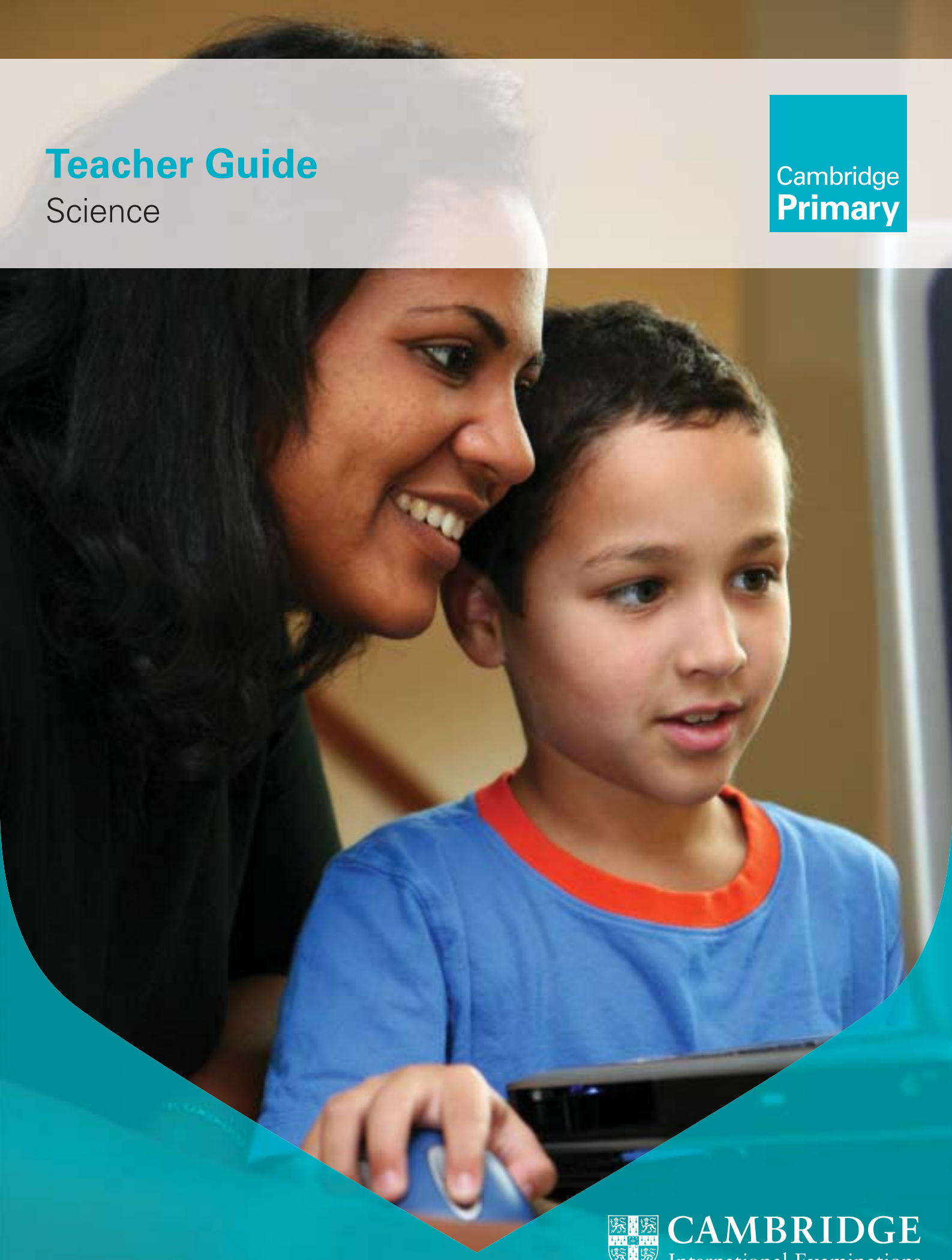
Teacher Guide

Science

Cambridge Primary



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Contents

SECTION 1: INTRODUCTION

Welcome to the Cambridge Primary Teacher Guide for Science.

This guide is designed to provide a suggested approach to the implementation and management of Cambridge Primary in your school.

It offers:

- An introduction to the Cambridge Primary Science curriculum framework
- Step-by-step guidance on the planning process, with exemplification at each point and helpful teacher training activities with resources
- Advice on differentiation and how to integrate this into your teaching
- Suggested techniques for implementing formative assessment and integrating this into your lesson planning
- Sample lesson plans with activities and resources to help get you started
- Advice on monitoring
- Advice on classroom practice
- Advice on resources
- Information on Progression Tests and Cambridge Primary Checkpoint tests
- Guidance on support and training available from Cambridge
- Guidance on administration

A comprehensive scheme of work

In addition to extracts provided in this guide, a full scheme of work covering the entire programme has been provided to help you get started. As we will explain, a scheme of work is a process rather than a rigid structure and these plans should be constantly amended in response to your own observations as a classroom teacher and other local considerations including the resources you may already have available at your school. These schemes of work are therefore in no way compulsory and simply offer a suggested starting point for covering the content of the curriculum within a suggested year of three terms each of 10 weeks duration. These can be expanded to suit the number of weeks available in your own terms and the holiday arrangements at your school.

Sample lesson plans are also provided to help get you started immediately at whichever point you begin delivering the programme.

1.1 How to Use this Teacher Guide

This guide provides a general introduction to Cambridge Primary and its underlying educational philosophy. It also offers guidance and advice on the essential processes of implementing Cambridge Primary and it is designed to cater for:

- Schools that are teaching a Cambridge programme for the first time and need to move from a completely different system of planning
- Schools that already deliver one or more Cambridge programmes but are new to Cambridge Primary

Schools new to Cambridge will find all sections of the Teacher Guide relevant to them. It provides a step by step guide through the process of implementing Cambridge Primary, offering a suggested breakdown of the curriculum across the available teaching time, sample lesson plans and sample lessons to get you started.

Existing Cambridge schools may be more familiar with certain aspects covered in this guide, especially if they already deliver the lower secondary phase of the Cambridge programme (now called Cambridge Secondary 1). This guide is written so that schools new to Primary can make use of the sections most relevant to them (e.g. Section 2: Planning or Section 3: Teaching Approaches).

1.2 Cambridge Primary

Cambridge Primary is an education programme for young learners. It combines a world-class curriculum, high-quality support for teachers and integrated assessment. The programme has been developed by University of Cambridge International Examinations and is used in primary schools around the world. Cambridge Primary helps schools develop learners who are confident, responsible, innovative and engaged.

Cambridge Primary covers

- English
- English as a Second Language
- Mathematics
- Science

for learners aged 5–11. It provides curriculum frameworks with integrated assessment for each subject.

Cambridge Primary provides a solid foundation for later stages of education.

It starts learners on an educational journey, focusing on what they should be able to do at each stage of primary education. It develops skills, knowledge and understanding that will prepare them for a smooth transition to Cambridge Secondary 1 and beyond.

Cambridge Primary offers optional, integrated assessment.

The assessment structure tracks learner progression through primary education. Learners taking Cambridge Primary Checkpoint receive a Statement of Achievement and detailed feedback on strengths and weaknesses.

Cambridge Primary supports teachers in providing the best teaching and learning.

Schools adopting Cambridge Primary gain access to first-class support for teachers through publications, online resources, training and professional development.

Cambridge Primary is practical and flexible.

No part of the Cambridge Primary curriculum is compulsory, giving schools the flexibility to choose the elements that are right for their learners. This means that they can use Cambridge Primary while following their school or national curriculum, or offer the entire programme.

Cambridge Primary has been developed by University of Cambridge International Examinations, the world's largest provider of international education programmes and qualifications for 5–19 year olds. Our programmes and qualifications are taken in over 160 countries in 9,000 schools and recognised by universities, education providers and employers across the world.

Cambridge international education programmes and qualifications	
Cambridge Primary (5–11 years*)	Cambridge Primary
	Cambridge Primary Checkpoint
Cambridge Secondary 1 (11–14 years*)	Cambridge Secondary 1
	Cambridge Checkpoint
Cambridge Secondary 2 (14–16 years*)	Cambridge IGCSE
Cambridge Advanced (16–19 years*)	Cambridge International AS and A Level
	Cambridge Pre-U

*Age ranges are for guidance only.

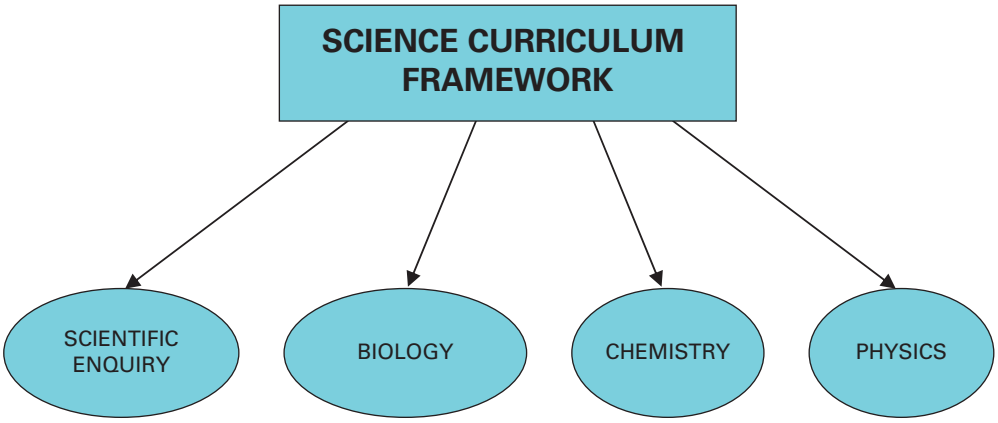
1.3 The Curriculum Framework

The Cambridge Primary Science framework provides a comprehensive set of learning objectives for Science. The objectives detail what the learner should know and what they should be able to do in each year of primary education. The function of the curriculum framework is to provide a structure for teaching and learning and a reference against which learners' ability and understanding can be checked.

There are six stages. Each stage reflects the teaching targets for a year group. Broadly speaking, stage one covers the first year of Primary teaching, when learners are approximately five years old. Stage six covers the final year of Primary teaching when learners are approximately eleven years old. It may be appropriate to introduce this framework at slightly different ages to suit your particular circumstances.

The Science framework is divided into four main areas called 'strands' which run through every stage: Scientific Enquiry, Physics, Chemistry and Biology.

Strands in the Curriculum Framework



Continuity, progression and balance

The Science curriculum framework allows for continuity and progression both within and between the stages. You can select any learning objective and trace its pathway clearly through the stages of the framework. This continuity allows the curriculum to be consistent and 'uninterrupted' between stages, whilst progression ensures that students move forward steadily. The table below shows how knowledge and skills can be traced through the framework.

An example of progression through the framework

Stage 1	Stage 6
Scientific Enquiry: **Plan investigative work** Make predictions.	**Scientific Enquiry:** **Plan investigative work** Make predictions using scientific knowledge and understanding.
Biology: **Humans and animals** Recognise and name the main external parts of the body.	**Biology:** **Humans and animals** Use scientific names for some major organs of body systems. Identify the position of major organs in the body. Describe the main functions of the major organs of the body. Explain how the functions of the major organs are essential.
Chemistry: **Materials** Identify characteristics of different materials.	**Chemistry:** **Material changes** Distinguish between reversible and irreversible changes.
Physics: **Forces** Recognise that when things speed up, slow down or change direction, there is a cause.	**Physics:** **Forces and motion** Recognise friction (including air resistance) as a force which can affect the speed at which objects move and which sometimes stops things moving.

The strands of the curriculum framework have been selected in order to provide balanced coverage of the fundamental skills, knowledge and understanding of Science at this level and they have also been designed to provide a sound foundation for stages seven to nine. Learners should be prepared at the end of stage six to move on smoothly to stage seven.

The selection of content in the framework at each level has been chosen to ensure a coherent progression for the learner. The curriculum framework has been designed to allow sufficient time for each learner to develop a true understanding of the skills and knowledge required. Teachers themselves are best placed to know the capabilities of their learners and can, of course, choose to supplement the framework as appropriate. What is within the curriculum framework is the content that will be assessed and analysed using the Cambridge Progression Tests on the Cambridge Primary support site. It is also tested in the Cambridge Primary Checkpoint tests for which feedback reports are provided.

Whilst it is important to be able to identify the progression of objectives through the curriculum, it is also essential for you as the teacher to bring the different strands together into a logical whole so that your teaching makes learning meaningful, purposeful and enjoyable. This can be achieved through detailed planning and with your ability as teacher to constantly re-tune your teaching to the needs of the learners.

A decision about approaches to planning is essential so that the process is clear.

SECTION 2: PLANNING

2.1 Getting Started

This next section will look at the process of planning, ensuring that you cover all of the content of the curriculum for stages one to six, given the teaching time you have available within each year.

We will start by identifying exactly ***what*** you need to plan:

- Complete coverage of the learning objectives for all of the stages, or those that you teach
- Progression and continuity of Scientific Enquiry and biology, chemistry and physics content
- The best order in which to teach the required units
- Detailed lessons, led by clear learning objectives that your learners will understand

And ***why*** you need to plan:

- To ensure appropriate timings are given to the different aspects of the curriculum
- To be clear about what can be assessed as a result of a lesson/unit of work
- To ensure a mix of teaching and learning styles in delivery – according to your learners' needs
- To ensure that all resources are available to deliver a successful lesson

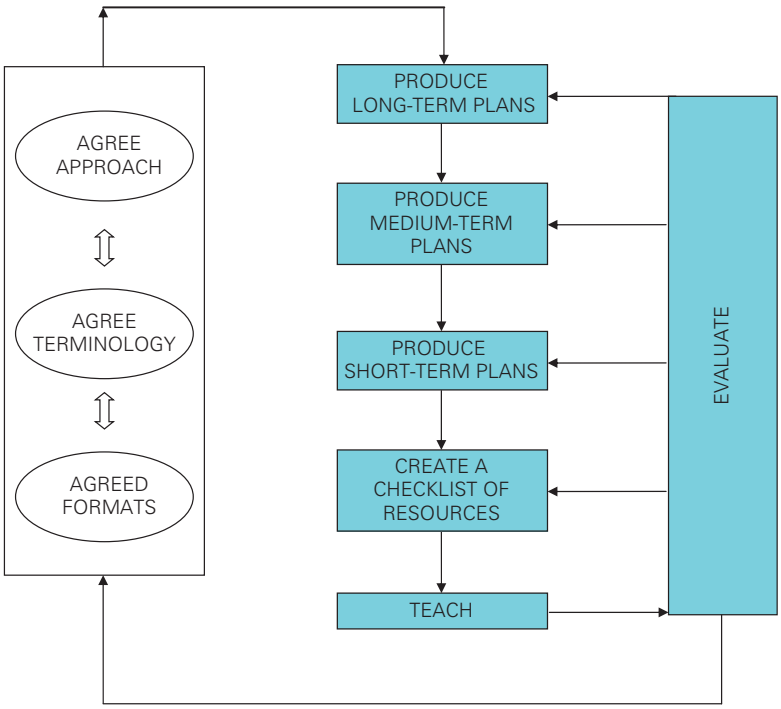
The following section lays out a step-by-step guide to the planning process, including how you can build in flexibility to allow you to adapt coverage, delivery style and timing to suit your needs.

2.2 A Consistent Approach

Download the curriculum framework for Science from the Cambridge Primary support site **www.cambridgeprimary.cie.org.uk** and familiarise yourself with the coverage and structure of the programme. We need to break the curriculum down and we can do this in three clear stages, but first it is worth getting all the primary teachers together to coordinate a consistent approach.

Look at the diagram below. Start by thinking about the decisions in the **white box**: approach, terminology and formats.

