Guidance for Subject Leaders: Whole School Approach

Contents

Acknowledgements

This guidance has been put together by Alison Trew, with support from PSTT Mentors and Fellows, all of whom have significant experience in science subject leadership, both in undertaking the role and in supporting the development of others.

Introduction

Before introducing new strategies to teachers and children, you need to know what is going on in science across the whole school.

This **Subject Leader Self-evaluation Tool** can be downloaded from our Support for Subject Leaders webpage and may help you to audit science in your setting.

Use the questions in the Subject Leader Evaluation Tool to help you assess what is working well in your school and what needs to be developed.

To find out what is happening across the school, you may decide to organise a staff meeting or talk to your colleagues individually.

To answer some questions, you may need to arrange time out of class to observe teaching, look at books and displays and talk to children.

The **Whole School Approach** section (the green boxes) is grouped into eight areas. Guidance for developing each of these areas is described in this document.

Whole school approach

1. Timetable

Is science taught weekly?

Ofsted's 2013 report, Maintaining Curiosity, recommends that *school leaders and governing bodies should provide sufficient weekly curriculum time [for science] so that individual pupils develop good scientific enquiry skills as well as the knowledge they need*. The Wellcome Trust's 2018 report, A review of Ofsted inspection reports: in relation to science and maths, states that *schools should deliver sufficient weekly curriculum time for science.* Children need regular, enquiry-based learning to develop the practical skills necessary for future work in science, technology or engineering. Restricting science to irregular 'science days' in primary schools does not allow enough time for children to develop these skills.

How much time is allocated to science?

There is no statutory requirement to teach science for a fixed number of hours per week and there is a huge variation in the number of hours spent teaching science across schools. The Wellcome Trust's 2017 State of The Nation report of UK primary science education found that *on average classes are taught science for the equivalent of 1.7 hours a week and 54% of classes receive less than 2 hours a week*.

The Key for School Leaders explains that:

- *Maintained schools need enough time to cover the content set out in the National Curriculum.*
- *Academies need enough time to allow for a broad and balanced curriculum, including English, mathematics, science and religious education.*

As long as you meet those requirements, the number of hours of science teaching for any phase is up to the school. The Campaign for Science and Engineering (CaSE) suggests that two hours is the *minimum* time needed to teach primary science with the required level of depth and understanding to deliver the science curriculum.

2. Curriculum

The PSQM CPD programme, which runs across the UK, supports subject leaders to effectively **implement** a curriculum for science that is informed by research evidence and best practice data.

What are the statutory requirements?

In all the countries of the UK, it is a statutory requirement to teach science. Despite apparent differences, the curricula in all these countries seek to provide relevance to real life and encourage the development of children's scientific skills and understanding of scientific processes.

In England

The **Statutory framework for the early years foundation stage** (published in 2021) sets standards for the learning and development of children up to five years old. All pre-schools and schools with reception classes (ages 4-5 years) must follow these standards. There are seven Areas of Learning and Development. *Understanding the World* is one of these and involves helping children to make sense of their physical world and their community through exploration and observation of people, places, technology and the environment. It is up to providers to decide how they will approach the curriculum. The following documents offer non-statutory guidance material to support practitioners implementing the EYFS framework in England:

- Development Matters in the Early Years Foundation Stage (updated in July 2021 by Department for Education) gives age-related expectations referring to the current curriculum and examples of how to support this.
- Birth to 5 Matters (published by the Early Years Coalition in March 2021) also offers similar age-related guidance on what a child might be doing at different stages and what adults might do and provide to support children's development.

At the time of writing (January 2022) there are no exemplification materials linked to the 2021 EYFS curriculum.

The **National Curriculum in England** (published in 2003) states that *science* is a core subject, along with English and maths, and is compulsory in Key Stage 1 (Years 1 and 2/ages 5-7) and Key Stage 2 (Years 3-6/ages 7-11). It emphasises that children should be taught about the nature, processes and methods of science by *working scientifically*. Children are expected to develop specific enquiry skills (asking questions, making predictions, setting up tests, observing, measuring, recording data, interpreting and communicating findings, and evaluating investigations) through carrying out investigations and studying the science content.

