Redhill Primary Academy

Science Policy

Signed

Mrs Beth Tutchener-Ellis, Chair of Governors
Summer 2020

Redhill Primary Academy
Policy for Science

REFERENCES USED IN DEVELOPING OUR POLICY:

The following texts were used in developing our thinking and as references in the formulation of this policy. They would make good background reading to give a flavour of the way we work and to the thoughts and ideas which underlie this and our philosophy and to support your teaching.

ASE Guide to Primary Science – Natasha Serret and Sarah Earle*********
Be Safe (4th Edition) – ASE *********
It's Not Fair - Or Is It? by Jane Turner et al, Millgate House Publishing 2011 ****
Concept Cartoons - Brenda Keogh & Stuart Naylor ******
Getting to Grips with Graphs - Anne Goldsworthy, Rod Watson, Valerie Wood-Robinson. ******
Nuffield Primary Science series ***
Misconceptions in Primary Science – Michael Allen **

Online

Teaching and Assessing Primary Science (TAPS) from Primary Science Teaching Trust (PSTT)
Explorify (Wellcome Trust)
Association for Science Education (ASE)
STEM Learning

******* essential reading if at all possible**
****** very useful for supporting your teaching**
***** highly recommended**
**** recommended**
- **other references used**

LEGAL REQUIREMENTS

In accordance with the Education Reform Act 1988, and subsequent Education Acts, we must teach Science as part of the National Curriculum for all registered pupils. We must ensure that all pupils have an equal access to the Science curriculum throughout their time in school.

AIMS

Through studying science we want the children to

- gain knowledge of the world around them and how it affects the practical, social, economic, environmental and political aspects of their daily lives;
- develop skills such as observation, measurement, communication in various forms, prediction from patterns, the appreciation of relationships between cause and effect and problem solving in real life situations;
- develop attitudes such as curiosity, healthy scepticism, respect for the environment, each other, the world around them and their place in it through the ability to make a balanced, informed evaluation of evidence.

PRINCIPLES

Children arrive at school with ideas about natural phenomena and events in the world about them. It is very important to appreciate that children's preconceptions affect their thinking and interpretation of scientific events. As well as planning science lessons on the basis of skills, knowledge and understanding in the National Curriculum, it is essential to consider the children's starting points.

ASE Guide to Primary Science – Natasha Serret and Sarah Earle

The one absolute characteristic of good science is that it involves children doing things themselves.

Initiatives in Primary Science Education

We believe teaching and learning in science is effective when

- Children's ideas are valued
- Assessment for learning is used to plan lessons and next steps
- Children are excited by and enthusiastic about their learning
- Activities present an appropriate level of challenge
- Clear progression of knowledge and skills is mapped out in the curriculum
- Children plan and carry out their own investigations
- Resources and environment stimulate learning
- Teachers enjoy planning and delivering science lessons that are both creative and stimulating
- Good use is made of cross-curricular links - science is in everything
- There is a good range of trips and other enrichment opportunities
- One-off opportunities are made use of
- Children can evaluate their learning and can talk about next steps
- We are proud to share what has been achieved.

ROLE OF THE SUBJECT LEAD

The responsibility of the science curriculum leader is to:

- take a lead in policy and the development of a scheme of work to ensure progression and continuity throughout the school;
- monitor progress through classroom observations and book scrutiny, and advise the Headteacher on action needed;
- take responsibility for upkeep and storage of resources;

- maintain an up-to-date portfolio of work produced throughout the school using samples provided by colleagues;
- keep up-to-date with developments in primary science by attending termly Co-ordinator Updates, and by reading newsletters from science associations and trusts, reports from Ofsted and so on.
- communicate all developments in the subject e.g. through staff meetings, distributing information, using notice boards.

GUIDE-LINES

The following should be used as guidance to teachers in establishing an approach to the planning and teaching of science in their classrooms.