A pathway to implementation



Approach: The general approach will largely be decided by colleagues in management. This, for example, may concern the whole curriculum and not just Science. Some schools merge subjects across the curriculum. For the purpose of this guide we assume that Science is going to be taught as a separate subject.

Terminology: Everyone involved needs to understand the terminology used so that, for example, 'long-term' plan means the same to all. This is true whatever the overall approach within a school.

Training Activity: Agreeing Terminology (Appendix A1)

In the appendices of this guide you will find an exercise that may be carried out by groups of teachers to reach an understanding of the planning terms:

Long-term [overview]

Medium-term [scheme of work] and

Short-term [lesson plan]

It also includes other relevant terms. When the terminology has been agreed, planning can begin.

Formats: It is not vital to all use the same documentation for planning but it is very helpful for communication and common understanding. They may vary from subject to subject if considered necessary, but it is particularly helpful if the formats used for planning are the same for each stage. Templates for all stages are provided at the back of the guide. Here it is suggested that formats for each stage of planning are used by all teachers who deliver Science. These will be discussed in more detail later.

Evaluation: Perhaps the most important box is the 'Evaluation' box. It is *always* a good idea to check how well something works. The diagram shows that this can be for any stage. If there is a problem delivering a lesson, it is often assumed that there is something wrong with the lesson plan. This can be true, but sometimes it may be because the medium or long term plan that is being used needs changing in some way. The **white box** issues may also need to be revisited.

2.3 Descriptions of the Planning Stages

Long-term planning involves considering the Science curriculum for the whole school. This includes taking account of the school calendar for the academic year and allocating a specific percentage of time for Science to be taught throughout the school. This is generally carried out by senior management.

It requires financial pre-planning in terms of resources. Different subject areas will receive budget allocations in order to provide the equipment and written resources necessary for the successful delivery of the Science curriculum.

You will need to engineer a balance between Biology, Chemistry and Physics. Scientific Enquiry skills need to be ongoing and sequential.

Medium-term planning involves planning coverage of the curriculum in units across an entire stage. This includes taking account of seasons, school events and possible visits to enhance the learning process.

It also requires pre-planning in terms of required resources, whether these are shared, limited or need buying in. The most important consideration is timing, thinking about when you will be delivering a new unit and how often skills need to be re-visited throughout the year. You will need to think about the order in which knowledge and skills need to be learned.

Again you will need to engineer a balance between Biology, Chemistry and Physics. Scientific Enquiry skills need to be ongoing and sequential across all units taught.

Medium-term planning is usually broken down into individual terms. The Scheme of Work provided by Cambridge for each stage has assumed covering two units per term in an academic year structured as three terms each of 10 weeks. Term length varies around the world so we have chosen a relatively compact approach so that you should be able to add further time as necessary.

The units of work can be arranged in various ways to provide a varied and interesting approach to delivering and ensuring coverage of the Science curriculum at each stage.

At this point in the process, planning generally considers specific units and the ***best order*** in which they can be taught, building on previous learning and developing knowledge and understanding throughout the year. Depending on what you decide, this permits units to be taught in isolation, or in a cross-curricular way, particular to each school's policies. Over time, you will be able to adapt these plans according to resources and available teaching time, and in the light of your own particular teaching expertise and confidence.

> ***New teacher's tip****: If you are new to teaching and unsure about the length of time it takes to deliver a particular topic, we have provided a comprehensive plan for all stages from which you can make a start. This is not intended to be followed to the letter, it only provides an initial starting point. Do not expect your plan to be perfect first time; start with an estimate of how long you think a subject will take and adjust your long-, medium- and short-term plans as you go along so that as you are delivering it you are also fine-tuning it. You are the best judge of the capabilities of your learners and how long it will take them to understand each topic given their existing knowledge.*

Short-term planning is a lesson plan for a particular lesson. Most commonly this evolves into a weekly plan. This is a detailed, working document and is led by the learning objectives for that session.

It provides:

- Essential information for all adults involved in the learning and considers the learning needs of all learners, including those with special educational needs (SEN) and/or the gifted and talented
- Continuity in the absence of regular teaching staff e.g. in times of absence
- An outline of resources, timings, working groups and assessment

The real value of a short-term plan is that it influences the next steps in the light of the learner's response to the learning opportunities presented. Detailed examples and templates are provided in the appendices.

The following sections provide a step-by-step guide to the planning process including some advice about meeting the training needs of colleagues.

The steps of the planning process (1–8) outlined in the diagram overleaf are divided into three logical phases that form the sub-sections of this section of the guide:

2.4 Phase 1 – Creating a Long-term Plan (steps 1–4)

2.5 Phase 2 – Creating a Medium-term Plan (steps 5–6)

2.6 Phase 3 – Creating a Short-term Plan (steps 7–8)

The 8 steps of the process are dealt with in each related sub-section as shown above.

The Planning Process

2.4 Phase 1
Creating a Long-term Plan

Step 1. Teaching time
Find out:
- how many hours there are to teach the subject?
- how is the teaching time divided?
- how many units you will be able to comfortably fit into a term.

Step 2. Approach
Think about:
- how you want to structure the teaching of the subject? Biology, Chemistry and Physics mixed together or taught separately for example.

Step 3. Allocate the strands
Allocate the strands for each stage across the number of units available per term.

→ **Look at Long-Term Planning 1**
You can show the allocation of strands here across the terms.
Later you can use this grid to show how the units are allocated (either for one stage or all six), by replacing the strand names with your finalised unit titles instead.

Step 4. Learning objectives by term
- Look at the curriculum framework.
- Decide which learning objectives will be covered in each part of the year, e.g. each term within a stage.
- Decide which learning objectives will be covered on an ongoing basis throughout the year.
- Decide where you are going to fit in the Scientific Enquiry objectives.

You can mark up the curriculum framework (e.g. use a colour code) to show the results.

→ **Look at Long-Term Planning 2**
You can use this to record your decisions on when each learning objective should be introduced in the year.

→ **Look at Long-Term Planning 3**
You can use this to show the results of your decisions in Long-Term Planning 2 term by term.

2.5 Phase 2
Creating a Medium-term Plan

Step 5. Creating Units
- Group ongoing and other learning objectives into topics and themes creating a logical, progressive sequence of learning including Scientific Enquiry.
- Rearrange for challenge, balance, timing, pace and appeal.
- Organise the number of units to match the estimated time available from step 1.

→ Print and cut out the individual learning objectives so you can try different arrangements on a separate sheet before finalising if it is helpful.

Step 6. Creating Medium-Term Plans
Identify suitable activities and resources to deliver the learning objectives in each unit.
Indicate how the lesson is to be taught.

→ **Look at Medium-Term Planning 1**
You can record your decisions with comments and timings on this template alongside the other information.
Medium-Term Planning 2
does not have these additional columns.

2.6 Phase 3
Creating a Short-term Plan

Step 7. Creating Lesson Plans
Identify what you are going to teach and how you are going to teach it.

→ **Look at Short-Term Planning**
Instructions are printed on the template on Page 31 of the Planning section.

Step 8. Evaluate the lesson and the planning
Amend your scheme of work and lesson plans to best suit the needs of your learners.

2.4 Phase 1 – Creating a Long-Term Plan

Step 1. Teaching Time

First you will need to establish the number of terms available, the length of the terms and the number of teaching units you will roughly be able to fit into each term. In this guide we will follow a structure of three terms of ten weeks, per stage.

Step 2. Approach

Next, you will need to decide the over all approach you want to take to the teaching structure of the subject. Here are a few helpful prompts to get you thinking along the right lines.

- Do I have a preferred way of working?
- Do I prefer to teach a mixture of Biology/Chemistry/Physics each term?
- Do I prefer to teach Biology/Chemistry/Physics for one term each?
- How are Science resources available in school? (If they are shared, this could dictate when you need to teach specific strands.)
- How can I ensure that I cover the whole curriculum for the stage during the year?
- How will I provide opportunities for Scientific Enquiry continuously throughout the year?
- How can I sensibly group learning objectives from the curriculum framework to incorporate them into meaningful units of study?

Different planning models may be useful in deciding the most effective way of meeting learners' needs. Models can be either linear (each topic delivered consecutively) or spiral (see below) or even a combination of both. In this guide and in the published Cambridge Scheme of Work (which is available on the Cambridge Primary support site to all registered centres) we have chosen a model in which a combination of the four strands are covered within each term. Scientific Enquiry objectives are worked in alongside every topic taught as these are ongoing skills that help reinforce a good scientific discipline.

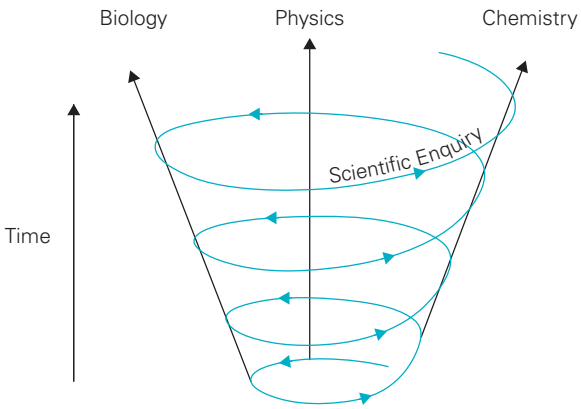
Managing Scientific Enquiry in your Planning

Scientific Enquiry underpins work covered in the Biology, Chemistry and Physics strands. The skills of Scientific Enquiry are ongoing in each stage and across stages. This is sometimes referred to as '**the spiral curriculum**'.

The spiral curriculum incorporates the four main elements of Scientific Enquiry

- Ideas and evidence
- Plan investigative work
- Obtain and present evidence
- Consider evidence and approach

Skills in each area are re-visited and practised, building on previous knowledge, skills and understanding. As this is the case we advise the use of a spiral planning model which permits a more holistic approach to delivery.



The Spiral Planning Model

The spiral model, shown here, provides a structure where the different strands, represented by the vertical arrows, are visited and then revisited in a continuous teaching and learning process that allows each strand to support progress and understanding in the other strands.

The practical nature of the skills and knowledge of the Scientific Enquiry strand means they form part of the substance *and structure* of that process.

Step 3. Allocating the Strands

Have a look at the curriculum framework. We are going to start by breaking down the framework broadly into the four major strands Scientific Enquiry, Biology, Chemistry and Physics to form an overview for all stages. Scientific Enquiry objectives underpin all the other strands as we have mentioned above and so are delivered alongside them at the same time.

Stage	Scientific Enquiry	Biology	Chemistry	Physics
1	Ideas and evidence Plan investigative work Obtain and present evidence Consider evidence and approach	Plants Humans and animals	Material properties	Forces Sound
2	Ideas and evidence Plan investigative work Obtain and present evidence Consider evidence and approach	Living things in their environment	Material properties Material changes	Light and dark Electricity The Earth and beyond
3	Ideas and evidence Plan investigative work Obtain and present evidence Consider evidence and approach	Plants Humans and animals	Material properties	Forces and motion
4	Ideas and evidence Plan investigative work Obtain and present evidence Consider evidence and approach	Humans and animals Living things in their environment	States of matter	Sound Electricity and magnetism

Stage	Scientific Enquiry	Biology	Chemistry	Physics
5	Ideas and evidence Plan investigative work Obtain and present evidence Consider evidence and approach	Plants	States of matter	Light The Earth and beyond
6	Ideas and evidence Plan investigative work Obtain and present evidence Consider evidence and approach	Humans and animals Living things in their environment	Material changes	Forces and motion Electricity and magnetism

This plan has been designed to provide a good balance between Biology, Chemistry and Physics in each stage with the development of Scientific Enquiry skills ongoing throughout.

You may prefer to teach separate terms of Biology, Chemistry and Physics according to your organisation and timetabling in school. You will need to decide your approach collectively at the outset of the planning process.

Step 4. Ordering the Learning Objectives

Next you need to work through all the learning objectives in the order in which they appear in the curriculum framework writing alongside each one which Term or Terms (Term 1 (**T1**), Term 2 (**T2**) or Term 3 (**T3**)) you think each one should be delivered in. An objective may need to be revisited in subsequent terms so could appear in T1 and T3 for example. You will need to think about the order of learning difficulty in allocating the objectives. The template **Long-Term Planning – 2** has been produced to help you record term allocations, it has a column on the right hand side in which you can write the appropriate timing for delivery.

You will find that some learning objectives relate to skills that apply to many strands as well as across the three terms. We have called these '**Ongoing**' objectives in this guide. You will need to identify these in the curriculum framework and put an '**O**' beside them in your list. See the completed example of Long-Term Planning – 2 included on page 16.

Next you will need to consider the **Scientific Enquiry** objectives. As explained in the introduction to this guide, these are designed to be addressed alongside the other strands and this means that they can easily be fitted into the content of your final teaching units.

Scientific Enquiry

Science teaching is not just about content, it has a highly applied nature through experimentation. It also includes the development of fundamental scientific skills, which are essential in creating young scientists who are capable of questioning, reasoning and seeking answers through investigation.

This guide will address how to incorporate these practical, investigative and thinking skills alongside delivery of the Science subject content of Physics, Chemistry and Biology.

Scientific Enquiry constitutes a strand of the framework in its own right. These skills need to be practised regularly and applied in familiar and new situations during practical sessions. As you will read later in this guide, Cambridge believes that learners gain a better conceptual grasp of new knowledge when that knowledge is set in a context provided by an activity. Scientific Enquiry lays down the main tenets of the scientific method by reiterating the accepted and proven procedures of investigation and reporting in each of the remaining strands.

Once you have allocated your learning objectives to a relevant term or terms you might want to produce a document that separates these lists out into their individual terms. This way you can see when learning objectives are first introduced to learners. You can either include the relevant ongoing objectives within this list or make a separate list for them against each stage. You can use the template **Long-Term Planning – 3** for this. Alternatively you can also keep the list all together and simply colour-code the times of first delivery, all those first delivered in Term 1 for example, then Term 2, then Term 3. A completed example of this has been included on page 18.

You are now ready to move on to creating your Medium-Term Plans where you will need to organise your learning objectives for each term into groups based around topics and themes. We call these groups 'Units'.