In Wales

A new curriculum, **Successful Futures**, was introduced in September 2022 for 3 to 16 year olds. There are six Areas of Learning Experience, one of which is *Science and Technology*. There is considerable emphasis on developing cross-curricular skills (literacy, numeracy and digital competence) and integral skills (creativity and innovation skills, critical thinking and problem solving, personal effectiveness, and planning and

organising skills). There is also greater emphasis on the cultural heritage of contemporary Wales. Teachers will need to consider how the geography of Wales, its local industry and Welsh individuals (historical and contemporary scientists and engineers) have shaped its science and technological activity. Curriculum Guidance is available to help schools develop their own curriculum for Science and Technology. The following documents outlining the four purposes of the curriculum may also be useful:

- The four purposes of the curriculum for Wales (includes Welsh and English statements)
- A new curriculum in Wales (a guide for children and families)

In Scotland

In Scotland, the **Curriculum for Excellence** (CfE) supports the Broad General Education (BGE) designed to provide a rounded education from the early years (age 3) until the end of S3 (age 13/14). The BGE is divided into five curriculum levels (early, first, second, third and fourth) across eight curriculum areas. Primary age learners typically work within early, first and second levels.

Science is one of the eight curricular areas. Through learning in the sciences, children and young people develop their interest in and understanding of, the living, material and physical world. CfE supports science skills and content and places increased emphasis on inter-disciplinary or cross-curricular learning.

Each curriculum area is supported by experiences and outcomes. Experiences and outcomes (often called Es&Os) are a set of clear and concise statements about children's learning and progression in each curriculum area. They are used to help plan learning and to assess progress.

CfE Benchmarks (published 2017) sets out clear statements about what learners need to know and be able to do to achieve a level across all curriculum areas. Benchmarks have been developed to provide clarity on the national standards expected within each curriculum area at each level and to support consistency in teachers' and other practitioners' professional judgements.

Principles and practice - each principles and practice document sets out the purposes of learning within a particular curriculum area, describes how the experiences are organised and offers guidance on aspects such as learning and teaching, broad features of assessment, progression and connections with other areas of the curriculum. The CfE science principles and practice document outlines the importance of developing inquiry and investigative skills and scientific analytical thinking skills across the BGE.

Within CfE literacy, numeracy and health and wellbeing are recognised as being particularly important – these areas are seen as being the 'responsibility of all' staff. All documents are available in both English and Gaelic.

In Northern Ireland

The **Northern Ireland Curriculum** (published in 2007) for The Foundation Stage (Years 1 and 2/ages 4-6), Key stage 1 (Years 3 and 4/ages 6-8) and Key Stage 2 (Years 5, 6 and 7/ages 8-11) is set out in six Areas of Learning. *The World Around Us* (WAU) is one of these Areas of Learning. It encourages children's natural curiosity and answers some of their questions about the world from the perspectives of geography, history, and science and technology. Teachers should enable children to develop knowledge, understanding and skills in four connected strands of:

- Interdependence
- Place
- Movement and Energy
- Change Over Time

Where possible, links should be made with the other Learning Areas. Therefore, interpretation of the WAU curriculum by the teacher should ensure that science is taught within a meaningful context rather than in isolation. Focus is placed upon the development of cross-curricular skills including Communication, Using Mathematics and Using ICT.

Do long and medium-term plans show progression in both subject knowledge and enquiry skills?

Subject leaders need to make sure that their school curriculum shows progression and sequencing of both subject knowledge and enquiry skills. Although children might be more engaged in a practical science lesson, it is important that they are able to understand and remember the underlying knowledge and concepts of the science that they are learning, and explain what they are investigating, rather than the experiment itself. On the other hand, a curriculum focusing only on subject knowledge will not equip children with the skills they need later to work independently in science and to access the secondary science curriculum. To put this simply, whatever curriculum you follow, *children should be doing science to learn science*.