- Start from where the children are at.
- Provide atmosphere in which the children are confident that their ideas will be accepted.
- When discussing ideas and investigations with children use open questions.
- Don't take the children's responses at face value: always ask 'How do you know?'

The Primary Science Curriculum

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

- develop scientific knowledge and conceptual understanding through the specific disciplines of biology, chemistry and physics
- 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. This is sometimes referred to as *Science Capital*[1]

Teaching should ensure that **Scientific Enquiry** (referred to as Working Scientifically in the NC) is taught through contexts taken from the sections on life processes and living things (biology), materials and their properties (chemistry) and physical processes (physics). In other words, opportunities for experimental and investigative science should be planned within the framework of the key scientific areas being studied.

When planning a unit of work, teachers should be aware of the following points:

- Planning needs to take into account what the children already know together with any misconceptions so that they are not taught what they already know. See **Assessment for Learning** below
- A unit of work should contain at least three investigations. See section on **Scientific Enquiry**, below.
- Planning should make reference to and include a clear Learning Focus (including those for **Working Scientifically**), key questions, key vocabulary, resources, and where appropriate, differentiation. It is also helpful, too, if planning identifies the type of evidence that will show that the lesson has taken place.

[1] See Godec, S., King, H. & Archer, L. (2017) The Science Capital Teaching Approach: engaging students with science, promoting social justice. London: University College London.

- It is not always appropriate to share objectives relating to knowledge with the children at the start of the lesson as this can take away the purpose of the investigation. In such cases, it is better to present the objective as a question. For example, how can we recover a dissolved solid?

Scheme of Work

The core of our teaching is based on the *Engaging Science* scheme of work which has the following strengths:

- It clearly sets out progression in Big Ideas[2]
- It clearly sets out the prior learning the children need to access the new learning. This can be used to inform the planning of assessment for learning tasks (see below).
- It outlines common misconceptions children are likely to have, which, again can be used to inform the planning of Afl.
- It lists key vocabulary (see below).
- It was designed with enquiry-based learning in mind.
- It contains engaging activities which appeal to children.
- It has a linked assessment framework.

In order to ensure progression between year groups and phases, it is imperative that the children are taught the objectives set out within the prescribed unit of work.

Vocabulary[3]

Science is a very vocabulary-rich subject. This includes vocabulary relating to

- key concepts
- natural phenomena
- the names, characteristics and features of living things
- the names and properties of materials
- evaluation of outcomes
- equipment as well as
- language which allows the children to describe their observations with increasing accuracy.

Therefore, key vocabulary should be taught explicitly during the course of the unit. Assessment for learning should include a task focussed on gauging children's grasp of the key vocabulary. It is good practise to give the children the opportunity to write what they think each of the words mean at the beginning of the unit, and then, when that word has been taught, return to their original ideas editing and refining their definitions as necessary.
Key vocabulary should also form part of a science display for easy reference in lessons.

SCIENTIFIC ENQUIRY (WORKING SCIENTIFICALLY)

[2] See also, Working with Big Ideas of Science Education, Wyne Harlen et al published by the Science Education Programme (SEP) of IAP 2015

[3] For discussion of the importance of vocabulary, the *vocabulary gap*, and strategies for closing it see, https://educationblog.oup.com/secondary/science/closing-the-word-gap-in-science; https://educationblog.oup.com/secondary/science/closing-the-word-gap-in-science-6-ways-to-build-scientific-vocabulary; https://edu.rsc.org/ideas/closing-the-word-gap/3010526.article;

The development of enquiry skills is central to enabling children to think and function as scientists.
During the course of a unit of work, the children should have the opportunity participate in a minimum of three investigations progressing from taking part in a **Modelled Investigation**, carrying out an **Intermediate Investigation**, to planning and carrying out an **Independent Investigation**.

What a Modelled Investigation should look like:
This is an opportunity for the teacher to model both the planning and carrying out of an investigation from start to finish. However, teachers should identify a specific skill or set of skills upon which they are going to focus. The investigation question should be one chosen by the teacher or one agreed upon by the class. The teacher should lead the investigation but assign children to different roles.