A completed example of Long-Term Planning – 2

Framework Code	Learning Objective	Ongoing (O) Term ref (T1, T2, T3)
	Ideas and evidence	
3Ep1	Collect evidence in a variety of contexts to answer questions or test ideas.	O, T1, T2, T3
	Plan investigative work	
3Ep2	Suggest ideas, make predictions and communicate these.	O, T1, T2, T3
3Ep3	With help, think about collecting evidence and planning fair tests.	O, T1, T2, T3
	Obtain and present evidence	
3Eo1	Observe and compare objects, living things and events.	O, T1, T2, T3
3Eo2	Measure using simple equipment and record observations in a variety of ways.	O, T1, T2, T3
3Eo3	Present results in drawings, bar charts and tables.	O, T1, T2, T3
	Consider evidence and approach	
3Eo4	Draw conclusions from results and begin to use scientific knowledge to suggest explanations.	O, T1, T2, T3
3Eo5	Make generalisations and begin to identify simple patterns in results.	O, T1, T2, T3
	Plants	
3Bp1	Know that plants have roots, leaves, stems and flowers.	T2
3Bp2	Explain observations that plants need water and light to grow.	T2
3Bp3	Know that water is taken in through the roots and transported through the stem.	T2
3Bp4	Know that plants need healthy roots, leaves and stems to grow well.	T2
3Bp5	Know that plant growth is affected by temperature.	T2
	Humans and animals	
3Bh1	Know life processes common to humans and other animals include nutrition (water and food), movement, growth and reproduction.	T1, T3
3Bh2	Describe differences between living and non-living things using knowledge of life processes.	T1, T2
3Bh3	Explore and research exercise and the adequate, varied diet needed to keep healthy.	T1, T3
3Bh4	Know that some foods can be damaging to health, e.g. very sweet and fatty foods.	T1, T3
3Bh5	Explore human senses and the ways we use them to learn about our world.	T3
3Bh6	Sort living things into groups, using simple features and describe rationale for groupings.	T1

(Continued)

Framework Code	Learning Objective	Ongoing (O) Term ref (T1, T2, T3)
	Material properties	
3Cp1	Know that every material has specific properties, e.g. hard, soft, shiny.	T1
3Cp2	Sort materials according to their properties.	T1, T2
3Cp3	Explore that some materials are magnetic but many are not.	T1, 2B
3Cp4	Discuss why materials are chosen for specific purposes on the basis of their properties.	T1, T2
	Forces and motion	
3Pf1	Know that pushes and pulls are examples of forces and that they can be measured with forcemeters.	T2
3Pf2	Explore how forces can make objects start or stop moving.	T2, T3
3Pf3	Explore how forces can change the shape of objects.	T1, T2
3Pf4	Explore how forces including friction can make objects move faster or slower or change direction.	T2, T3

A completed example of Long-Term Planning – 3

Framework Code	Learning Objective
	Ideas and evidence
3Ep1	Collect evidence in a variety of contexts to answer questions or test ideas.
	Plan investigative work
3Ep2	Suggest ideas, make predictions and communicate these.
3Ep3	With help, think about collecting evidence and planning fair tests.
	Obtain and present evidence
3Eo1	Observe and compare objects, living things and events.
3Eo2	Measure using simple equipment and record observations in a variety of ways.
3Eo3	Present results in drawings, bar charts and tables.
	Consider evidence and approach
3Eo4	Draw conclusions from results and begin to use scientific knowledge to suggest explanations.
3Eo5	Make generalisations and begin to identify simple patterns in results.
BIOLOGY	**Plants**
3Bp1	Know that plants have roots, leaves, stems and flowers.
3Bp2	Explain observations that plants need water and light to grow.
3Bp3	Know that water is taken in through the roots and transported through the stem.
3Bp4	Know that plants need healthy roots, leaves and stems to grow well.
3Bp5	Know that plant growth is affected by temperature.
BIOLOGY	**Humans and animals**
3Bh1	Know life processes common to humans and other animals include nutrition, movement, growth and reproduction.
3Bh2	Describe differences between living and non-living things using knowledge of life processes.
3Bh3	Explore and research exercise and the adequate, varied diet needed to keep healthy.
3Bh4	Know that some foods can be damaging to health e.g. very sweet and fatty foods.
3Bh5	Explore human senses and the ways we use them to learn about our world.
3Bh6	Sort living things into groups, using simple features and describe rationale for groupings.
CHEMISTRY	**Material properties**
3Cp1	Know that every material has specific properties, e.g. hard, soft, shiny.
3Cp2	Sort materials according to their properties.
3Cp3	Explore how some materials are magnetic but many are not.
3Cp4	Discuss why materials are chosen for specific purposes on the basis of their properties.
PHYSICS	**Forces and motion**

(Continued)

Framework Code	Learning Objective
3Pf1	Know that pushes and pulls are examples of forces and that they can be measured with forcemeters.
3Pf2	Explore how forces can make objects start or stop moving.
3Pf3	Explore how forces can change the shape of objects.
3Pf4	Explore how forces, including friction, can make objects move faster or slower or change direction.

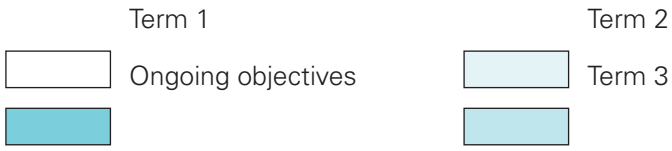
Notes:

The learning objectives can be colour coded:

– *Ongoing* – refer back to Long-Term Planning – 2 template

– *A different colour for each term* – once only *when it is first introduced.*

This template provides a means to highlight coverage as an on-going record throughout the stage. For example:



2.5 Phase 2 – Creating a Medium-Term Plan

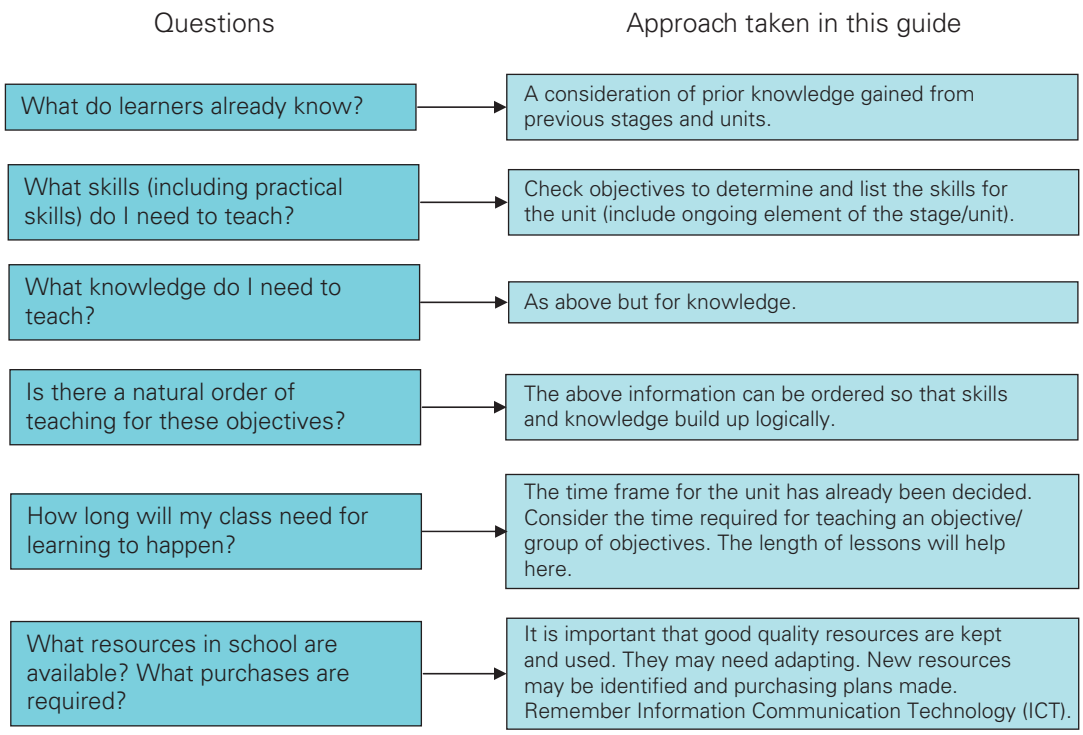
You should already have decided roughly how much time is available for each teaching unit as part of your long-term planning. For example it may be two weeks or it may be four depending on the length of time available in your terms.

Steps 5 Creating Units and 6 Medium-Term Plans

The starting point for creating a medium-term plan is the list of objectives that you have allocated to each term. You need to order these now into themes and topics so that you have:

- A logical and progressive teaching sequence that takes into account prior learning and the ascending level of demand belonging to each skill
- Good timing so that the pace of learning is challenging and realistic for all learners
- Identified activities to deliver the objectives and resources
- Identified opportunities for ICT
- A variety of enjoyable and appealing learning opportunities for your learners

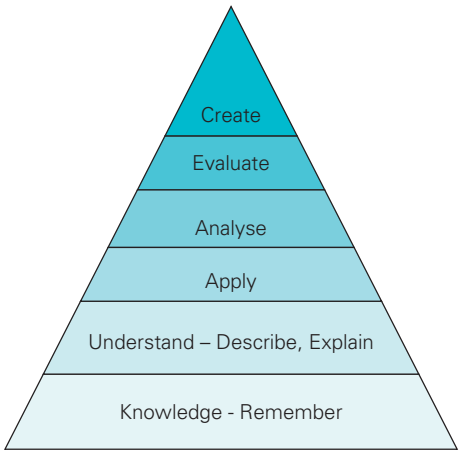
A set of questions can help to organise ideas. The table below shows some possibilities. The information (possible answers) given in the right-hand column shows what decisions have been made for the suggested medium-term plan provided by Cambridge and available to all registered Centres on the Cambridge Primary support site.



To help you determine the order of learning by considering the level of difficulty of each required skill, the broad principles of Bloom's taxonomy may be helpful.

Look at the ascending hierarchy of skills indicated in the triangle and exemplified in the two tables. Think about the levels of skill required by the learner across and within your units. Are you asking learners to perform tasks that require a higher level of skill towards the end of the term, having built up their knowledge systematically in previous lessons? Are the skills and knowledge required by any given unit built up gradually to form a logical progression? A clear hierarchy of skills in planning and delivery sets a good example to your learners of how the learning process works.

Bloom's Taxonomy (Revised)
http://www.apa.org/ed/new_blooms.html



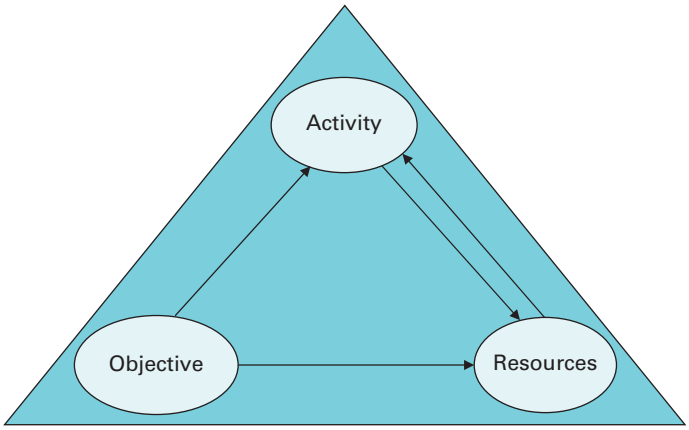
Based on an APA adaptation of Anderson, L.W. & Krathwohl, D.R. (Eds.) (2001)

Compile information in a different way or propose alternative solutions
Present and defend opinions by making judgments about information and validity of ideas. (based on criteria)
Examine and break information into parts – make inferences; find supporting evidence for generalisations.
Using new knowledge; solving problems in new situations by applying knowledge, etc. in a different way.
Demonstrate understanding: organising, interpreting, describing and stating main ideas.
Show memory of previously learned materials by recalling facts, basic concepts and answers.

Possible questions that illustrate each level

Change an unhealthy fatty food to a 'healthy' low fat food by changing the ingredients. Explain the benefits of your choices vs. the originals
Do you feel that a low fat yogurt is a healthy snack for children aged 8–11? Give reasons for your answer
List three ways of serving low fat foods and explain which ones have the most health benefits. Provide evidence to support what you say
Which kinds of fruit are best for baking a pie?
Compare the benefits of eating cheese vs. fruit
What are the benefits of eating low fat foods?

The diagram below might help you in considering this. It is important that the activities are objective-led. Choose the objective, decide the activity from that and the resources needed will then become apparent.



Decisions about units, activities and resources should be recorded as a medium term plan. Two blank templates are available in Appendix E of this guide for you to create your own medium term plans.

Medium Term Planning – 1 has additional columns for comments and time allocation.

Medium Term Planning – 2 is without these columns

A comprehensive set of medium term plans (or Scheme of Work) is provided on the Cambridge Primary support site. Extracts from the full Scheme of Work are provided as Appendix B at the end of this guide.

A completed example of Medium-Term Planning – 1 is included below.

A completed example of Medium-Term Planning – 1

Stage 1, Unit 1A: 1.1 Ourselves

In this unit, learners learn that humans and other animals move and grow.

They also learn about their senses and how they can use them to explore the world around them.

Scientific Enquiry work focuses on:

- Observing and describing living things, and communicating what happened in their work
- Exploring and using senses
- Opportunities to think about how to treat each other and other living things with care and sensitivity

Code	**Ideas and evidence**
1Ep1	• Try to answer questions by collecting evidence through observation.
	Plan investigative work
1Ep2	• Ask questions and contribute to discussions about how to seek answers.
1Ep3	• Make predictions.
1Ep4	• Decide what to do to try to answer a science question.
	Obtain and present evidence
1Eo2	• Explore and observe in order to collect evidence (measurements and observations) to answer questions.
1Eo1	• Suggest ideas and follow instructions.
1Eo3	• Record stages in work.
	Consider evidence and approach
1Eo4	• Make comparisons.
1Eo5	• Compare what happened with predictions.
1Eo6	• Model and communicate ideas in order to share, explain and develop them.

Framework Codes 1	Learning Objective 2	Activities 4	Resources 5	Comments 6	Time 3
	Humans				
1Bh1	Recognise the similarities and differences between each other.	Collect data, e.g. eye colour, count and interpret	ICT database for results	Assess SE skills	1:30 hr
1Bh2	Recognise and name the main external parts of the body.	Play games, e.g. Simon Says			0:30 hr
1Bh4	Explore how senses enable humans and animals to be aware of the world around them.	Introduce senses using songs and rhymes Look – magnifying glasses Listen – sounds on CD Smell – food/fragrances Feel – feely bags Taste – salty/sweet	CD – songs/ rhymes Magnifying glasses Food/ fragrances Feely bags	Assess using sensory story	2 hrs

Steps 1 and 2 Complete the framework codes and learning objectives straight from the

	Science curriculum framework and/or the Scheme of Work or long-term planning templates.
Step 3	Allocate the timings – use the suggestions given in the Scheme of Work as a guide.
Step 4	***Outline*** activities that would address the learning objective. This can include a list of suggestions; you may later choose to only do a selection of activities depending on the time you have in class.
Step 5	Consider the resources that would be needed to be able to carry out your suggested activities. Some will need pre-preparing or even buying in.
Step 6	Consider ways you might be able to assess the learning objective. You might need to plan a visit for a particular activity. You might need to think about other provision for Special Educational Needs (SEN) learners. Write these thoughts in the 'Comments' column.

Once you have arranged and ordered your objectives around the themes you can give meaningful titles to each group or 'Unit'. You should then be able to arrange these units to fit into the timings you decided on earlier. In this guide we have opted for two units per term and three terms per stage or year. A different time structure or the limitation of having to use shared resources might have an effect on the order in which you deliver the curriculum.

Now you are ready to decide what activities and resources can be matched to the learning objectives you have grouped together.

2.6 Phase 3 – Creating a Lesson Plan (Short-Term Plan)

Short term plans are for teachers to use in the classroom when delivering their lessons.

A blank template that can be used for either a single or a weekly lesson plan is provided in Appendix E. Producing lesson plans for single lessons is particularly useful when first introducing the framework. However, when teachers have become confident in their teaching, have a sound knowledge of the subject matter and know the best way to deliver it in the classroom, daily plans can become weekly.

In order to introduce the template to teachers it might be helpful to run a training exercise like the one below to familiarise all staff with the format and help them understand its requirements. It would also serve to reinforce what teachers already know about planning lessons.

Training Activity: Producing a Lesson Plan Format (Appendix A2)

This activity describes an exercise that may be carried out by groups of teachers to explore what a short term plan (for a single lesson) should contain. They can then experiment with a format to include all that they decide would be useful. Photocopiable sheets are included.

Step 7. Creating your Lesson Plan

On page 27 you will find a copy of the Cambridge Short-Term Planning template which contains the instructions for filling in each section of the plan. Spend a little time familiarising yourself with the different components.

The lesson plan is like a recipe. The quality of the ingredients will directly affect the quality of the overall outcome. In this case, good planning makes for successful teaching and an enjoyable learning experience.

Make sure that your lesson plans describe:

- What is to be taught and
- How it is to be taught

Sample short-term plans are available in Appendix C at the back of this guide.