Further support for teachers in England:

You might be interested in reading Ofsted's 2019 report, Intention and substance regarding the importance of knowledge and concepts. It states that all practical work must be firmly rooted in the science that they are learning.

Teachers may find the PLAN assessment resources useful for understanding knowledge progression in topics and progression in working scientifically skills. Teachers need to be confident about the key learning, vocabulary and working scientifically skills appropriate for their year group. *Plan Knowledge matrices* and *PLAN*

Working scientifically matrices provide this information. *PLAN Examples* of work show suitable activities for each age group.

PSTT Fellow, Claire Loizos, who has experience in science subject leadership, has created a document to show curriculum progression in primary science for schools that she supports on the Isle of Wight. We believe that other teachers will find this document useful and we are very pleased that she is happy to share these resources much more widely. You can download the document here and you will find it below Resources tab. For each science topic from Year 1 to Year 6, *Primary Science Curriculum Progression* provides:

- National Curriculum objectives
- prior learning
- future learning
- key questions to ask children
- appropriate vocabulary
- 'sticky' knowledge
- key scientists
- linked texts
- possible investigations for each enquiry type
- a BIG question (which could be an assessment opportunity)

Further support for teachers in Wales:

Teachers should refer to the Curriculum Guidance for Science and Technology which defines six *statements of what matters* (curiosity; design & engineering; living things & the environment; matter & materials; forces & energy; computational processes), the *principles of progression* and *descriptions of learning*. The *descriptions of learning* provide guidance on how learners should progress within each *statement of what matters*. There are 5 progression steps and steps 1, 2 and 3 correspond to expectations of what learners should attain by ages 5, 8 and 11.

Further support for teachers in Scotland:

Two versions of the Education Scotland STEM self-evaluation and improvement framework for early learning and childcare, ASN, primary and secondary schools are available. One version has been developed for STEM coordinators and senior leaders. A two-page summary version for practitioners has also been produced. The framework includes challenge questions and a series of progression statements for relevant quality indicators to help settings reflect on and plan improvements in relation to STEM.

Teachers may be interested in the Scottish Government second annual report on progress with the STEM Education and Training Strategy which highlights progress made in the first year as the strategy starts to deliver benefits for educators and young people.

Further support for teachers in Northern Ireland:

Teachers may be interested in The Implementation of The World Around Us, a report on a project organised by the Council for the Curriculum, Examination & Assessment (CCEA) and Curriculum Advisory Support Service (CASS) in 2008, which documents how different schools have implemented the WAU curriculum. It includes an audit tool for your school and examples of strategy and an action plan that you may find useful.

Teachers will find the Progression Guidance (published by CCEA), which describes the progression of skills and understanding through the primary years, a useful document.

Are effective cross-curricular links made?

Ofsted's Maintaining curiosity report (2013) stated that *teachers who coupled good literacy teaching with interesting and imaginative science contexts helped pupils make good progress in both subjects*. This argument could also be applied to other subjects as linking subjects can double the time available to teach both subjects. Several resources are available to support cross-curricular learning and here we have listed some of these:

- Let's Go! Science Trails and Let's Go! STEM Trails (both published by PSTT) provide support and ideas for outdoor learning of science and include cross-curricular links to many other subjects. Suitable for ages 4-11.
- Standing on the Shoulders of Giants (published by PSTT) links the work of 10 famous historic scientists to the work of contemporary scientists, giving children an appreciation of how wider scientific understanding develops over time, and offers a series of engaging practical investigations that encourage children to generate their own questions to explore and develop their understanding further. Cross-curricular links to many other subjects are also provided. Suitable for ages 5-11.
- Titanic Science (published by PSTT) is a multi-disciplinary resource telling the story of the Titanic that contains individual investigations to highlight science concepts and links to creative writing, history and numeracy. Suitable for ages 7-11.
- PSTT's science club resource, Engineering our World, include a history element through introducing 8 famous (mainly historical) scientists and engineers as a stimulus for group-based engineering challenges.
- The PSTT has a series of Science and History resources for older primary children (7-11 years) which offers the opportunity to foster interest and engagement in

science through cross-curricular teaching and learning of history and citizenship.