What an Intermediate Investigation looks like:
The children work in groups to plan and carry out an investigation based upon a question that they have been given.

What an Independent Investigation looks like:
Working in groups or independently, the children plan and carry out an investigation of their own. The work produced should be used as assessment evidence. See **Assessment of Enquiry Skills**,
below.

Opportunities for purposeful play or at least some tactile experience are an essential part of **Scientific Enquiry** and should be provided wherever practicably possible. Children should be encouraged to make observations which can then be turned into investigation questions. (See appendix for illustrative examples).

The Enquiry Cycle
We aim to ensure that children understand that scientific enquiry is a cyclical process (as *answers* tend to lead to further *questions*), and that working scientifically demands that scientists have work through a series of steps in a particular order to ensure that their findings are reliable and can stand up to scrutiny.

The enquiry cycle[4] stages we teach are

- asking questions
- making predictions
- setting up tests
- observing and measuring
- recording data
- interpreting and communicating results
- evaluating

Teachers should make frequent reference to the enquiry cycle, making it explicit what stage is being focussed upon and what is going to happen or be done next. Children should not be expected to record every stage in their books (as in a secondary school write-up): only the part or parts that have been the particular focus of the teaching.

[4] For a detailed description of these skills see https://pstt.org.uk/resources/curriculum-materials/enquiry-skills

Children should also have opportunities to carry out shorter more discreet investigations known as an **Observe, Describe, Explain**. (See appendix for illustrative examples).

Enquiry Types[5]
In order to teach the broadest possible range of enquiry skills, we teach the children that investigation questions can usually be best answered by choosing the most appropriate enquiry type from the list below:

- Classifying and sorting
- Pattern seeking
- Comparison and fair testing
- Observing changes over time
- Research (an excellent opportunity to develop reading skills in the wider curriculum)

As the children move through school they should be increasingly aware of the defining features of these and should, in upper KS2, be able to choose the enquiry type most suited to answering a given question.
It is good practise to display the children questions using the enquiry types as headings as it helps to reinforce their understanding of the characteristics of each type. (See appendix).
Planning proformas (for the children) have been designed for **Comparison and fair testing**, **Pattern seeking**, and **Observing changes over time**. (see appendix)

Classroom Display
In addition to children's questions (see above), classroom displays should feature both the Big Ideas pertaining to both the new learning and the prior learning (underpinning it) both of which are clearly stated within each block of planning from the Engaging Science SoW.

ASSESSMENT
Assessment for Learning
Each block of work should begin with a well-chosen formative assessment task aimed at providing insight into whether the children have the necessary prior knowledge to take on the proposed new learning. Formative assessment tasks should also provide the teacher with information about any misconceptions the children might have about key concepts[6]. Below is a list of generic assessment types which can be used

- structured mind maps (see appendix for an illustrative example)
- responses to concept cartoons[7]
- odd-ones-out[8]
- Positive, Minus, Interesting (PMIs)
- What if . . ? scenarios
- Observe, Describe, Explain activities (see appendix for an illustrative example)
- Explorative play

[5] For detailed description of the different enquiry types together with suggested investigations for each year group, see It's Not Fair - Or Is It? by Jane Turner et al, Millgate House Publishing 2011
[6] Our Scheme of work clearly states likely misconception. See also Misconceptions in Primary Science – Michael Allen. The PSTT Bright Ideas materials also lists the misconceptions linked to various Odd One out activities https://pstt.org.uk/resources/curriculum-materials/bright-ideas
[7] See Science Concept Cartoons by Stuart Naylor & Brenda Keogh, a digital version of which is saved on the network. There is also a KS1 edition saved on the network in the form of a PowerPoint.
[8] See example on Explorify https://explorify.wellcome.ac.uk/ and PSTT Bright Ideas https://pstt.org.uk/resources/curriculum-materials/bright-ideas together with examples of PMIs and What if . . ? scenarios

Outcomes from these tasks should then be used to inform planning. For example, it may be necessary for groups of children to revisit key ideas taught earlier within that particular strand.

