The Science Curriculum

The science curriculum is pieced together using the following principles:-

C1**:** Disciplinary Knowledge
We want children to understand what it is to be a scientist; to understand what it is to work scientifically; to feel confident working/thinking this way. Pupils in Year 1 upwards experience a 'working scientifically' unit at the start of the year, where the skills needed for working scientifically are explicitly taught.
We prioritise the teaching of fair testing as a critical concept; as a concept that can transform a pupil's understanding of working scientifically. We have a consistent method for teaching this.

C2: Substantive Knowledge
We look to ensure substantive knowledge is taught and learned in a carefully planned progression. We make links back to previous relevant knowledge and make this explicit to the children in the elicitation exercises we carry out at the outset of each unit.

C3: Botheredness & Purpose
Wherever possible, we aim to narrow the focus of a topic and go deep- this to generate purpose, for example making pin-hole cameras when learning about light or to generate botheredness, for example teaching about microplastics when learning about materials.

C4: Spirituality
We look to identify opportunities for spiritual reflection and growth when planning and in practice. *'Knowledge is finite. Wonder is infinite.' (Matt Haig).* For example when teaching about light, we might explore beautiful light effects or why Jesus is described by some as the light of the world.

C5: Threads
Wherever possible we plan for units of work to deliver one of our core threads as well as the subject specific objectives. For example our 'Sustainable Fashion' unit delivers on our Eco thread and because the pupils are in Yr 5/6, this will mean they will be expected to speak their truth and change other people's opinions as part of their unit.

Teaching methods used in Science

Lessons/ units will/ may include the following strategies:-

Re 'Engagement':
We aim, wherever possible, for science lessons to be practical and enquiry based. We look to encourage pupils to generate their own questions.
E2.Establish a learning culture- growth mindset & learning powers

- Open it up- give tasks for pupils which have no one answer/ where there is no ceiling to the learning/ where there is lots of scope for discussing the learning process and celebrating effort and ideas rather than correct answers.
- Own it- pupils encouraged to develop their own ideas/ own questions/ own success criteria/ give own feedback (see PA1)
- 'What I learnt' exit cards- careful to use only when learning has taken place as opposed to consolidation.

E3: High expectations & formative intervention

We want to inspire SEN and vulnerable children to develop a passion for science. We respond to their needs when planning and delivering lessons. If a pupil or pupils struggling to understand the learning we support them through:-

- Peer support- pupil works with another pupil on the concept they are struggling with
- Practical—approach the learning again from a more practical and/or concrete angle

E5.Quality of Teacher Questions (ref also techniques to develop MASTERY)

- Keeping it open
- What might be the answer—ask what might be rather than what is the answer to open up the thinking/ language of possibilities
- A range of answers—discuss each of a multiple choice of possible answers- eg what plants needs to grow:- electric light, lemonade, air, water, sand, soil, chocolate, milk.
- Keep it challenging
- Asking why---- rather than is square a tarpezoid ask why is it// rather than is this sentence a clause ask why is this a clause rather than a sentence?// rather than is 23 a prime– ask why is 23 a prime?
- Asking for clarification (explaining. defining, giving examples, supporting, enquiring)
  - Can you develop on that? What do you mean by..? How does that help? Does anyone have a question to ask about that?
  - Examples- Ask- 'give me an example of what you mean' // Ask another pupil to follow up on a response by providing an example.
- Asking for reasons and evidence (forming an argument/ assumptions/ reasons/ evidence)
  - Why do you think..? How do we know that? What are your reasons for…? Do you have evidence of..? Can you justify your opinion?
- Analyse
- How could you change this to make it fairer?

E8: Working together, talking

- Develop it—one pupil gives their response- then another is asked to qualify or build on their response- then a third is asked to qualify the response further and so on
- Snow-balling- individual pupils develop an idea/ response--- then join with a partner to share their responses—then pair joins with a group etc etc

E10: Organisation

- Guided groups- possibly teacher and TA working with up to 4/5 groups through one lesson- on input/ sessions tailored to their needs… eg more able off the carpet during whole class work…eg less able working with teacher as well as TA at some point during the lesson, eg set two groups off- work with two others- then send these two off and track back to original two etc etc

Re: Thinking

We prioritise conclusions and hypotheses in the investigation process because this is where the thinking happens; where thinking becomes restructured; where the striving for understanding happens.