An example of a completed short-term plan can be seen on page 28.

Step 8. Evaluating your Planning

Remember that your plans are a working document. You will need to be responsive to your learners and adapt your teaching as required. Here are a few things to consider regarding the creation and maintenance of lesson plans:

- Teachers need to keep in touch with the learners' needs and ensure learning is of good quality and that knowledge and skills are retained
- 'Over-planning' of a whole week's work can lead to inflexibility
- Sometimes lessons need to speed up, on other occasions it may be necessary to revisit an aspect of learning
- Teachers must be prepared to amend plans from lesson to lesson
- If learners' work is poor or they have struggled during the lesson, it might be sensible to revisit the work and not rush on to the next objective
- Plans should not just 'sit' in a neat folder. A good set of plans may have notes written all over them to show what went well and what might need adjustment for next time.

There is a need to try and keep 'on track' or keep up with planned work but teachers should not stick so firmly to their plans that they cannot follow an idea that is unplanned. Quite often, excellent lessons result when something happens to stop the planned lesson – a local or national event, an individual brings something into school – and the learners are interested.

Teachers should feel that they can use these stimuli to develop talk, reading or writing. Learning takes place when learners are motivated and enthusiastic.

Whilst it is true that 'unplanned' activities should not lead the teaching, it may be possible for teachers to revisit both short and medium term plans to see if any objectives can be met. In this way, a certain amount of flexibility can be allowed. At the same time it should be remembered that the time allowed for a term's units is 10 weeks – therefore an unplanned activity could happen AND the intended planning be followed as well.

Further advice on how to monitor the success of your teaching can be found in Section 3: Teaching Approaches and Section 4: Assessment. The techniques discussed can help you work active learning and formative assessment in to your lessons which will improve the feedback on your teaching.

Short-Term Plan instructions

Week beginning: gives a date reference; daily plans should add the day				**UNIT: The title of the unit of work**			**CLASS: The class to be taught**
Timing	**Framework ref**	**Learning Objectives**	**Success Criteria (Details in sub-section 3.1)**	**Activities (see notes below re: differentiation details etc.)**		**Resources**	**Evidence of Achievement**
				Description	**W/G/I**		
Breaks the total lesson time down, showing how long is to be spent on each activity	This is the code taken from the medium term plan which is from the framework document	These are selected for each lesson. There is often more than one	These are questions or statements that will be used to measure achievement (success) (See Section 4 on Assessment)	Description of the activity	W=whole class; G=group; I=individual or independent work	Materials that will be needed for the activity	A code shows what kind of evidence the teacher will use to decide if the success criteria have been met and the objective has been achieved. (see Section 4: Assessment)
Organisation: Details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
How the class will be organised; this may be just for certain activities; it should include details of differentiation / groups / adult role (linked to activities).				This where any comments should be made about how the lesson has been and whether the next session plans need to be amended. Before the lesson, as part of the planning, extension activities and homework can be listed here.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

A completed example of a Short-Term Plan for Stage 1, Unit 1.1, Ourselves

Week beginning: 1st week of term				**UNIT: 1.1 Ourselves**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr	1Bh1	Recognise the similarities and differences between each other.	I can tell you some ways in which I am the same as my friend. I can tell you some ways in which I am different from my friend.	Introductory discussion: By just looking at each other, who can tell me some way in which we are all the same/different?	**W**		**Q&A** **D**
	SE 1Ep1	**Ideas and evidence** Try to answer questions by collecting evidence through observation.	I can answer the question by counting.	How many children in our class have e.g. brown eyes? Collect data, e.g. eye colour, count and interpret	**W**	ICT database for results Or Flipchart for tallying/ IWB for recording	**D** **O** **M**
	1Ep2 1Ep3 1Ep4	**Plan investigative work** • Ask questions and contribute to discussions about how to seek answers. • Make predictions. • Decide what to do to try to answer a science question.	I can make suggestions. I can make a prediction. I can decide what to do.	Produce a bar chart showing data and ask pertinent questions to show that the children understand how to interpret it. e.g. How many children have brown eyes? How many children do not have brown eyes? How many children altogether? Which eye colour do the least children have? Etc. . .		Recording sheets (see appendix)	
	1Eo1 1Eo2 1Eo3	**Obtain and present evidence** • Explore and observe in order to collect evidence (measurements and observations) to answer questions. • Suggest ideas and follow instructions. • Record stages in work.	I can look to find out answers. I can follow instructions. I can show how we recorded the answers.				

(Continued)

Week beginning: 1st week of term				UNIT: 1.1 Ourselves		CLASS:	
Timing	Framework Ref:	Learning Objectives	Success Criteria	Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual Description	W/G/I	Resources	Evidence of achievement
	1Eo4 1Eo5	**Consider evidence and approach** • Make comparisons. • Compare what happened with predictions.	I can compare myself with others. I can say if my prediction was correct.				
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
As an introductory lesson, this needs to be very teacher-led. Any other adult support can be helpful in making and recording observations. SEN learners may need 1:1 assistance, depending on their particular level of need.				Assess SE skills: there is a lot that could be assessed here. Either choose a focus group for another adult to observe and record their responses on a checklist of skills or focus on 1 or 2 SE objective/s for a group and/or all children to make recording easier. Display the bar chart produced and refer to it throughout the week, asking pertinent questions. Homework: find out eye colour in your own family – invite them to bring in photos or send a letter home requesting that they be allowed to bring them to the next lesson.		**Q&A**: question/answer **D**: discussion **O**: observation **M**: marked work	

Notes:

- *The plan can be formatted to view a week at a time and not every lesson – **this is important to support manageability.***
- *Most of the plan is self-explanatory. It seeks to include most of the desirable elements. It is possible to expand the format to A3 but this risks the planning process taking too long for the time frame – also sometimes the detail required will be brief.*
- *Class organisation is crucial to the plan working properly including differentiation and the role of additional adults. Plans can be shared to make expectations clear.*
- *SUCCESS CRITERIA:*

  These are an essential part of planning and should be clear and manageable.

  These may be part of active assessment activities where students determine the criteria. In planning, teachers need to write a broad outline of anticipated suggestions.

SECTION 3: TEACHING APPROACHES

This section considers some of the different ways that you may choose to deliver particular activities throughout the year.

There are as many ways to teach as there are teachers! We all have our own preferences – and ways in which we feel most comfortable teaching.

Training Activity: Planning and Delivering a Lesson (Appendix A3)

In the appendices you will find a useful training exercise that helps to draw out just how many of these approaches teaching staff already practise and simply do not notice from familiarity.

3.1 Sharing the Learning Intention

Making objectives clear to learners is an essential part of giving them power over (and responsibility for) their own learning. Knowing how the objectives link together over time as an articulated whole in the medium and long term provides a kind of learning landscape, a route along which learners are travelling. The short-term plan will have selected objectives for the lesson. When delivering the lesson, the objectives need to be shared with the learners. It is at this stage that a further breakdown of the objective is needed.

First of all, the word 'objective' itself may need to be made easier to understand. 'Today we are learning to ...' is an easier phrase.

When objectives or learning intentions are shared, learners become more involved, have a better understanding of what they have to do and can comment on their own learning.

- Understanding what is meant to be learned is vital for learners
- It takes very little time and is said at the same time as any instructions are given
- The learning intention can be displayed and read together
- It needs to be made clear ... conversion to 'child-speak' may be necessary

Training Activity: Sharing Learning Intentions (Appendix A4)

In the appendices you will find a suggested training activity that has some details about how this might be done with different groups of children. This can also help with marking.

The framework makes the objectives clear to teachers at each stage.

To make objectives clearer to learners the words need to be changed.

The table below gives examples of verbs that could be used when re-wording objectives. They are *only* examples with some alternatives listed too.

***'knowledge'* = to know. . .**	***'concepts'* = to understand. . .**
– to link evidence – to recognise – to identify	– to explain – to identify – draw conclusions – make generalisations – need for repeated measurements – evaluate – interpret – consider
***'skills'* = to be able to. . .**	***'attitude'* = to be aware of. . .**
– to explore – ask and answer questions – make and test predictions – observe – take measurements – suggest ideas – follow instructions – record – make comparisons – model and communicate ideas – use simple information sources – recognise, plan and carry out a fair test – talk about – review – collect evidence – present results – discuss	– to identify – to know about

Example of rewording an objective

Objective: 6Pm4 Predict and test the effects of making changes to circuits, including length or thickness of wire and the number and type of components.

Words used: "What I want to know is if you can predict, then test the effects of making changes in the circuits you make."

Explaining the learning intention takes very little time. Finding the right words will improve with practice and need not be written in the lesson plan. A sheet of notes may be useful though. It is easier provided the learning intentions in the medium term plan are clear. The words used will also relate closely to the 'success criteria' (more on these below).

Making the wording of the objectives accessible to learners will need to be done by individual teachers as they know their learners best.

Delivery of subject content in Science is heavily dependent on specific scientific vocabulary. To assist you with this, a vocabulary list has been included at the start of each unit. It sometimes helps to present the earning intention as a question

For example, how will changing the thickness of the wire affect how your circuit works?

This question then helps learners establish the relevant success criteria. Success criteria can often be written or worded as "I can ..." statements.

For example, here the related success criteria could be:

"I can predict how changing the thickness of the wire affects my circuit".

And

"I can show and explain what happened."

Creating Success Criteria

The learners' understanding of the learning intention is developed much more fully if it is followed by an invitation to them to create **'success criteria'**. These success criteria provide a way for teachers and learners to know at what point a learning objective has been achieved.

There are many ways that this can be done.

- Whole class discussion
- Group discussion followed by feedback to whole class
- Group discussion where the task is differentiated and learners work with an adult on their own task
- Using talk partners

One of the best ways to generate the success criteria with learners is to use samples of work from, for example, the previous year.

- Select two pieces of work – one that has most, if not all of the requirements, and one that does not quite include all of them

- Ask learners to discuss with, for example, their talk partners, what they like about the work and what could be improved
- Feedback comments can be collected and the learners can decide which are the most important things to think about when doing the task. In this way 'success criteria' are produced

The learning intention and the success criteria should be displayed throughout the lesson. The criteria may be in the form of 'steps' so that learners can check their 'success' by following the pathway created by the 'steps'.

Learners work independently on the lesson task. Before finishing they can be asked to say how far they have met the criteria and record this on their work. This could also be a shared activity, if learners are grouped together in pairs creating a 'talk partner'.

Once learners are used to the routine of producing success criteria, it can happen often – not necessarily for all tasks. You may be concerned that there will not be enough time in lessons to do this. However, you will quickly discover that time is no longer wasted on repeating the task instructions because the learners now all understand what they have to do and are keen to get on and complete the task.

Giving success criteria a central role in lessons and allowing learners to produce them:

- Helps learners to gain a deeper understanding of what to do
- Gives learners ownership of the criteria so that they can create a successful 'product'
- Gives learners a basis for self-evaluation and peer evaluation
- Enables learners to become active learners

See the section on Assessment for how the creation of Success Criteria fits into formative assessment techniques.

Training Activity: Creating Success Criteria with Learners (Appendix A5)

In the appendices you will find a training activity on how to create success criteria with your learners. Teachers will find their own ways of doing this as their expertise develops

Talk Partners

Using talk partners can create a very positive atmosphere in the classroom as learners find themselves working with different people – people who they do not know that well. Teachers can decide how to organise talk partners in either a structured or a random way.

Learners are excited by getting a new talk partner at each rotation. Combinations of partners can include anyone in the class, they are all inclusive. Indeed this can often have benefits for learners with special educational needs. In addition, the use of talk partners can result in increased tolerance and respect, improved behaviour and increased self-esteem.

3.2 Active Learning

Learner-centred learning or 'Active Learning' recognises that the focus in teaching is getting learners to 'do' rather than 'listen'. This emphasises the practical nature of teaching at the primary phase. Learning by doing attaches real meaning to whatever related knowledge is being taught. Being told how to swim is after all not the same as being able to do it and as thought is an action too, we need to put it into a context, connect it to our emotions as we discover its applications. Understanding requires belief and these three simple points are a neat reminder of how that deeper learning is accessed through activity.

- I listen – I forget
- I see – I believe
- I do – I understand

It is clear that a range of different teaching strategies will be needed to provide the correct environment in which learners can develop their skills, knowledge and understanding. Included in these are methods that encourage active learning, thinking skills and independent work. The role of the teacher in planning, providing and adapting learning experiences to cover a range of learning abilities (differentiation) is central to promoting skills and knowledge development. Good differentiation is the key.

It is vital that we as teachers know exactly where our learners are in terms of what they know, understand and can do. This affects how we plan, and how we will cater for all individual learning needs.

The introduction to each unit of work provided in the Cambridge Scheme of Work outlines what should have been covered previously. For less able learners, this may mean looking at previous units of work to find activities more suited for them. For more able learners, this might entail looking at units from stages further on in order to meet their higher-level learning needs.

There are several ways in which the needs of students can be met. Planning learning opportunities in this way is known as differentiation.

3.3 Differentiation

Differentiation is when a teacher reflects on the needs of the learners and matches the teaching methods, learning tasks, resources or environment to individuals or groups. There is a variety of reasons for the range in learners' needs, but the key principle is that through differentiation all learners can become successful.

The main reasons for the need for differentiation in the primary classroom are:

– **the learner's level of ability** – this is both for supporting the less able as well as challenging the most able

– **personal styles of learning** or pace of work.

How to differentiate

There are many ways in which teachers can create or adapt teaching methods or materials to give every learner the opportunity for challenge and success.

- **By using ability groups** The most common way of differentiation is where learners are placed in high, average or low ability groups for some subjects. This can be the most effective way to help the teacher match the work to the different levels, but it sometimes causes the less able learners to develop a poor self-image, especially if groupings are rarely reviewed.
- **By using mixed-ability groups** An alternative to this method might be to group learners according to gender, age, friendship, or other criteria. This prevents stigmatisation and research has shown that less able learners work better in mixed-ability groups. However, more able learners may not reach their potential and will not necessarily be as challenged as they are in same ability groups.
- **By varying the task** This is when learners cover the same work or meet the same objectives but in different ways. For example, when learners are working on 'sorting and classifying', some might use photographs of animals, whilst others might be able to work directly from a book activity or worksheet. The most able might make up their own identification keys for others, or work using more detailed keys.
- **By varying the outcome** This is when learners are expected to reach different standards by learning through adapted learning styles or resources. Some students may need extension activities. These should be based on the same learning objective as the rest of the class and need to be very high but with realistic expectations. Challenge students to take responsibility and be independent and active and to question and evaluate their learning. At the end of the lesson they can be asked to share experiences and ideas, so that all of the class can see and hear higher level Science. In some cases they may be able to set their own success criteria.

  For example, if the class task is to write up their investigation, some whose written language is weak might record their work in simple diagrams and pictures, or use a structured worksheet. Others, whose scientific write-up skills are good, might write a more detailed report, where their conclusion comments on whether their findings support or contradict their original predictions.
- **By varying the use of resource** This is when learners have activities planned which provide for their concrete or abstract understanding. Learners at a lower level of understanding will need to work with more physical, hands-on models (that soften the level of abstraction). Learners at a higher level of comprehension will be able to work with 2D models or with written information and diagrams much more readily.

  Written work or homework can be adapted to suit particular needs if a learner needs more help with understanding the written word. Enlarged print, illustrations which provide clues to the meaning of the words or audio resources can be used.

  For example, when finding out about bones and muscles and how they work, some learners will need to look at and move jointed dolls and/or a model skeleton to aid their understanding. Others will remember what they have observed or seen and be able to relate it to discussions and further written work.
- **By giving open-ended tasks** This is often the case when giving learners an investigation. They usually start with a question, to which there are several possible answers. For example, "Which paper towel is the most absorbent?" This prompts a variety of responses to how the answer might be found and engages the learners more as they are directing their own learning when they are allowed to work in this way.