Summative Assessment

Assessment of Knowledge

Summative assessment evidence is to be gathered over the course of a unit of work. Rather than end of unit tests, we believe it is better to make judgement based upon the children's responses to the tasks they are set in their day-to-day lessons. However, it is important that these tasks are sufficiently open-ended to allow children of all abilities to demonstrate the extent of their knowledge and understanding.

As these tasks may have been set as Afl tasks, it is important the children have the opportunity revisit them, edit their initial ideas and demonstrate how their thinking has moved on.

To help children retain what they've learnt, it is recommended that teachers plan activities that have been shown to embed ideas with the long term memory such as quizzes and interleaving techniques.

Assessment of Enquiry Skills

At the end of a block of work, the children should plan and carry out an independent investigation using a task from the Primary Science Teaching Trust's Focused Assessment Plans (part of their Teaching and Assessing Primary Science resources)[9]

Recording of Assessment Outcomes

Each child's book should contain the relevant assessment sheet(s) from the Engaging Science resources. Teachers should use assessment outcomes to highlight the learning objectives that have been met. Children should be encouraged to self-assess using the 'I can' statements that also appear on these sheets.

Working Scientifically should be assessed using a separate sheet which maps out progression in enquiry skills from Y1 to Y6 (See appendix).

ORGANISATION OF TIME

We recommend that children should spend approximately ninety minutes a week engaged in scientific activities at KS1 and approximately two hours a week at KS2.

SEN

Where appropriate, children with Special Education Needs will have work which is differentiated to match their ability level. They may also have additional support from the teacher or teaching assistant, which is focused upon their particular needs and targets

Every effort should be made to recognise the needs of children who have a talent for science. Teachers should aim to extend talented pupils through differentiated planning, setting open-ended tasks, tasks that develop problem solving skills, encouraging independence and offering opportunities to use and apply their scientific understanding in different contexts.

EQUAL OPPORTUNITIES

We are committed to providing all children with an equal entitlement to scientific activities and opportunities regardless of race, gender, culture or class. In school we aim to meet the needs of all our children by differentiation in our science planning and in providing a variety of approaches and tasks appropriate to ability levels. This will enable children with learning and/or physical difficulties to take an active part in scientific learning and practical activities and investigations and to achieve the goals they have been set. Some children will require closer supervision and more adult support to allow them to progress whilst more able

[9] See Primary Science Teaching Trust https://pstt.org.uk/resources/curriculum-materials/assessment

children will be extended through differentiated activities. By being given enhancing and enriching activities, more able children will be able to progress to a higher level of knowledge and understanding appropriate to their abilities.

HEALTH AND SAFETY

It is the responsibility of teachers to risk assess lessons and activities. Essential guidance can be found in Be Safe (4th edition) published by the ASE, a copy of which is kept in the staffroom. Useful health and safety advice can also be found on the CLEAPPS website[10]

ICT

Science presents numerous opportunities for the purposeful use of ICT. ICT can help pupils to

- visualise and understand scientific processes and systems
- record, present and analyse results
- explore relationships
- find information and carry out research
- communicate ideas

Recommended activities include

- the use of digital microscopes to develop observational skills;
- sensing and data logging using LogIt data logger equipment;
- green screen;
- time lapse photography and slow motion using i pads; and
- various i pad apps including ones for QR codes, augmented reality, tone generation

For further ideas and more detailed discussion, see separate portfolio of examples.

RESOURCES

Science resources can be found in the Science area in the conservatory. Where appropriate, they are boxed according to units of work.

[10] http://primary.cleapss.org.uk/ An excellent website for teaching ideas and risk management advise. Password required – see TH