- The Royal Society of Chemistry (RSC) has developed cross-curricular science ideas webs to support medium-term planning. These provide ideas for linking science teaching and learning with commonly used primary curriculum history topics: either to link two discrete science and history topics or to give science lessons a history theme. Each resource contains key questions which can be used to drive enquiry-based learning around science topics. Each web is available in three age ranges (5-7 years, 7-9 years and 9-11 years) to cover different abilities.
- Children's stories provide a wonderful stimulus for learning science. STEM Learning has several resource packs for all ages based around popular children's books for Teaching science through stories.
- A Science Reading Challenge within a school setting, where the focus is reading books for pleasure, can extend children's knowledge of science and show children that science reading can be interesting and fun. To find out more, please click on the link to visit a PSTT resource explaining how to organise your own Science Reading Challenge.

You may also be interested in the Centre for Industry Education Collaboration (CIEC) primary resources for teachers. Activities provide an opportunity to learn about different science topics and are put into a real-life context. These are linked to the National Curriculum for England but could be useful for teachers across the UK. You can search their resources by either the science topic, the type of enquiry or through cross-curricular links.

3. Scientific literacy

Are children using scientific vocabulary with understanding?

None of the primary science curricula of the UK define age-appropriate science vocabulary. It is left to the class teacher to decide.

PLAN Knowledge matrices list key vocabulary for science topics for different year groups. Although this resource is linked to the English National Curriculum, it could also be useful for teachers across the UK.

Are children learning to reason and to explain their ideas?

Children need opportunities to practise using scientific vocabulary and to take part confidently in discussions with others about issues involving science. There are resources available that allow children to do this.

Bright Ideas, developed as part of a PSTT-funded project, offers strategies to encourage pupils to develop their thinking though talking about science and sharing their ideas in a dedicated discussion slot: Odd One Out; Positive, Minus, Interesting (PMI); and The Big Question.

Explorify, originally created by The Wellcome Trust, provides a range of science activities (including some Bright Ideas strategies, videos and hands-on activities) designed to spark curiosity and debate.

"I can explain!", created by PSTT Fellow, Ali Eley, consists of beautifully illustrated, high-quality picture cards and language prompts to facilitate rational discussion. Children work in small groups to explore scientific concepts. Through developing and practising effective group talk skills, they link ideas with evidence, and use scientific vocabulary with confidence and understanding.

4. Scientific enquiry

Are children taught enquiry skills?

Whichever curriculum your school follows, children should have the opportunity to carry out practical investigations in science that help them to develop their scientific skills. These are the skills that scientists need to carry out research and are sometimes referred to as a cycle of *plan, do, review*. Teachers in English schools will know these skills as *working scientifically skills*. Elsewhere they could be referred to as *science enquiry skills* or simply *enquiry skills*:

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

Definitions and examples of different enquiry skills can be found here.

Teachers should be aware of the progression of these skills across the primary phases and plan to teach and assess these skills within children's practical investigations. For example, if children are recording data in a table:

- With children (ages 5-7), you might model how to use a pre-prepared table with column headings to record observations before you ask children to do this independently.

- With children (ages 7-9), you might provide a table (with or without column headings) for children to record their observations.
- With children (ages 9-11), you might expect children to draw their own table with appropriate column headings to record their findings (including for repeat readings and averages).

PSTT has designed symbols to represent enquiry skills (for consistency in their own resources) that could be displayed in your classroom to help the children identify and recall the particular science skills they are using in their science investigations.