T1: Generating thinking/ P4C

- Visualisers- many uses- eg evaluate a pupil's writing.. eg demonstrate peer marking…eg analysising responses to test…eg evaluate photo of a DT product.
- Concept Walls—work out bricks that make up a concept- eg bricks that make up bullying/ friendship/ tourism etc.
- Links—develop synthetic thinking by asking pupils to make links between different objects/ statements etc
- Odd one out- develop divergent thinking by asking pupils to identify the odd one out and justify their answer.
- True or false// right or wrong—say which statement true/ which false
- Statements- Generate responses to a statement and discuss—eg This a picture of a Tudor queen; It is not possible to think without words; exercise leads to a healthy lifestyle; the wolf was innocent girls are cleverer than boys.
- Alternative explanation—start with one explanation – perhaps an incomplete one eg re a science concept- pupils then provide 1-3 others that offer better explanation.
- Thinking with flow diagrams *—use a flow diagram to work out how one thing might have led to another
- Define it-* divide up into always true and usually true

Re Clarity of Learning:

CL1: Know their starting points

- Elicitation - task completed - including recap on previous learning and then

upcoming learning. This includes 'heard the word' for key technical vocab

CL2: Be clear about the end point and the big picture

- Sharing the learning intention- needs to be clear and unambiguous. Careful to separate clearly the task instructions from the learning intention; provide examples alongside the learning intention to ensure they are fully understood.

CL3: Be clear about the steps to get there

- Success Criteria- The purpose of the success criteria is to make the children absolutely sure about what is in the teacher's mind as the criteria for judging their work . The success criteria can take many forms. Examples might include a model algorithm; a modelled piece of writing; a writing frame; a self-evaluation checklist; a learning mat or a list of vocabulary. Basically they are a visual aide-memoir for pupils and a reference point for teachers when explaining and then evaluating learning during a lesson

Re Pupil autonomy:

PA1: Pupils exploring their own ideas and questions

- Immersion- before asking them what they know, pupils immersed in the topic / provided with experience to stimulate their interest/ ideas/ existing knowledge.

PA2: Pupil self-evaluation

to enable learners to become aware of their own beliefs and values and their own spirituality; this to guide their own ethical decision making; this to have a positive attitude to the search for meaning;

- Journal entries- pupils record their understanding re a topic or concept in their books or reflection journals

Re Proof of learning:

PL1: All student response systems

- Randomiser/ numbers on each chair/ Lolly pop sticks--Have lolly pop sticks with pupils' names written on. Vary the way you use the lolly pop sticks, for example have a 'joker' stick which allows you to ask anyone you want or use other randomiser strategies. Call out number on a chair to answer. Use randomiser on white board. Use all 3 different methods in each lesson to keep it from going stale. Have pupil photos to pull out of pack.
- Card fans— ABCD, Yes/No, 1-5, Strongly agree---Strongly disagree---For example give pupils multiple choice answers and ask them to vote A, B, C or D. *(see Embedded FA p 90)*

PL2: Picking up on and responding to needs quickly:

- Do a quick check- move quickly around room picking up on how well the pupils 'get' the learning. Work out how many pupils are struggling and respond immediately through-
- Mini-lesson- provide those pupils who need it with another mini-lesson-explaining concept in different way

PL3: Feedback pupils to teacher

Learning is revisited to ensure that important knowledge and vocabulary has a chance to enter the long-term memory.

- Elicitations- pupils revisit these
- Hinge questions- these based on the important concept that critical for pupil understanding. Present to pupils mid lesson to evaluate progress. Must be diagnostic not up for discussion. All pupils must respond. Must be able to collect and interpret all pupil responses within 30 seconds.
- Diagrams- pupils represent their understanding as a diagram. Could use existing well known diagrams as start point- eg London tub map—http://bit.ly/InvNu78. Concept maps allowing pupils to perceive relationships between concepts.
- Concept cartoons- eg characters with speech bubbles- pupils discuss who they agree with and why

PL4: Retrieval Practice

- End of unit quizzes -Google Forms, Google Jamboard, Kahoot- https://kahoot.com/; Mentimeter https://www.mentimeter.com/; Carousel- https://www.carousel-learning.com/; Quizizz https://quizizz.com/?lng=en; Quizlet-https://quizlet.com/en-gb; Get Plickers- https://get.plickers.com/
- Misconceptions retrieval– Misconceptions can be general, based on on previous lessons or classwork. Often ones that pupils can find confusing, tend to always get wrong or aren't necessarily true to begin with.
- Finish the answer…Give pupils a sentence starter (or a collection of them) and they then must complete the rest of the answer.
  e.g.The Romans were not successful on their first attempt of invasion of Britain because….