It is important that all learners have the opportunity to take part in a discussion, and can respond orally or through cards, symbols, tactile materials, specially adapted or specialised resources or with the support of an adult.

The important thing to remember is that you as teacher are aiming for the learners in your care to make progress ***at their own particular level*** throughout the year. There may be in-school targets that have to be met, but it is your job to demonstrate that ***all*** those you teach have improved knowledge, understanding and practical skills by the end of the year. This will only be possible if there is evidence of good differentiation in your lessons. This will enable you to plan for individual learning needs and to promote challenge and success for all learners in all your classes.

The following page illustrates how a lesson plan can include differentiated tasks.

Example of Incorporating Differentiation into a Short Term Plan

Week beginning: 1st week of term				**UNIT: 5.1 The Way We See Things**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr 1 hr	5Pi6	Know that we see light sources because light from the source enters our eyes.	I can name several different light sources I can explain how we see light from a source. HA I can explain and show how shadows are formed using appropriate scientific vocabulary A I can explain and show how shadows are formed. BA I can show how shadows are formed, with help.	Revise the fact that light travels by asking children to demonstrate this using torches. Explain and record how we can see light. Revise and ask the learners to demonstrate how shadows are formed.	**G/I** **W** **I/G**	Working torches Spare batteries and bulbs Collection of opaque objects	**Q&A** **D** **O** **O** **M** **Q&A** **D** **O**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Learners split into three ability groups; HA = high achievers / A = average / BA = below average Teacher to support BA. Adults other than teachers (AOTT's) to support A group.				**Note**: A common misconception is that light comes from our eyes. **Extension**: How can shadows be made bigger/smaller? **Homework**: Find some everyday uses of shadows or bring ideas to discuss where you see shadows before next week's lesson.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

SECTION 4: ASSESSMENT

4.1 What is Assessment?

As with planning, it is useful to think of assessment as three connected levels: short term assessments which are an informal part of every lesson; medium term assessments which are used to review and record the progress learners are making over time in relation to the key outcomes; and long term assessments which are used at the end of the school year in order to track progress and attainment against school and external targets.

Types of assessment

Formative:	to establish whether learners have met the learning outcome or are on track to do so. (These are both short and medium term.)
Summative:	to 'sum up' what learners have achieved. (These are long term.)

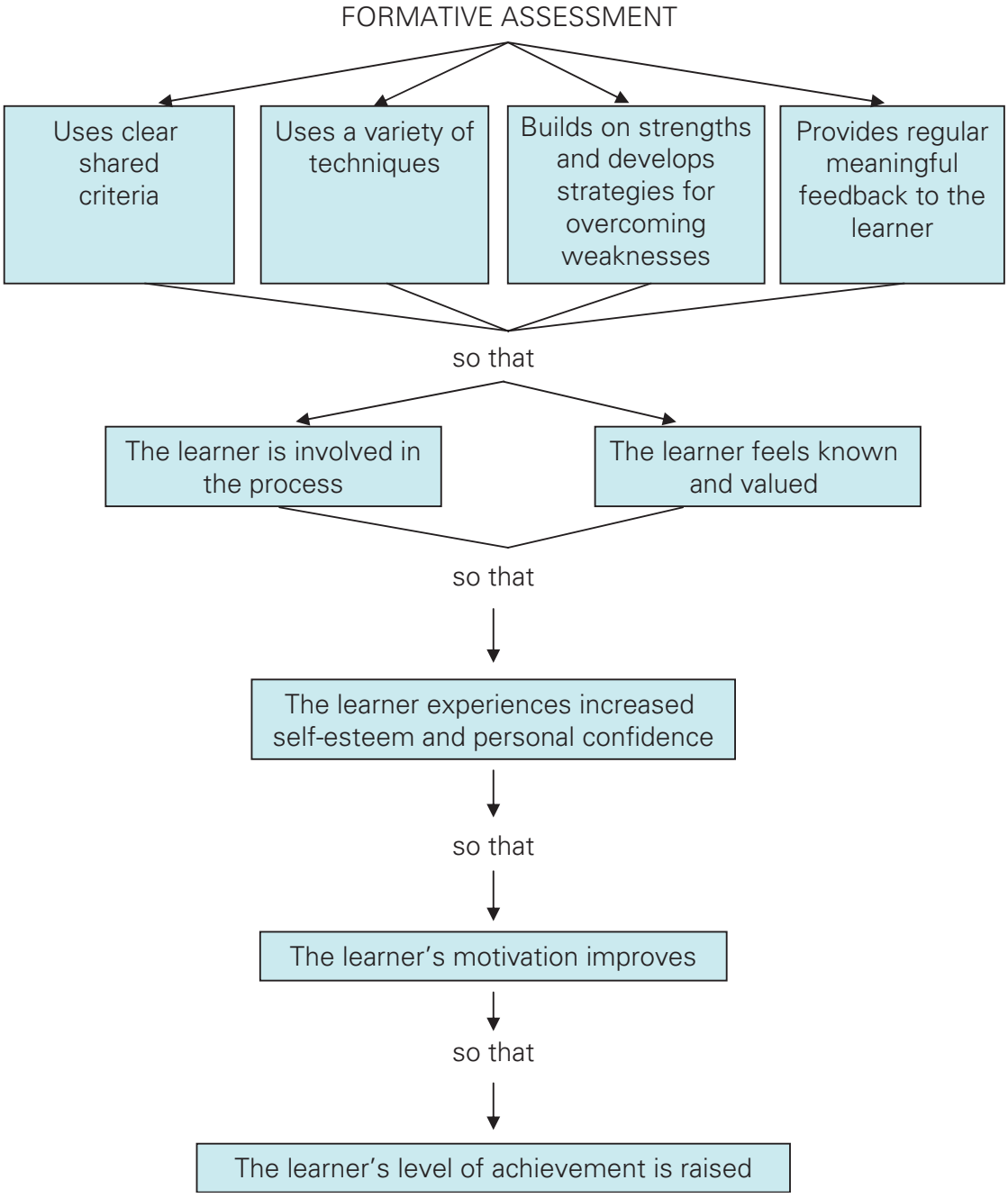
Functions

Formative Diagnosis:	to identify why learners do not understand or have difficulty with some topic or idea and to use this information to take appropriate action to correct mistakes or misconceptions.
Formative Evaluation:	to determine whether the action following the diagnosis has resolved the learner's difficulties.
Summative Evaluation:	to establish what general level of ability the learner has attained in terms of understanding, selecting and applying the knowledge and skills they have been taught. This kind of assessment is used as a means of reporting to other establishments and to parents on the actual attainments of learners.

Formative assessment is the process by which we analyse and review what a learner has learned and how they have learned it. For most teachers this process is inseparable from the actual teaching process in which everyday observations in the classroom can help build up a fully rounded picture of an individual's progress over time. Effective formative assessment involves evaluating learners' progress and making decisions about the next steps that will be required to address their development needs.

4.2 Using Formative Assessment to Raise Achievement

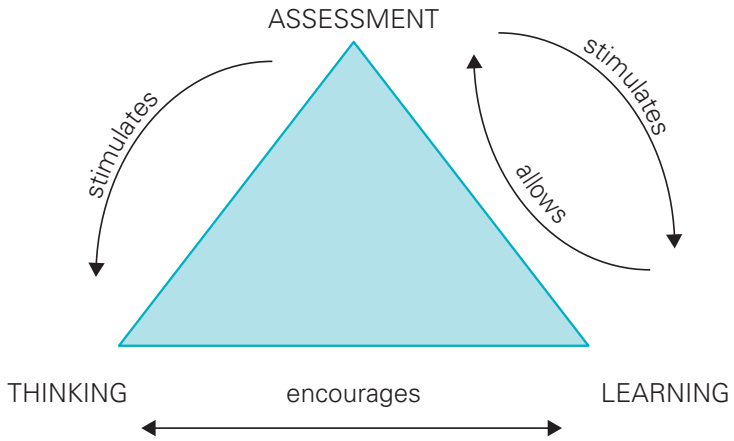
A summary of what has been said so far about formative assessment.



Assessment makes a difference to learning. Furthermore, it can make a positive difference when learners are actively involved with their learning.

The influence of assessment

In Science, thinking, learning and assessment can be linked together in a creative and integrated (combined) way. The figure below attempts to show this relationship.



Thinking encourages learning which allows assessment to take place. In turn, assessment motivates both thinking and learning.

Think back to the earlier sections of this guide and consider how some of the things we have talked about, such as involving learners in their own learning, sharing learning outcomes and creating success criteria, making use of student-centred learning etc. can be combined with the general and informal kinds of assessment you use in the classroom.

The purpose of assessment is to provide information for a variety of audiences.

Below is a summary of when and how assessment can take place.

- During a lesson: direct questioning
  interaction/discussion
  observation
- End of lesson: quick revision test (yes/no, etc)
- After lesson: making written feedback on work
  homework task
- End of unit: test or focused task (homework)
- End of year: progress tests/achievement tests

Formative assessment is therefore an integral part of teaching and learning and should not be 'bolted on' to activities. It helps to give the curriculum meaning for each learner. Furthermore, it enables each learner's learning to progress at the optimum rate.

Assessment results, whether in the short, medium or long-term view, should give direct information about learners' achievements in relation to objectives. Whether you are considering the steps required to reach a single objective or achievement of objectives over time, they should be **criterion referenced** (an agreed measurement or standard that needs to be reached – such as the 'success criteria' discussed earlier).

Such criteria should be clear and well established. The ways in which criteria are set up and used should reflect traceable routes of educational development which offer continuity to a learner's assessment at different ages: assessments should relate to **progression**. At the informal level, for example, you might want to measure how well individuals have grasped the content of a unit or lesson.

At a larger scale, say end of year tests, assessment results should be capable of comparison between classes and schools so that colleagues may share a common language and agree standards: assessments should be **moderated**.

Perhaps most importantly, learners should have a role in their own assessment. They should know exactly what is expected of them and also be able to offer a personal view of their performance. This involvement of learners is described fully in sub-section 3.2 Active Learning and further in sub-section 4.2 Using Formative Assessment to Raise Achievement.

Learners need to know:

- Where they are in their learning
- Where they are going
- How to get there

Core principles of formative assessment

- Share learning goals and success criteria, both long term and short term
- Activities must match the learning intentions
- Develop success criteria with learners
- Make the focus of the success criteria *how* they will achieve the learning intention
- Effective questioning needs to fit the purpose, giving learners thinking time
- Learners should be actively involved in self-evaluation

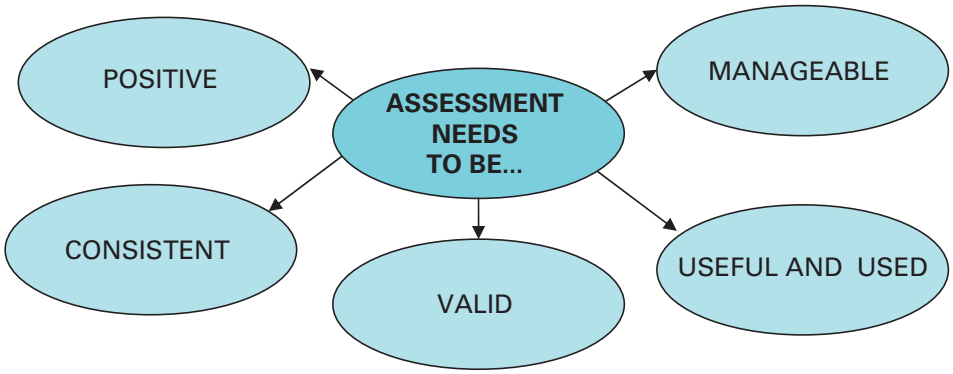
Assessment for Learning

'Assessment for learning' brings all the above ideas together as a conceptual approach. A good working outline of the concept was provided by England's Qualifications and Curriculum Authority. It has become widely accepted and runs as follows:

1. The provision of effective feedback to learners
2. The active involvement of learners in their own learning
3. Adjustment of teaching to take account of the results of assessment
4. Recognition of the profound influence assessment has on the motivation and self esteem of learners, both of which are critical influences on learning
5. The need for learners to be able to assess themselves and understand how to improve

4.3 Developing Assessment in the Classroom

This sub-section is concerned with developing strategies for assessment in the classroom. The diagram below shows the essential properties of a functioning classroom assessment.



To support development of assessment in the classroom, teachers need to build their own skills and knowledge so that it becomes an integral part of classroom practice. The following training activity enables you to identify the extent to which formative assessment is already being practised in your school.

Training Activity: Taking Stock of Formative Assessment Skills (Appendix A6)

- Take stock of what formative assessment skills already exist amongst staff – this gives everyone a chance to consider the elements of formative assessment. It is a valuable audit tool.
- You can then complete a summary sheet to show which areas you feel you need to support. (At the same time the audit also provides an opportunity for you to celebrate the skills that staff have developed already.)
- Finally, school managers can use the resulting information from the audit of skills to plan training needs for the whole school – some of these may be met by expertise already in school (shown on the individual summary sheets) or some of these may be met by the provision of an external trainer.

4.4 Assessment Techniques

There are many ways to approach formative assessment. You can identify the most appropriate ways at the planning stage and indicate them on your plans.

The amount of assessment that can realistically be carried out will be partially dependent upon the **assessment techniques** chosen and the suitability of the task for assessment. You will need to know that key aspects of the learning have been grasped in order to move on to the

next lesson or unit and you will have to decide on the best techniques for assessing these. Here are some pointers.

Assessment techniques generally fall into two broad categories:

Product – The learner must work alone for *effective* assessment to be made and the assessment is made after the task has been completed.

Process – The learner works alone but the ***process*** of learning is assessed and therefore the assessments must be done at the time that learning is taking place.

or The learner works in a collaborative group. Issues arise concerning how to identify the contribution of one learner, especially when the exercise depends on a co-operative effort by all.

We will look at assessing the *Process* first.

1. Question and Answer

Open and closed questions

Closed questions – these require definite answers. They may be "yes" or "no" responses and require very little description or explanation.

e.g. Question: What piece of equipment do we use to measure forces with?

Answer: A Forcemeter.

Open questions – these allow a range of responses and require the students to think for themselves, make suggestions and plan appropriately to find answers.

e.g. Question Which paper towel is the most absorbent?

Answers Here detail can be teased out by further questions such as "Why?", "How could you find out?" "What equipment might you need?"

Questioning provides good opportunities for ***differentiation.*** Different levels of question can be pitched at pupils of different abilities and matched to their level of reasoning. It is good to include key questions in lesson plans.

Training Activity: Using Questions Effectively (Appendix A7)

This exercise may be carried out by groups of teachers to explore the different kinds of questions that teachers might ask. It also helps teachers decide about the kinds of questions they may wish to ask in the classroom. The activity aims to promote discussion between colleagues to improve their expertise.

2. Observation

Think about what we have said concerning active learning and how it gives meaning to knowledge by placing it in the context of a rounded experience. Think about how this experience and knowledge can be linked to a wider continuum of knowledge by allowing learners to understand where they are on their learning journey.

Active and experiential learning gives you, as the teacher, the opportunity to approach a topic in many different ways at once. It also gives you the opportunity to observe how individual learners learn, which topics they learn best and in what particular way they learn best. This can inform your planning in terms of their development and also in terms of improving your own delivery over time.