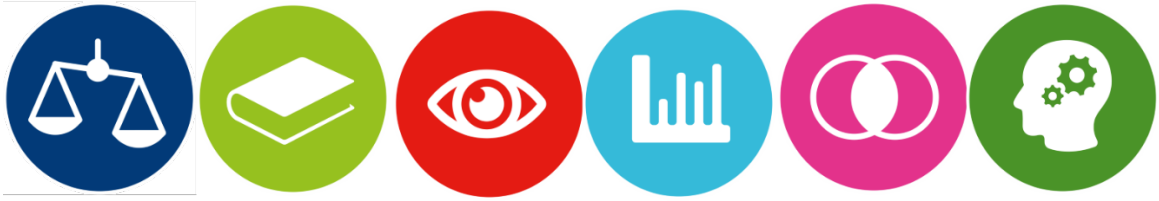
You may also be interested in Working Scientifically in the Primary Classroom - Progression of enquiry skills from EYFS to KS3 published by the Centre for Industry Education Collaboration (CIEC). This document contains progression grids, guidance and child-friendly self and peer assessment posters. *Note: this document will be updated to reflect changes in the EYFS curriculum in England when the new curriculum becomes statutory in September 2021.*

Do children regularly carry out practical investigations using a range of enquiry types?

Whichever curriculum your school follows, over the course of an academic year, pupils should carry out several investigations that involve different types of enquiry:

- **comparative / fair testing**
- **research**
- **observation over time**
- **pattern seeking**
- **identifying, grouping and classifying**
- **problem solving**

Definitions and examples of different enquiry skills can be found here. PSTT has designed symbols to represent types of enquiry (for consistency in their own resources) that could be displayed in your classroom to help the children identify what type of investigation they are doing.



The PSTT provides a wealth of resources to support teaching and learning of different types of enquiries. You can search for activities related to particular science topics and age groups.

If children are carrying out a comparative or fair test, you may find CIEC's Interactive Planning Tool useful. This interactive document supports children working together to consider all the possible variables in an investigation and helps them to plan their practical work.

Teachers might like to consider using Role Badges for children carrying out practical work. These can promote teamwork and help practical lessons run smoothly. CIEC produces a set of five badges which you can download here.

5. Differentiation

Is every child's prior knowledge considered when teachers plan units of work?

Some children may have a deeper subject knowledge compared with their peers in areas that interest them, and others may have some misconceptions that need to be addressed. To elicit children's understanding before planning and teaching a topic, so that you can differentiate your teaching appropriately, you could use one of these Assessment for Learning (AfL) strategies:

- a Concept Map (either a group discussion of initial ideas or children's individual concept maps)
- a Bright Ideas discussion slot (or a similar activity from Explorify)
- a Concept Cartoon® (published by Millgate House Education)
- a sorting activity (for example: materials into different groups depending on their properties or statements into True or False)
- a matching activity (this could include real objects, materials, pictures or vocabulary)
- an exploring walk (for example: a sound walk around the school building, a nature walk to identify living things in the environment)
- a modelling activity (for example: using foil or playdough to create an animal and describe its features)

Note: this is not an exhaustive list.

You can find examples of AfL strategies in the Teacher Assessment of Primary Science (TAPS) Pyramid Tool. Although these examples are taken from English and Welsh primary schools, the strategies that are demonstrated are transferable to any primary school.

Teachers looking for activities to elicit children's understanding at the start of a topic will also find Explore, Engage, Extend (published by PSTT) a useful resource. There are twenty sets of highly engaging practical activities to support teachers with AfL in science. The activities generate rich assessment data, enabling the teacher to plan the topic in response to the children's specific needs. The topics presented are written for Key Stage 2 (ages 7-11 years), but they are also transferable across year groups, and can be easily adapted for the curriculum being followed by the school. A free sample unit is available here.

Do teachers adapt the pace, challenge and content of activities for pupils, including SEND and EAL?

To understand science, children need to be taught some abstract concepts and new vocabulary. This can be difficult for deaf children, EAL children, children with dyslexia and children on the autistic spectrum. To develop science skills, children need to carry out practical investigations that can involve group work, using unfamiliar equipment, moving to a different space (possibly outdoors) and science lessons can be noisier than other subjects. This can be confusing for children with dyslexia, dyscalculia, children on the autistic spectrum and for those with visual impairments. To address children's individual needs, teachers can adapt teaching and learning strategies.

