary knowledge the student has gained.
- Tests should actually test what you want to measure. Have the students learnt, remembered and can apply their knowledge.

- Secondary:M/C diagnostic questions from BEST are a great resource for uncovering misconceptions and easy to find gaps in students learning.

https://www.stem.org.uk/best-evidence-science-teaching

- Primary resources: TAPS

https://pstt.org.uk/resources/curriculum-materials/assessment

Further Reading

- OFSTED research document *HERE*
- Curriculum handbook by Mr Gordon https://docs.google.com/document/d/1W5Ld-Oofdlvg_fDTyYGLcVmCoDp_pWFj/edit
- One stop shop compiled by Adam Boxer
- https://achemicalorthodoxy.wordpress.com/2019/06/27/thinking-curriculum-the-one-stop-shop/

Primary helpful links

- **Staff and pupil surveys**
- https://explorify.wellcome.ac.uk/teaching-support/toolkit
- **Progression of knowledge**
- https://www.planassessment.com/science-subject-leader
- **Progression of Working Scientifically skills**
- https://www.planassessment.com/plan-progression-in-ws-skills
- **Barriers to Learning**
- https://pstt.org.uk/application/files/7415/0538/3452/Supporting_SEND_pupils_in_science.pdf

More Links!

- Primary Science Capital Teaching Approach
- Ofsted Review Guidance https://tinyurl.com/OfstedReviewGuidance

5 emerging issues for primary science teachers

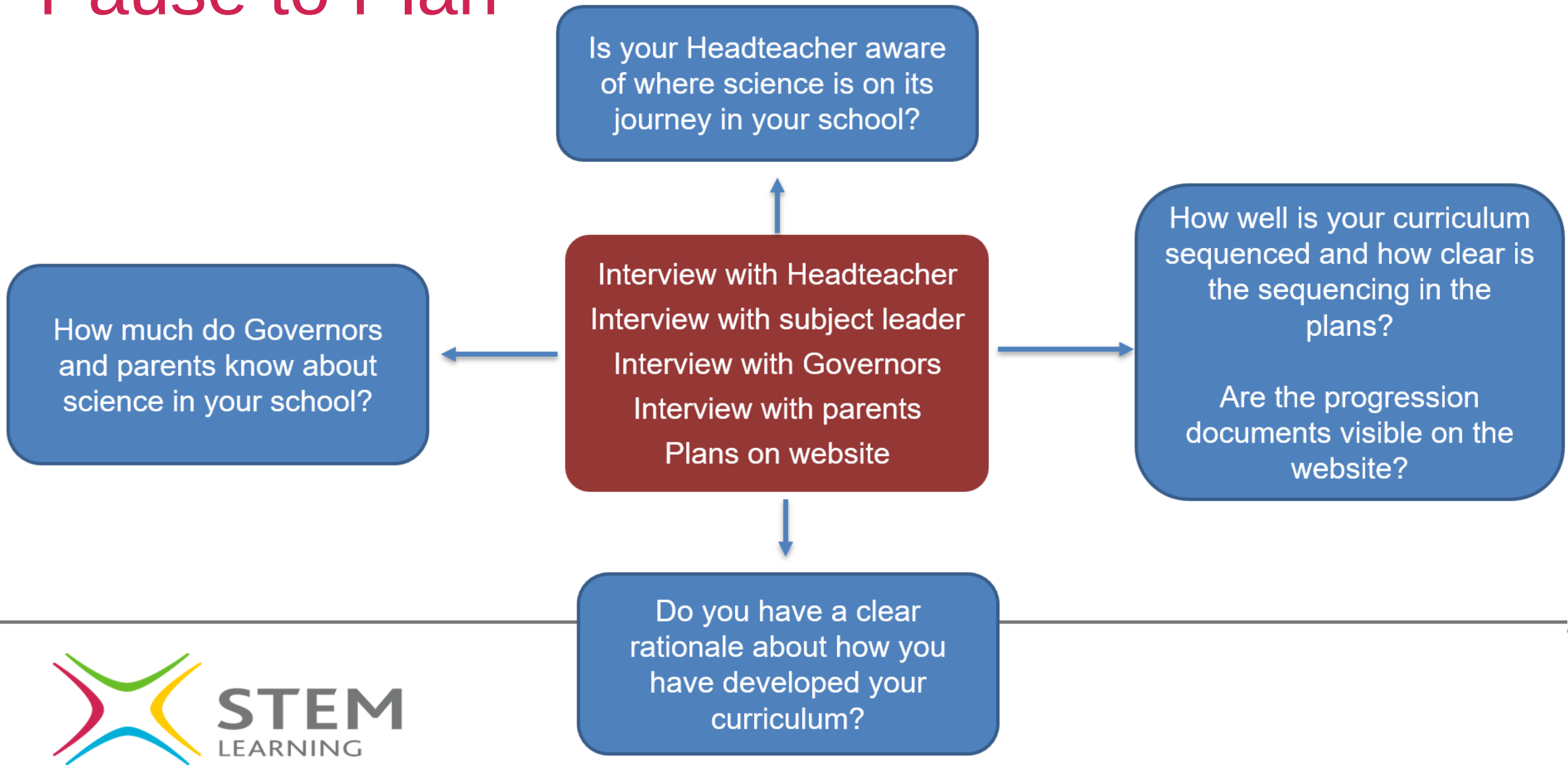
Five key issues emerge from the review that are of particular relevance to primary science teachers, science subject leaders and their senior leadership teams. Guidance is provided on each of the following:

1. Subject leadership and developing teacher expertise in science is a necessity
2. Expertise in science requires children to build substantive and disciplinary knowledge
3. Improvement of children's science learning needs to be curriculum-led and sequenced
4. Purposeful selection of a range of teaching approaches includes direct instruction and enquiry-based teaching
5. Teachers need sufficient subject knowledge to assess effectively

Have you got…….
An ambitious and well sequenced Science curriculum.
A broad and balanced Science curriculum

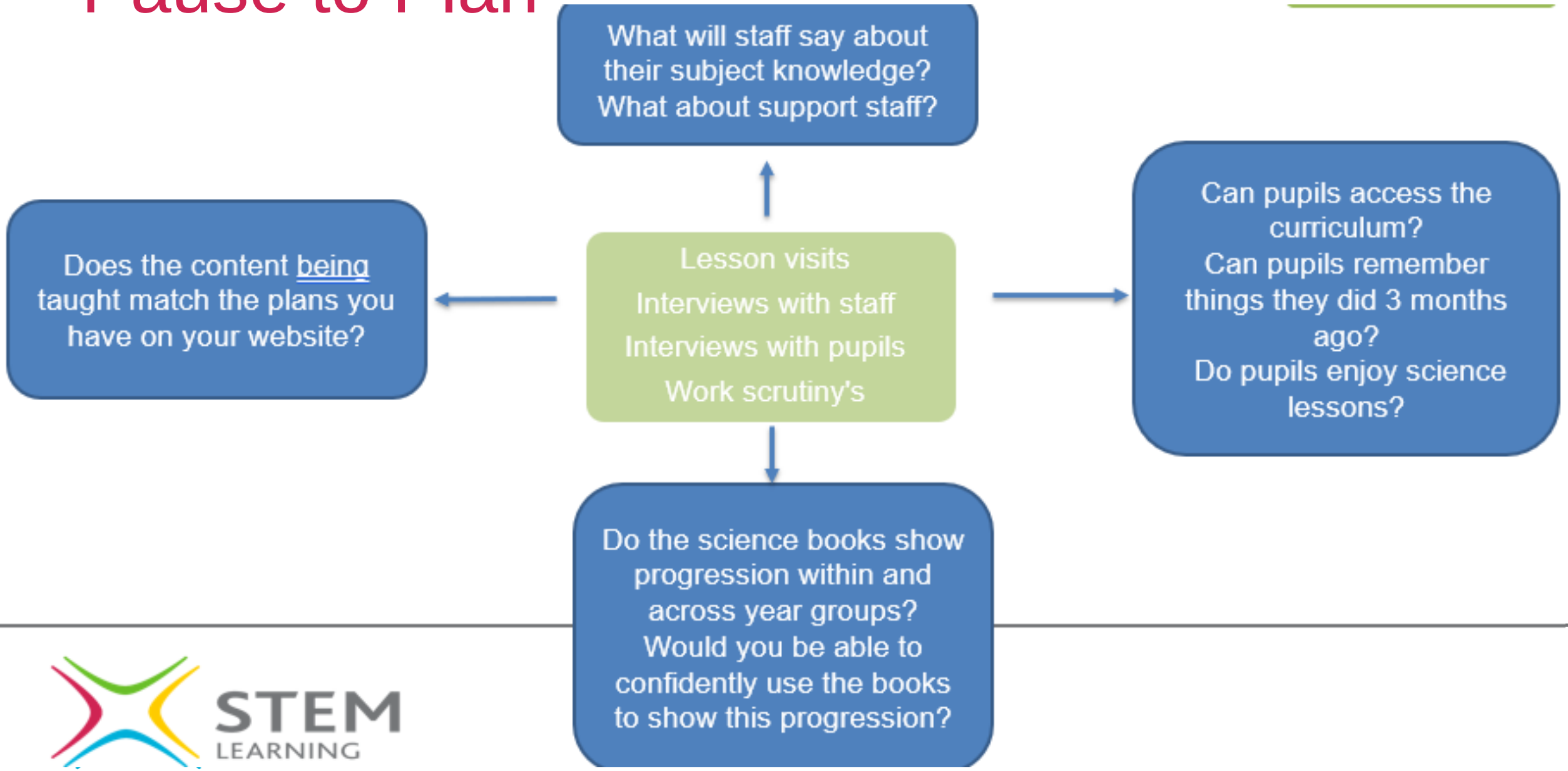
What do you need to do next?

Pause to Plan



STEM LEARNING

Pause to Plan



STEM LEARNING

Thank you for Listening

- Summer Term CPD opportunities
- Primary HERE
- Secondary Technicians HERE
- Secondary Teachers HERE

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