Think what makes an impact on a young learner's mind:

seeing? * thinking? * hearing? * feeling? *

These might translate approximately into:

practical activity

investigation

problem solving

game

You will need to consider *how* any observation is to take place, such as:

The physical location of the teacher

- The teacher sitting with a group of learners where any participatory role is 'outside' the assessment to be made
- The teacher sitting with a group of learners where the role is passive and understood by the learners. Should any intervention be necessary to extend explanations etc., then it must take place because assessment is NOT about creating a threatening situation that may prove intimidating for a young mind. It is about being part of a positive learning experience. (The assessment may continue even if adjustments have to be made to the main objective and anticipated outcomes.)
- The teacher sitting away from the learners but in a situation that can fulfil the requirements of the assessment

The learners being assessed

- Learners must be involved, as with all assessments, with the relevant criteria at the outset of the activity
- Issues concerning collaboration must be addressed positively. As a means of promoting learning, learners need to interact and this should not be dismissed in terms of making valid assessments. Attention may be focused so that these issues are not perceived as a problem but as a positive contribution to the learning process. In this respect, the professional judgement of the teacher plays a crucial role in determining what each learner has achieved.

Techniques 1 and 2 (question and answer, and observation) are of the 'PROCESS' type where concentration on a single learner or small group is required for a short time. The number of assessment decisions is restricted to one or a small number of objectives.

Technique 3 below is of the PRODUCT type. Much of it can take place outside the classroom. This allows recording of decisions away from the restrictions of the classroom. A larger number of objectives may be tackled. At the same time it must be emphasised that marking work **with** the learner can be an example of excellent practice.

3. Giving Feedback

Feedback may be oral or written. All feedback should be positive and meaningful to learners. We are constantly giving our learners feedback. Our response to their contributions in questioning sessions or discussions may be oral but it can also be non-verbal – a smile or a gesture. There are countless examples of when we do this – a smile at the beginning of a lesson, a nod of the head. Below are listed a number of different techniques of giving feedback.

a. Oral feedback

Oral feedback is potentially the most effective form of feedback. Getting learners to talk together before answering questions increases their achievement. It is the most natural and frequent feedback experience for them. The language of the classroom has an enormous impact, and should create an ethos where speaking freely about learning is positive. Teachers' oral feedback needs to be focused mainly around the learning objective and success criteria for the lesson, and is therefore focused. Feedback can be given to an individual, to a group or to the whole class. Where verbal feedback has been used to give a response to written work the task could be annotated V.F. (verbal feedback) and initialled by the marker.

b. Non-verbal feedback

This is very effective, particularly with very young learners, and the competitive element really motivates reluctant learners in all stages. It takes the form of reward systems, or positive signs to show that the teacher is pleased with a learner's response/s. Examples include the use of a smile, thumbs up, a stamp or sticker on their work, or a star or team-point on a class or individual chart. Sometimes these rewards are offered alongside incentives, for example, the learner with the most receives a small gift at the end of term.

c. Distance marking

This should be positive, clear and appropriate in its purpose – it needs to offer positive benefits to staff and learners, and the outcomes need to be fed back into planning. Most effective feeedback occurs when the work is shared together face-to-face, but if this does not occur, and the work is looked at away from the learner, the following should be considered:

Can the learner read your comments?

Can the learner understand your comments?

Do you allow them time to read your written comments?

Do you allow time for some improvement on the work to be made before moving on to the

next activity, or do you expect them to be able to transfer your improvement suggestions to another piece of work in a new context?

d. Acknowledgement marking

This is a courtesy look at the work, and may include a tick or an initial. It implies that some dialogue took place during the lesson, which will have had impact on their learning. The acknowledgement simply informs others that the work has been dealt with orally, in a group or whole-class setting.

e. Closed exercise marking

This is where the work is marked together, and therefore fewer examples of the work have been given. Learning is the priority, and misconceptions or errors are shared and not reinforced. Answer cards may be given to the learners to correct their own work, if it has been differentiated. Where this method has been used in class time, the learner marking the work will annotate it with their initial.

f. Motivational marking

Some learners seek confirmation from the teacher that they are achieving. We need to encourage intrinsic motivation where the learner can identify their own successes first, then celebrate with them. As a general rule this marking should be as positive as possible.

g. Response partners

This is when two learners discuss their findings, thoughts, ideas or answers together before giving a response to the class or the teacher. They can be paired, in mixed ability or ability groups. It engages everyone in the lesson, develops collaborative and active learning, clarifies thoughts, and it makes it a 'safe to talk' environment. It can occur in the introduction, independent work and plenary. A response partner helps you with your work, offers you a reflection on your work and helps you to make your work better.

h. Quality marking

This is when success and improvement needs are highlighted against the success criteria. Asking for some small improvement is rich in its impact on a learner's work and their attitude to improvement and learning. This would not take place for every piece of work, and with training and modelling by the teacher, learners can be encouraged to mark their own and each other's work using this approach. This approach can be done orally, especially with younger learners, as well as written.

i. Self and peer assessment

Learners should be involved as far as possible in the analysis and constructive criticism of their own work. We should encourage them to use self-evaluation continually, so that reflection, pride in success, modification and improvement become a natural part of the process of learning.

Peer assessment and self assessment are much more than learners marking their own or each

other's work. To improve learning, it must be an activity that engages them about the quality of their work and helps them reflect on how to improve it. Peer assessment enables learners to give each other valuable feedback so they learn from and support each other. It adds a valuable dimension to learning: the opportunity to talk, discuss, explain and challenge each other enables them to achieve beyond what they can learn unaided. Peer assessment helps develop self assessment, which promotes independent learning, helping learners to take increasing responsibility for their own progress.

Further advice on marking

Time spent giving written feedback must lead to improving the learner's work. Sometimes a frustrating aspect can be when they keep repeating the same errors all the time. Written feedback strategies need to make it quicker and more effective.

Written feedback has other key functions.

- It can show what needs to be taught next. Often, the same error may be identified – perhaps this can form the basis of a whole class discussion. Feedback from marking should be planned into the next session. Learners need to become used to feedback as a way of learning. They can often make improvements straight away to their work
- It also shows teachers how successful their teaching has been – it is easy to identify when a lesson or activity has not contributed to the learning
- A positive outcome is the way that plans for the next lesson will be amended

When giving written feedback on work:

- A highlighter pen can be used to show where the written work has been particularly successful
- If the learning intention has been written, pages of work can become more meaningful both for the learner and for the teacher when reviewing the work at a later date. A brief comment can be written against the learning intention to say whether it has been *very well achieved* or *achieved*. Not achieved is a very negative comment. *Needs more help* or *partly achieved* sound much better. A system of codes could work just as well. At the same time, a comment directed to the learner is important, for example*, This is a very structured and well presented report, Anna, I have enjoyed reading it. Thank you*
- Where the learning intention is not written down, a written feedback comment at the end of the work needs to be written that includes the wording of the learning intention, for example, You have managed to draw a conclusion and make further predictions from it very well. If sticky labels are used for students who are not fluent writers, the words suggested above may be used
- To save time-consuming record-keeping, a triangular corner of the page may be folded and coloured to show that the piece of work shows achievement of the particular objective. (The word version can be written at the beginning by older students. For younger learners a code, for example, 2Eo8, could be written by the teacher when giving written feedback on the work. Schools and teachers will have their own systems of record keeping – it is worth remembering that annotating written feedback in ways similar to those suggested above saves a lot of paperwork!

Many of the strategies described above, especially in self and peer assessment are examples of where active learning and assessment can happen.

4.5 Assessment Available from Cambridge

As part of Cambridge Primary, end of stage tests (Progression Tests) are provided for stages 3–6. These are available from the Cambridge Primary support site.

Progression Tests

These are for use within the classroom to measure the progress of the learners and identify strengths and weaknesses**.**

The tests are designed to be flexible and can be used to:

Assess the performance of the learners against the learning objectives in the curriculum framework. The Progression Tests are produced to precise specifications to ensure a representative coverage of skills and knowledge. The tests assess learning objectives from the entire stage and so should be used when teaching is complete. However, it is preferable that they are used when there is still time left in the term to provide learners with feedback, help them reflect on their achievements and consolidate the year's work.

Diagnose strengths and weaknesses. The results of the tests should be fed back to the learners. It is important that they know their strengths as well as being aware of the areas where they are weak. Feedback should always be constructive and should include practical advice on how to improve areas of weakness.

Examine progress from one year to the next. The Progression Tests can help you see whether learners are progressing at a steady rate or better, or worse, than expected. The comparison against an external standard means that even the weakest learners can show progress, which may have been overlooked if these learners were always compared with their stronger peers. Similarly, lower than expected performance in an able learner can be identified and investigated.

Inform planning. The results of the tests can be used to reflect on their teaching over the year and prompt changes for subsequent years. If there are areas where the entire class appears to be strong or weak, the teacher should consider the strategies used for those areas and adapt them as necessary. The data from the tests will also be of value to the following year's teachers to provide them with information about prior knowledge of the learners entering their classes. Alternatively, it is possible to give the test for the previous stage at the beginning of the next stage to determine the 'starting point' of the learners and identify any areas of weakness that need to be addressed.

Assist reporting to parents. The results of the progression tests can be combined with the teacher's own observations to produce informative reports to parents. Parents want to know how their child is doing and the results of the tests provide quantitative evidence of this. Reports should include areas of strength as well as areas where improvement is needed.

Administering the Progression Tests

You can administer the progression tests through the Cambridge Primary support site (**https://cambridgeprimary.cie.org.uk**). The site allows you to:

- set up different learner groups
- access the Progression Test papers and store marks
- generate reports to track learners' progress by comparing individual results against the rest of the class, the school or other schools around the world
- compare results on a year-by-year basis
- generate reports to help you reflect on your teaching practice, making relevant changes to focus your efforts where they're needed most
- download, print or email your analysis reports to share with other teaching staff and parents
- access your account on different devices

Making use of the reports

These are useful analyses to gain an overview of the strengths and weaknesses in the whole group. They enable teachers to consider factors that might affect this. It is always a good idea to begin by reviewing the planning for the objectives where the weakness was shown, for example:

- Was a reasonable amount of time allowed for delivering the objectives?
- What do the notes say on the planning following the lessons?
- Was a balance achieved between whole class and differentiated tasks?
- Were there any activities which could be described as favouring either boys or girls (gender bias)?

It may be that the planning check alone does not directly reveal the possible reasons for any weaknesses shown in the reports. If this is the case, we need to consider the response of the learners and their performance in class. This could still lead back to planning.

It is possible that the content of a lesson was too difficult for some learners. If so, some amendments should be made to the original plans. Doing this does increase pressure on 'finishing' the set of lessons for the objectives in question. However, time spent revising materials can save time when new objectives are introduced because they will be delivered on a firmer base of understanding.

It is also important to check the areas that were strengths because some 'extra' time could be gained by reducing the input for these areas. This has to be carefully judged as you do not want to reduce the standard in those areas.

A content review for areas of weakness may show that the chosen activities were not as stimulating as others. This will affect learners' responses quite significantly.

All of this analysis will provide information that can help you improve the planning and teaching for the following year. Although groups of learners will vary from year to year - the review process needs to be ongoing to allow learners to gain a firm grasp of concepts and methods and should not be seen as a procedure that simply follows the tests.

The tests assess learning objectives from the entire stage and so should be used when teaching is near completion. Lessons following the test period will need careful planning so that learners can target the particular weaknesses identified in the reports. Differentiation is the key to the success of these lessons. The reports may show similar problems for groups of learners which will help with organisation – groupings created for this may change from lesson to lesson. Using adult support is essential.

More able learners can have a set of lessons prepared that extend their skills and understanding whilst ensuring that their areas of weakness are picked up as well.

Learners can have their own set of targets. These should be set up as part of regular practice in class. Setting up success criteria will support this as well as other self assessment tools so that learners are involved at all times.

For target-setting to be successful targets should be **S**pecific, **M**easurable, **A**chievable, **R**ealistic and **T**ime-bound (i.e. SMART). They also need to focus upon key priorities.

Cambridge Primary Checkpoint tests

Cambridge Primary Checkpoint are additional (end of Primary) tests available to Cambridge Primary schools. These are intended for learners at the end of their final year of primary education, when they are around 11 years old. They provide an assessment for learning objectives from stages 3–6 of the curriculum framework.

They provide a form of detailed, diagnostic feedback that is a central feature of Cambridge Primary Checkpoint.

Feedback is provided at the level of individual learners, teaching groups and whole school.

Details about Cambridge Primary Checkpoint (including specimen papers) are available from **www.cambridgeprimary.cie.org.uk**

SECTION 5: INFORMATION COMMUNICATION TECHNOLOGY AND SCIENCE

ICT is a valuable resource which should be used appropriately to help develop students' scientific knowledge, skills and understanding. It is important however, to consider where ICT may add value to the learning over other non-ICT resources.

Planning

As with all planning, start with the objectives.

Questions about ICT linked to the objective might follow:

- Will using ICT develop the activity?
- What software is available that can be matched to the objective?
- Is it age-appropriate?
- How will using ICT affect the pace of learning?
- Will I use it for the whole class?
- What about differentiation?
- Will it be better for groups or individuals to work on differentiated tasks?
- Do I need to be involved with a group working on an activity on the computer?

These are just examples of the questions you may think of. The answer to the final one is an interesting one as learners need support with all assignments – careful planning should show how your movements during the lesson can include this for some or all of the participants just like any non-ICT activity.

Your answers will reflect what is available in terms of hardware – one computer per class? An interactive whiteboard (IWB)? A computer suite?

Example 1 a Stage 3 knowledge-based objective:

3Bp1 Know that plants have roots, stems, leaves and flowers

At the planning stage, you will have asked similar questions to these:

What skills and/or knowledge does this objective require?
What activity/activities would best fulfil this objective?

Now you also need to ask:

Would using ICT add any value to this activity?

(Remember – the learning objective is the driver for the lesson, not the activity.)

This is ***your*** planning and you choose the best ways to present activities.

The opportunities for ICT in the Primary Science Framework suggestion for this objective are:

Use simple simulation software to identify and label the common parts of a plant.

Now you need to ask:

Is this suggestion useful for the activities I am planning?
Can I use it for introduction/explanation/demonstration/assessment?

It could be that you have decided to have the learners looking at different kinds of flowering plants (real and imitation) and that you decide that this first-hand activity is better than that offered in the ICT suggestions. That's fine.

However, the ICT suggestion ***could*** provide an activity for a less able group working with an adult to be able to achieve the objective after they have done the practical activity.

Another alternative to incorporating this ICT suggestion is for it to be used as a quick assessment activity for individuals/groups in the plenary at the end of your lesson.

So the suggestions given are for you to consider in the light of your own teaching – and to use them selectively and flexibly.

The same process can be applied for any learning objective.

Example 2 a Stage 3 skills-based objective

3Bp5 Know that plant growth is affected by temperature

At the planning stage, you will have asked similar questions to these:

What skills and/or knowledge does this objective require?
What activity or group of activities would best fulfil this objective?

Now you also need to ask:

Would using ICT add any value to this activity?

(Remember – the learning objective is the driver for the lesson, not the activity.)

This is ***your*** planning and you choose the best ways to present activities.

The opportunities for ICT in the Primary Science framework suggestions for this objective are:

1. ***Place plants in locations with different temperatures and use dataloggers to track the temperature over a set period.***
2. ***Use a digital camera to record the plants at the beginning and end of the experiment.***
3. ***Present the pictures and the downloaded datalogger records. Discuss the findings and draw conclusions.***

Now you need to ask:

Is this suggestion useful for the activities I am planning?
Can I use it for introduction/explanation/demonstration/assessment?

It could be that you have decided to have the learners observing flowering plants in different locations around school over time.

The use of dataloggers here would avoid much confusion and collation of results. If you are more interested in how the learners interpret results then using the dataloggers would be an ideal, time-saving opportunity for the results to be gathered.