For children with **dyslexia, dyspraxia, and dyscalculia**:

- introduce new scientific vocabulary in advance
- highlight important instructions and allow more time for children to carry out tasks
- provide a laptop or tablet to record information
- provide handouts to reduce the need for writing
- using Widgit science symbols can be helpful (simply-drawn colourful symbols that illustrate a single concept in a clear and concise way)

For **deaf** children:

- introduce new scientific vocabulary in advance
- make the lesson as visual as possible with pictures, diagrams and film clips to illustrate meaning

For **visually impaired** children:

- seat the child at the front of the class, away from glaring light
- describe clearly and familiarise the child with any equipment

- give clear instructions relating to moving around the classroom during practical work (avoid terms such as 'over there')
- describe in detail important visual observations during practical investigations
- offer to read written information (or partner the child with a 'reader')
- enlarge any handouts to a bigger size and a clear font style

For children on the **autistic spectrum**:

- some children will benefit from seeing pictures or visual stories about changes in routine that might occur during a practical science lesson
- use clear and precise language when giving instructions or explaining abstract concepts
- allow more time for children to process instructions

For **EAL** children:

- use more visual clues (diagrams, photographs), making sure that these are culturally appropriate
- allow children to work in groups alongside mixed-ability peers during practical work
- model and use a speaking frame that uses key vocabulary and language structures
- use a writing frame to show how text should be organised
- use drama to explain scientific concepts
- provide scaffolding so that learners can move from supported to independent learning
- there may be opportunities to partner the child with another who can speak their home language, so they can converse confidently. Be careful not to overuse this strategy.

For many children with special educational needs and disabilities, PSTT's Science in My Pocket is a highly versatile resource. The carefully designed and simple science activities in the pockets can be used with children from nursery up to age 11. Instruction cards inside each pocket include supporting background knowledge and notes for the teaching assistant/teacher leading the activity. Science in my Pocket activities have been shown to be effective for:

- Speech and language development
- EAL – accessing scientific vocabulary in a safe environment
- Short term emotional disturbance, e.g. if a child arrives at school upset
- Extension work, e.g. children might design their own pockets

- Homework activity
- Development of specific personal habits of mind, e.g. independence, negotiation, resilience
- Developing thinking skills across the curriculum
- Promoting good group work

Finally, for all children, it is important to think about how to organise **group work** in science lessons, whether it is a card sort activity or a child-led practical investigation. The approach will probably vary according to what topic is being taught and the needs of the pupils. Teachers might consider the following strategies:

- Working with a group of children who need more support so that they can scaffold their learning
- Working with the most able scientists in the class so that they can challenge their learning
- Teaching science in **mixed-ability groups** so that children with good literacy and numeracy skills can support other children. If you do this, it is important that these children do not dominate any practical or group work. It can be useful to assign roles to each member of the group and to make sure that these roles are changed regularly. Here are some suggestions:
    1. Resources Manager (collects and sets up the equipment)
    2. Health and Safety (checks that the experiment is carried out safely and correctly)
    3. Data Collector (records the results)
    4. Communications Officer (provides feedback to the class about the group's findings and conclusions)

Note: all of the children should be involved in drawing conclusions and evaluating their investigation. The Communicating Officer may need to explain that members of the group have conflicting ideas if this is the case.

Are all children able to demonstrate their science skills and conceptual understanding in an appropriate way?

Children could record their learning in a wide variety of ways. Whilst teachers should help children to develop the skill of communicating in science and drawing conclusions from their investigations, it is not necessary for primary-age children to write a record of their investigations in the traditional format: method, results, conclusions. Children could use many genres for writing in science: instructions, a consumer report (for example, the best material for an umbrella is…), a newspaper report, a diary entry (for example, a day in the life of a red blood cell), writing a letter or a story.

Some children do not have literacy skills to match their science knowledge or skills. They may struggle to record their ideas, predictions or findings in science through written work.

Children could present their findings from enquiries orally, use PowerPoint presentations, drama, hot-seating, posters, art work or film.

Children could demonstrate what they know using annotated diagrams, posters, card sort activities, concept maps, graphic organisers, True/False statements, or classifying and grouping activities.

You could use a floorbook to keep a record of children's comments, activities and ideas.

6. Assessment

Are teachers using formative assessment to ensure children make progress with their subject knowledge and enquiry skills?

Explore, Engage, Extend is a useful PSTT resource designed to support teachers with formative assessment (assessment for learning, AFL) in science. The twenty activities generate rich assessment data, enabling the teacher to plan the topic in response to the children's specific needs. The topics presented cover the upper primary age range, but they are also transferable across year groups, and can be easily adapted for the particular curriculum being followed by the school.

The Teacher Assessment in Primary Science (TAPS) project, funded by the PSTT, has developed resources that embed assessment of both subject knowledge and enquiry skills within classroom primary science activities for ages 4-11 years. There are two approaches within TAPS:

1. TAPS provides a database of Focused Assessment Plans and Examples.

TAPS focused assessment plans have a particular focus on the assessment of ***working scientifically*** (science enquiry skills) within a topic context - allowing the teacher to assess one skill within a practical enquiry. Taking one focus (i.e. one science enquiry skill) at a time is more **manageable** with a whole class and increases the **validity** of teacher judgements. During the lesson children may well be involved in other aspects of scientific enquiry that are not the focus. For example, if the focus is on interpreting data, the children may also have discussed how to carry out the enquiry and used their measuring skills to collect data, but any recording of children's learning is around the focused element. Many teachers find that annotating plans or just noting those children who have 'not yet met the objective' is sufficient for their record keeping. **Assessment Indicators** on the TAPS plans provide suggestions about what the children might do or say to demonstrate their science skills or knowledge during practical investigations. As these plans have been trialled by schools, teachers working independently can feel secure that their judgements are consistent with those of other teachers. Using a TAPS

focused task each half-term, means that the full range of children's scientific knowledge and skills can be considered in depth during the year. It is recommended that the TAPS Focused Assessment activities are used about two thirds of the way through a topic so that the assessment information can be used formatively; areas for children's development can be identified and subsequent teaching can address children's needs. Used in this way, TAPS Focused Assessment plans can provide a tool for both assessment for learning and summative assessment.

Teachers will find the following Overviews of TAPS Focused Assessment Plans, showing progression in science skills, useful for deciding which plan to use with their class:

- In England - Overview of TAPS plans for Focused Assessment of Working Scientifically
- In Wales - TAPS Cymru Overview of Focused Assessment plans for progression in science skills
- In Northern Ireland - Overview of plans for progression in science skills from TAPS-NI

2. The TAPS pyramid model

The TAPS Pyramid provides schools with a structure to evaluate and develop their assessment processes. It offers a supportive source of examples of assessment for learning strategies (in the *Pupil Layer* and *Teacher Layer*) that can be used as formative assessment. By clicking on each box in these layers, you will be taken to examples from a range of schools. The interactive functions allow you to traffic light your assessment systems (on your own saved copy) and make notes on the approaches in your school.

The following pyramid tools are available:

- TAPS pyramid model (for curriculum in England)
- TAPS Cymru pyramid model (for curriculum in Wales) - in English
- TAPS Cymru pyramid model (for curriculum in Wales) - in Welsh

Teachers in England may find CIEC's Enabling Accurate Teacher Assessment in Primary Science a useful document. It provides guidance on carrying out ongoing assessments to inform summative judgements. CIEC also provides an online tracking system for Years 1 to 6 which teachers may wish to use to collate and monitor their assessment judgements.

Is summative teacher assessment reliable?

Whatever method of assessment teachers use, it is important that their judgements are reliable. Not only should subject leaders monitor the children's attainment and progress, but they should also monitor the processes used by teachers to make their

assessments. It is useful to arrange **moderation sessions** with other teachers; in larger schools, in academies, in federations and science clusters, it may be easy to arrange a meeting of teachers of similar year groups to share and discuss children's work. In smaller schools, it may be necessary for teachers of different year groups to support each other. However moderation is organised, having a discussion of teacher judgements and a shared understanding of the subject and assessment, will strengthen the reliability and validity of your data.