However, the suggestion of taking before and after pictures ***could*** provide an activity for a less able group working with an adult to be able to achieve the objective. It is perfectly acceptable for an explanation to be based on observation, rather than mathematical data sometimes.

So the suggestions given are for you to consider in the light of your own teaching – and to use them selectively and flexibly.

Opportunities for ICT in the Primary Science Framework

Appendix D of this guide lists ICT opportunities and suggestions for use within Science. Please note that the activities in the scheme of work have been written to be carried out without needing ICT facilities.

SECTION 6: THE LEARNING ENVIRONMENT

6.1 Classroom Organisation

There are many different ways of organising the classroom when teaching Science. Over time, a mix of all the approaches outlined below will prove suitable – depending on the nature of the work being undertaken, available resources (including time), the abilities of the learners, and the teacher's personal preference.

Strategies for the Effective Management of Learning

Classroom Organisation	Advantages	Limitations
Whole Class Teaching Discussion Demonstration Watching DVD/TV	Easy to organise. Economical in terms of resources required.	No opportunities for first-hand experience. Not matched to the learners' abilities. Difficult to involve the whole class.
Practical Work Children work in small groups doing similar tasks. Resource demands are known.	Easy to plan ahead. Provides opportunities for first-hand experiences. May need a lot of equipment. Can be matched to the children's abilities. Easy to compare observations between groups. Facilitates easy record-keeping.	Follow-up may prove difficult.
Circus of Experiments Small groups of children rotate around classroom during the lesson, trying out a variety of activities.	Easy to plan ahead. Offers opportunities for first-hand experiences. Less demanding in terms of resources.	Activities cannot be sequential. Assumes equal time for all activities and all groups. Makes record-keeping more difficult.

(Continued)

Classroom Organisation	Advantages	Limitations
Thematic Approach Small groups work independently to contribute to the whole theme or topic.	Learners work at their own pace. Provides opportunities for first-hand experience. Leads to good communication.	Difficult to arrange a balanced experience of Science. Difficult to ensure coherence. Difficult to ensure that the rest of the class understand.
Individual Topics Individuals or small groups work on items selected by themselves.	High motivation. First-hand experience. Pupils work to own potential. Good for a Science Club.	Demanding on teacher. Structured framework necessary. Difficult for lower ability students. Stretches resources.

Use your discretion to choose which of the above approaches will best suit the learning situation for the lesson planned. This will enable the classroom to be managed, with learning opportunities facilitated in different ways – according to desired outcome.

Once the organisational method has been chosen, it is important for you to then decide how you will support, guide and assess during the session and to identify this in the lesson plan for each session.

How can I support learners during an activity?

This needs to form the basis of your lesson plan.

Here is a list of things to think about when planning.

Can I support and guide by:

- Working 1:1 with an individual?
- Working with a small ability group and asking relevant questions to scaffold their thinking?
- Differentiating work by giving different groups different outcomes to work to?
- Organising them to work in mixed-ability groups, where more able learners help less able learners?
- Providing appropriate worksheets/recording sheets to facilitate easier recording?
- Giving them different activities?
- Using any other available adults to work alongside particular individuals/groups?
- Moving between groups and acting as facilitator?
- Challenging more able learners to extend their thinking?

Can I assess by:

- Observing and recording individual responses?
- Questioning a particular group, e.g. boys, middle ability learners?
- Giving immediate verbal feedback?
- Giving written feedback on their work?
- Setting questions in the same context and asking them to apply what they have learned in a new situation?
- Giving a formal test?

These decisions need to be included in your lesson plan so that any other adult who needs to be involved in the lesson can be included and is made aware of their role.

6.2 Creating a Positive Atmosphere

All of the above should set the classroom scene. The role of the teacher in creating the atmosphere in the classroom is central to everything that happens to promote teaching and learning.

Teaching approaches should be consistent. Learners will struggle to engage in active learning where they work with talk partners and groups if they are usually discouraged from talking. Creative thinking would be difficult in a classroom where this is not encouraged. Working in a group is not easy if learners are used to working individually.

Excellent active learning activities resulting in such positive assessment practices will not take place in a 'non-productive' atmosphere.

The best assessment for learning will happen where the teacher creates an environment where everyone is comfortable and familiar with routines. Learners will respond to all kinds of activities if the atmosphere is one that encourages them to participate fully in developing their learning.

The role of the teacher will be to:

- Ensure that learners take an active role in the learning process
- Show appreciation of everyone's ideas
- Encourage everyone to give good reasons for their ideas
- Involve everyone in discussions
- Inspire confidence in their learners to test their own ideas
- Make sure they have enough time to explore ideas properly
- Help learners to work together and share their ideas with others and to appreciate the ideas of others
- Encourage them to make their own decisions
- Use varied questioning techniques and encourage learners to think of their own questions
- Make learning Science enjoyable and fun

SECTION 7: SUPPORT AND RESOURCES

7.1 Resources from Cambridge

Cambridge Primary centres receive access to a range of resources when they register. The Cambridge Primary support site (**https://cambridgeprimary.cie.org.uk**) – is a password protected website that is the source of the majority of Cambridge-produced resources for the programme. Included on this website are:

- Curriculum Framework
- Progression Tests and analysis tools (see Section 4)
- Schemes of Work – these give a recommended course outline where teaching objectives are organised into a recommended teaching order. A brief outline of activities to achieve these objectives is provided. Some resources are recommended here
- Editable versions of the Planning templates in this guide

7.2 Training Available from Cambridge

Online Training Opportunities

An online introductory course is available free to Cambridge Primary centres. Details including the enrolment key and instructions on how to access the course are sent to the main Cambridge Primary Co-ordinator at your centre upon registration and are also available from the Cambridge Primary support site. The course is self-study and as such can be completed at any time when you first register for Cambridge Primary. It provides an introduction to Cambridge Primary, the Cambridge educational philosophy and the services and resources available to Cambridge Primary centres.

Additional online tutor-led courses are also available. These courses will be advertised on the events page of the Cambridge public website at **www.cie.org.uk** as they become available through the year.

Face-to-Face Training Opportunities

Face-to-face training is available in the form of workshops and lectures covering structure, planning and teaching strategies. To see what training courses are currently available in your region go to **www.cie.org.uk/events**

You can email Customer Services via **info@cie.org.uk** or call us on **+44 1223 553554** or on **01223 553554** if you are in the UK.

If you would like to discuss bespoke training please contact our Training Services Team at **trainingservices@cie.org.uk**. Bespoke training events can be arranged for either individual schools or for a collaboration of schools in a particular region. Please be aware that prices for bespoke training (beyond a basic minimum charge) will be negotiated on an individual basis according to requirements.

7.3 Support with Administration for Cambridge Primary Checkpoint

There are three key documents that will be sent to your Cambridge Primary administrator on an annual basis.

- Handbook for Centres
- Cambridge Primary Checkpoint Administrative Guide
- Procedures for the Submission of Entries booklet

These documents are made available on CIE Direct.

CIE Direct **https://direct.cie.org.uk** is the online tool for Cambridge Examinations Officers and Administrators to submit and amend your Cambridge Primary Checkpoint entries.

7.4 Enquiries

Ask CIE

Ask CIE is an online bank of answers to frequently asked questions about Cambridge examinations and services. The next time you have a question about administering Cambridge examinations, just go to Ask CIE. Simply type your question into the search box, or use the menu to guide you. There is also a Noticeboard on the Ask CIE homepage to alert you to important announcements. You can find Ask CIE on our website at **www.cie.org.uk**, or go direct to **www.ask.cie.org.uk**

Customer Services

You can also email us via **info@cie.org.uk** or call us on **+44 1223 553554** or on **01223 553554** if you are in the UK.

7.5 Resources Recommended by Cambridge

The Cambridge Primary support site gives details of materials currently endorsed or recommended by Cambridge. These materials have been approved to support the delivery of the Science framework and their content has been checked against the framework. Recommended schemes are useful as a set of resources from which teachers can select appropriate activities. Endorsed schemes are able to support Cambridge Primary comprehensively in all aspects. As publishers create new or updated materials, we review them and list these items on the website. Please note these items must be bought direct from the publisher, or from a bookseller.

APPENDIX A: TEACHER TRAINING ACTIVITIES

The following pages include training activities referred to throughout the guide.

A1 Agreeing Terminology

A2 Producing a Lesson Plan Format

A3 Preparing and Delivering a Lesson

A4 Sharing Learning Intentions

A5 Creating Success Criteria with Learners

A6 Taking Stock of Formative Assessment Skills

A7 Using Questions Effectively

Training Activity A1: Agreeing Terminology

Workshop session to agree terminology.

This is a very short activity which should lead towards a discussion that reaches an understanding of the different levels of planning.

Objectives:

To identify different levels of planning

To identify their purpose

To obtain an oversight of different terminology

Instructions:

Explain activity using Training Activity A1: Handout sheet (photocopiable overleaf)

- Consider all of the terms used in planning and display them

  e.g. long term

  short term

  scheme of work

  unit of work

  framework

  lesson plan

- Individuals or groups use the sheet to make notes identifying different planning levels and terminology and what they mean
- Discuss at end to reach agreement

The value of this activity is in working through the task and not so much the outcome. The discussion will make the levels of planning clearer.

At the end, leaders of the activity may wish to share the definitions as given in this guide. A shared understanding will make the guide easier to follow.

Training Activity A1: Handout

Objectives:

- To identify different levels of planning
- To identify their purpose
- To obtain an oversight of different terminology

LESSON PLAN FORMAT

Long Term Planning

Medium Term Planning

Short Term Planning

Training Activity A2: Producing a Lesson Plan Format

Objective:

To produce a format for lesson plans

Instructions:

- Handout 1: invite colleagues to list as many of the areas they think should be included on a lesson plan as possible.
- Collate ideas on flip chart to gain some kind of consensus
- On A4 paper work out a possible format to include all of vital material
- Distribute Handout 2 with more details either during activity or as part of plenary
- Distribute Handout 3 as a sample format following discussion

Possible inclusions that may be suggested:

Objective(s)

Success criteria – statements that support assessment (whether or not an objective has been achieved – see Section on Assessment)

Activity (ies)

Organisation

Any special arrangements / groups

Roles of different adults (including teacher)

Resources etc.

Training Activity A2: Handout 1

Objective:

To produce a format for lesson plans

LESSON PLAN FORMAT

WHAT SHOULD IT INCLUDE?
•
•
•
•
•
•
•
•
•
•

What could it look like?

Design a format for lesson plans. Include all of the appropriate headings and spaces for completion.

Training Activity A2: Handout 2

Information for formatting short-term plans

Activity/lesson plans (for a single lesson or related lessons in a subject, taught over the course of a week) should show:

- Detail of the planned activity, including points to be covered by the teacher in introducing tasks and supporting the learners' learning during and after each lesson
- Key questions to be covered/addressed during each activity
- A breakdown of specific tasks in detail (steps the learners need to go through, rather than the overall activity)
- Differentiation and grouping of the learners, and any relevant staffing details
- Details showing how the lesson(s) will link to existing provision for special educational needs, such as learning support assistants or individual education plans
- Information about hours needed for the activity
- Resources needed for the activity
- Learning objectives
- Expected learning outcomes
- Success criteria – descriptions/statements to measure whether the learning objective has been achieved
- Assessment opportunities
- Space for notes about specific group or individual performances

Annotating the short-term plan should also support the teacher in preparing subsequent activities in the medium term plan, in response to the learners' performances or the outcomes of the task.

Training Activity A2: Handout 3

Week beginning:				UNIT:		CLASS:	
Timing	Framework Ref:	Learning Objectives	Success Criteria	Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual Description	W/G/I	Resources	Evidence of Achievement
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
							Q&A: question/ answer **D**: discussion **O**: observation **M**: marked work

Training Activity A3: Preparing and Delivering a Lesson

Objective:

This is a motivational exercise to share experience and build confidence.

Instructions:

Distribute sticky labels or 'Post It' notes. Ask colleagues to think of all the different things they do when preparing and delivering a lesson. Invite them to write each one on a separate label or note and stick it on a large sheet of paper displayed for all to see. The following discussion can be very entertaining but it has a serious side too in recognising all of the skills that a teacher has to practise in the classroom . . .

The list below is just a sample that might come from Activity 3.

They are not presented in order of importance:

- Preparing lessons / resources
- Instructing a class
- Letting learners talk
- Making tasks accessible to all
- Sharing achievements
- Giving praise and rewards
- Asking questions
- Setting tasks
- Marking work
- Leading discussions
- Sharing learning intentions (objectives)
- Setting homework
- Setting targets
- Letting learners take the lead
- Observing learners
- Discussing with groups
- Discussing with individuals
- Helping an individual
- Explaining things
- Answering questions
- Offering reassurance

The list can go on and on.

It is possible that all of the above could occur during one lesson. Good management of time, resources and, most important of all, the learners, can make it all happen!

Training Activity A4: Sharing Learning Intentions

Objectives:

- To learn how to convert a range of learning objectives into child-friendly language
- To learn how to write appropriate success criteria
- To be made aware of the many ways in which learning intentions can be presented to learners

Instructions:

1. Refer back to page 32 in Section 3: Teaching Approaches. Select a range of learning objectives from the curriculum framework that clearly represent the following categories of activity:
   - To know
   - To understand
   - To be able to
   - To be aware of
2. Ask teachers to re-word these objectives using child-friendly terms.
3. Refer back to pages 33 and 34 of Section 3: Teaching Approaches and ask teachers to suggest appropriate success criteria for each objective.
4. Give out Handouts 1 and 2. Ask teachers to suggest a range of methods in which learning intentions can be presented to a whole class, differentiated groups, younger and older learners etc. A list of possible methods can be found below.
   - Verbally – not always as successful as a visual method which remains available throughout the session
   - Writing on a black/whiteboard/flipchart – the simplest way (older learners may copy this into their books/working sheets)
   - Completing a chart and displaying for all to see
   - Saving it on a computer for display on an interactive whiteboard
   - Having a set of pre-printed sticky labels for each learner's book – useful for younger learners
   - Write on an individual or group sheet to display on the desk (good where tasks are differentiated and objectives are different)

Charts or posters might look like something like those suggested in Handouts 1 and 2.

Training Activity A4: Handout 1

Today we are learning to

write learning intention here

We'll know we've done this because

list success criteria here

Training Activity A4: Handout 2

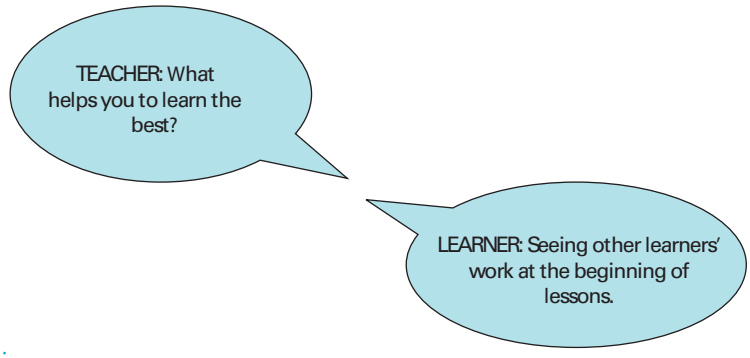
Learning Intention

A more formal approach may appeal to older learners

We will know we have achieved this because. . .

Success Criteria

Training Activity A5: Creating Success Criteria with Learners



Objective:

To plan and deliver a lesson in which learners write their own success criteria.