For moderation of children's scientific knowledge and enquiry skills, these resources may be useful:

- Using TAPS focused assessment plans (as described above) and comparing children's work with the *Assessment Indicators*.
- Teachers in England may also find PLAN assessment resources helpful for comparison of age-appropriate attainment in knowledge, conceptual understanding and enquiry skills. PLAN examples of work show the work of one pupil who meets the requirements of the knowledge statements in the English National Curriculum for each topic. Comparing PLAN examples of work for your year group with the work of your pupils could help you identify those pupils who are meeting/not meeting the expectations.

7. Safe science

Does the school have access to informed advice and consider safety guidance and risk assessments?

PSTT advises teachers to refer to either the CLEAPSS website or SSERC website for up to date health and safety information when planning practical activities for children. You may also find it is useful to have a copy of the book **Be Safe** (published by ASE) in school. Be Safe includes advice on risk assessments for food hygiene, outdoor learning, making things safely and the safe use of chemicals, animals and plants in school.

The Health and Safety at Work Act and subsequent Regulations require employers to protect their employees by, for example, providing safe working conditions, information & training for health and safety, and (model) risk assessments for activities (required under a range of regulations, including COSHH). CLEAPSS or SSERC membership enables employers to discharge these responsibilities.

In **England, Wales** and **Northern Ireland**, most local authorities are members of **CLEAPSS** which means that their schools are members. CLEAPSS provides health and safety support for leaders, risk assessments and tried and tested practical activities. If your primary school is a member of CLEAPSS, you can ring the CLEAPSS helpline and get advice on almost anything to do with science. If your primary school is part of an Academy, you will need to check whether your school has membership of CLEAPSS. In the absence of CLEAPSS membership, the employer, be it the governors or trustees, must consider how to fulfil aspects of the Health and Safety at Work Act

and its subsequent regulations and teachers should be aware of where they can get appropriate advice.

In **Scotland**, all 32 Scottish Local Authorities are members of **SSERC**, a registered charity set up for the benefit of Scottish education. Members can access health and safety advice, risk assessments and whole school guidance.

8. Outdoor learning

Are the school's outdoor spaces and the local environment being used as a learning resource for all science topics?

Outdoor learning is an important way of contextualising science and allows children to engage with the environment around them; something that cannot always be achieved in a classroom. A short review of the literature concerning outdoor learning in primary schools is available from PSTT Fellow, Michele Grimshaw *et al.* in the ASE's Journal of Emergent Science (2019) Issue 16, p40-45.

The following PSTT resources may help your school to make the most of its outdoor areas:

- Let's Go! Science Trails - a book, developed by a group of teachers in the London borough of Haringey and led by PSTT Fellow Jeannette Morgan, offers support and ideas for 29 science Trails covering all aspects of the primary science curriculum to promote outdoor learning from ages 4-11.
- Let's Go! STEM Trails - a book describing another 29 Trails to explore science concepts in the outdoor environment of the school grounds and locality, which focus on and link this to technology, engineering and maths in thought-provoking ways. Suitable from ages 4-11.
- Playground Science - is a set of fun and informal science activities that children can carry out in their playtimes. The activities use simple instructions and a small amount of equipment to encourage the children to explore the world around them and to develop scientific skills.
- Growing Music - a free booklet describing a PSTT/WOMAD Foundation project which brings together music, science and design technology within a cultural context. The project is based on growing bamboo and playing Colombian pan pipes and is suitable for ages 7-11.
- Science in My Pocket - a set of science activities in small bags (pockets) for teaching assistants to use with children who need emotional and behavioural support. They can be used indoors or outdoors and mostly involve moving around which suits the needs of many children.
- Learning Science Together provides resources for running an Outdoor Detectives family learning event.