Instructions:

Stage 1: Planning

- Learning objectives selected
- Create own estimation of success criteria
- Prepare samples of previous work – good and not so good

e.g. writing; artwork; photographs; 3D objects; video clips of P.E., games, drama

- Plan good (open) questions that will get learners (in talk partners) thinking and discussing the subject matter of the learning intention. (Responses may reveal some misconceptions)

Stage 2: Lesson Delivery

- Introduce lesson
- Give task instructions
- Share learning intention
- Ask questions to promote discussion – record success criteria
- Share work samples: what can you see? Compare and check against list . . . this may add or subtract items
- Display the agreed list in ways already described
- Learners work on task referring to criteria as they work
- Invite learners to share work with class / talk partner
- Learners make improvements
- . . .and finally:

  Plan a discussion at the end that:

  – Summarises the learning
  – Selects examples where improvements have been made
  – Refers to the next step / learning focus

Training Activity A6: Taking Stock of Formative Assessment Skills

- Take stock of what formative assessment skills already exist amongst staff – this gives everyone a chance to consider the elements of formative assessment. It is a valuable audit tool. You will find the elements listed helpfully in a document below
- You can then complete a summary sheet to show which areas you feel you need to support. (At the same time the audit also provides an opportunity for you to celebrate the skills that staff have developed already.)
- Finally, school managers can use the resulting information from the audit of skills to plan training needs for the whole school – some of these may be met by expertise already in school (shown on the individual summary sheets) or some of these may be met by the provision of an external trainer

Notes on the survey form.

- This form is to enable teachers and schools to consider which elements of formative assessment they feel most comfortable with and also to help identify where further training would be helpful
- The prompts are generic to suit teachers of all year groups and some may not be relevant to the Foundation Stage, for example. If this is the case please put "not applicable" in the comments box

Desirable Outcomes	Always	Sometimes	Never	Comments
I write clear learning intentions in my medium term planning.				
I write clear learning intentions for each Science lesson on my weekly plans.				
I write clear learning intentions for every lesson or activity I plan to do.				
I share my learning intentions with the learners both verbally and in writing.				

Desirable Outcomes	Always	Sometimes	Never	Comments
My learning intentions are put into "child speak" so they can be understood.				
I identify the success criteria for the lesson and share them with the learners.				
The learners identify the success criteria when the learning intentions have been shared.				
Learning intentions and success criteria are clearly displayed.				
Sharing learning intentions has become an expectation for the class.				
I tell the class the reason for doing the activity (the aside).				
Class write the learning intentions in their books (where appropriate).				
Class or learners are able to say the learning intention to each other or the teacher.				
I am using the learning intentions and success criteria as part of my feedback strategy.				
I take time to teach learners to be self-evaluative.				
Learners are involved regularly in evaluating their own success.				

Appendix A6

Desirable Outcomes	Always	Sometimes	Never	Comments
I give oral feedback during the lesson based specifically on the learning intention.				
In my marking, I indicate where the learner has met the success criteria.				
I show where some improvement can be made.				
I write a 'closing the gap' prompt to help learners make the improvement.				
Learners are given time to identify their own improvement.				
I give learners specific time to read my written feedback and respond to it.				
All the learners in my class have science targets.				
The learners are involved in setting and discussing their own targets.				
Targets are visual, e.g. using target cards, on display or in books.				
Targets are SMART so that learners know when they have met them.				
Targets are shared with parents.				
When a target has been met, a new target is agreed and recorded.				

Your View	Yes	No	Unsure	Comments
I think that sharing learning intentions has had a positive impact on class's learning.				
I think that giving oral and written feedback based on success criteria has had a positive impact on class's learning.				
I think the use of individual science targets has had a positive impact on class's learning.				
I think that parents/ carers understand our approach to providing feedback.				

Appendix A6

TEACHER SUMMARY SHEET

Your name ..... School .....

Stage taught .....

I feel really confident about these aspects of using formative assessment:

✓

✓

✓

I'd like further support with these aspects:

✓

✓

✓

Support to be given by:

SCHOOL SUMMARY SHEET: to be completed from the teacher summary sheets.

School Name: .....

Staff at this school feel really confident about –

✓

✓

✓

We would like further support with –

✓

✓

✓

We can offer expertise to other schools in…….....

✓

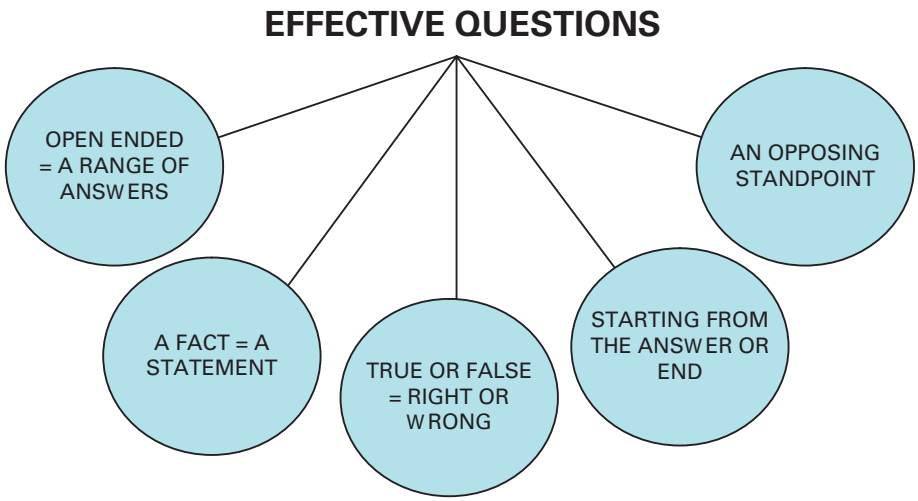
✓

✓

Agreed action points following discussion:

Appendix A6

Training Activity A7: Using Questions Effectively



Instructions

Work with your talk partner.

Discuss each question and decide what type of question it is. Record the number in the appropriate circle.

1. Everything is alive. Agree or disagree?
2. Why does this toy move and this one does not?
3. Bricks are the best material for building a house. Why?
4. How could Cinderella have helped her stepmother to become a better person?
5. The answer is square. What might the question have been?
6. (on reading the poem 'The Train Ride' and omitting the title) What is the setting for this poem? Is it a bus, train, bike, car, plane or boat?
7. This picture shows a Viking. Do you agree or disagree?
8. Should only girls be nurses?
9. What would you find in a healthy meal?
10. Glass is an excellent material for making a shelter. Agree or disagree?

APPENDIX B: SAMPLE SCHEMES OF WORK

The following pages contain extracts from the comprehensive Scheme of Work provided on the Cambridge Primary support site.

They include:

- Stage 1: Unit 1A, 1.1 Ourselves
- Stage 3: Unit 1A, 3.1 Life Processes
- Stage 6: Unit 1A, 6.1 Human Organs and Systems

STAGE 1 UNIT 1A 1.1 Ourselves

In this unit, children learn that humans and other animals move and grow.

They also learn about their senses and how they can use them to explore the world around them.

Scientific Enquiry work focuses on:

- Observing and describing living things, and communicating what happened in their work
- Exploring and using senses
- Opportunities to think about how to treat each other and other living things with care and sensitivity

Code	**Ideas and evidence**	**Recommended Vocabulary**
1Ep1	• Try to answer questions by collecting evidence through observation.	human animal move grow
	Plan investigative work	
1Ep2	• Ask questions and contribute to discussions about how to seek answers.	senses – sight/seeing, touch/feel, taste, smell, hear/ing
1Ep3	• Make predictions.	
1Ep4	• Decide what to do to try to answer a Science question.	head – eyes, ears, nose, mouth, hair body arms – shoulders legs – knees feet – toes
	Obtain and present evidence	
1Eo1	• Explore and observe in order to collect evidence (measurements and observations) to answer questions.	
1Eo2	• Suggest ideas and follow instructions.	**Scientific Enquiry**
1Eo3	• Record stages in work.	look guess (predict) compare
	Consider evidence and approach	
1Eo4	• Make comparisons.	
1Eo5	• Compare what happened with predictions.	
1Eo6	• Model and communicate ideas in order to share, explain and develop them.	

Framework Codes	Learning Objective	Activities	Resources	Comments	Time
	Humans				
1Bh1	Recognise the similarities and differences between each other.	Collect data, e.g. eye colour, count and interpret	ICT database for results	Assess SE skills	1 hr
1Bh2	Recognise and name the main external parts of the body.	Play games e.g. Simon Says			1 hr
1Bh4	Explore how senses enable humans and animals to be aware of the world around them.	Introduce senses using songs and rhymes Look – magnifying glasses Listen – sounds on CD Smell – food/ fragrances Feel – feely bags Taste – salty/sweet	CD – songs/ rhymes Magnifying glasses Food/ fragrances Feely bags	Assess using sensory story	2 hrs

STAGE 3 UNIT 1A: 3.1 Life Processes

This unit looks at basic life processes common to animals and plants.

It considers what makes a healthy diet.

Scientific Enquiry work focuses on:

- Observing and comparing living things
- Recording observations
- Making generalisations

Ideas and evidence	Recommended vocabulary
Collect evidence in a variety of contexts to answer questions or test ideas	living non-living move breathe feed reproduce grow senses taste touch see hear smell water food human animal seeds flowers plants light dark
Plan investigative work	
Suggest ideas, make predictions and communicate these.	
With help, think about collecting evidence and planning fair tests.	**Scientific Enquiry**
Obtain and present evidence	Sort group name describe explore investigate tell look talk about measure compare
Observe and compare living things and events.	
Measure using simple equipment and record observations in a variety of ways.	
Present results in drawings.	
Consider evidence and approach	
Draw conclusions from results and begin to use scientific knowledge to suggest explanations.	
Make generalisations and begin to identify simple patterns in results.	

Framework Codes	Learning Objective	Activities	Resources	Comments	Time
3Bh6	Can sort living things into groups, using simple features and describe rationale for groupings.	Identify what all living things can do – move, grow, reproduce, breathe, feed, use senses Sensory activities – as a reminder of what our senses are: Taste/smell tests Feely bags Blindfold games Listening activities – identifying sounds Grouping activities	Photographs Hoops Feely bags Magnifying glasses		2 hrs
3Bh2	Can describe differences between living and non-living things using knowledge of life processes.	Revise living vs non-living. Distinguish between living vs non-living. Explore different ways of moving. Investigate how we breathe.	Secondary sources – Internet, books, CD roms Mirrors	Link with P.E.	2 hrs
3Bh1	Know life processes common to humans and animals include nutrition (water and food), movement, growth and reproduction.	Revise what we need to stay alive. Discuss animal needs also. Visit a local market and look at available foods. Revise changes from birth until now. Discuss other human physical changes – e.g. growth. Animal families activities.	Photographs	Adhere to school policy re educational visits.	2 hrs 1 hr
3Bp4	Know that plants need healthy roots, leaves and stems to grow well.	Revise what plants need to grow well. Measure growing plants over a few weeks. Plant seeds and observe flowers growing.	Specimen plants for comparison, healthy, unwatered, kept in dark	Begin plant experiments early in topic and observe regularly.	3 hrs

STAGE 6 UNIT 1A: Unit 6.1 Human Organs & Systems

This unit builds on previous work covered in Units 1.1 – Ourselves, 1.3 – Living & Growing, 3.1 – Life Processes, 3.5 – The Senses, 3.6 – Keeping Healthy and 4.1 – Skeleton & Muscles.

Learners find out about specific organs, their related systems and basic functions.

Scientific Enquiry work focuses on:

- Make a variety of relevant observations
- Make comparisons
- Suggest and evaluate explanations using scientific knowledge and understanding and communicate this

Obtain and present evidence	Recommended vocabulary
Make a variety of relevant observations and measurements using simple apparatus correctly.	organ body major organs system heart brain liver stomach intestines kidneys lungs function digestion breathing excretion circulation control disease symptoms cure
Consider evidence and approach	
Make comparisons.	**Scientific Enquiry**
Suggest and evaluate explanations for predictions using scientific knowledge and understanding and communicate these clearly to others.	observe compare name know understand function predict explain

Framework Codes	Learning Objective	Activities	Resources	Comments	Time
6Bh2	Can identify the position of major organs in the body.	Class activity – draw around an individual, then identify the positions of known major organs. ***Or. . .*** dress up a willing volunteer in a boiler suit and Velcro organs inside the suit. Pretend to be a doctor and "remove" the organs – discuss what they are and what they do. Identify and draw major organs in a body outline in books. (Stomach/ intestines, lungs, kidneys, heart, brain)	Paper or fabric cut-outs of organs. Boiler suit with Velcro attachments. 3D fabric "organs".	Be sensitive to the learners' codes of acceptable behaviours.	1 hr
6Bh3	Can describe the main functions of the major organs of the body.	Complete a table depicting main functions. Stomach/intestines = digestion Lungs = breathing Kidneys = excretion Heart = circulation Brain = control Discuss each in turn. Demonstrate using a model or using secondary sources. Illustrate on body outlines – write about functions.	Model or Internet/books/ CD-roms Templates		2 hrs

Framework Codes	Learning Objective	Activities	Resources	Comments	Time
6Bh4	Can explain how the functions of the major organs are essential.	Discuss what happens if any of these don't function efficiently. Are there any treatments or cures to alleviate symptoms and/or diseases? Research in groups and collate findings.	Secondary sources Internet/books/CD-roms.	Invite a health practitioner in to talk about this.	2 hrs
6Bh1	Can use scientific names for some major organs of body systems (heart, lungs, kidneys, stomach/ intestines, brain)	Assess: Provide blank outlines or incomplete systems. Learners to complete missing details and describe functions of organs/ systems.			1 hr

APPENDIX C: SAMPLE LESSON PLANS

- Stage 1: Unit 1A, 1.1 Ourselves
- Stage 2: Unit 1A, 2.1 Light and Dark
- Stage 3: Unit 1A, 3.1 Life Processes
- Stage 4: Unit 1A, 4.1 Skeletons and Muscles
- Stage 5: Unit 1A, 5.1 The Way We See Things
- Stage 6: Unit 1A, 6.1 Human Organs and Systems

Stage 1: Unit 1A, 1.1 Ourselves

Week beginning: 1st week of term				UNIT: 1.1 Ourselves		CLASS:	
Timing	Framework Ref:	Learning Objectives	Success Criteria	Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual Description	W/G/I	Resources	Evidence of achievement
1 hr	1Bh1	Recognise the similarities and differences between each other.	I can tell you some ways in which I am the same as my friend. I can tell you some ways in which I am different from my friend.	Introductory discussion: By just looking at each other, who can tell me some way in which we are all the same/different?	**W**		**Q&A** **D**
	SE 1Ep1	**Ideas and evidence** Try to answer questions by collecting evidence through observation.	I can answer the question by counting.	How many children in our class have e.g. brown eyes? Collect data, e.g. eye colour, count and interpret	**W**	ICT database for results Or Flipchart for tallying/ IWB for recording Recording sheets (see appendix)	**D** **O** **M**
	1Ep2 1Ep3 1Ep4	**Plan investigative work** • Ask questions and contribute to discussions about how to seek answers. • Make predictions. • Decide what to do to try to answer a Science question.	I can make suggestions. I can make a prediction. I can decide what to do.	Produce a bar chart showing data and ask pertinent questions to show that the learners understand how to interpret it. e.g. How many children have brown eyes? How many children do not have brown eyes? How many children altogether? Which eye colour do the least children have? Etc. . .			
	1Eo1 1Eo2 1Eo3	**Obtain and present evidence** • Explore and observe in order to collect evidence (measurements and observations) to answer questions. • Suggest ideas and follow instructions. • Record stages in work.	I can look to find out answers. I can follow instructions. I can show how we recorded the answers.				

(Continued)

Week beginning: 1st week of term				UNIT: 1.1 Ourselves		CLASS:	
Timing	Framework Ref:	Learning Objectives	Success Criteria	Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual Description	W/G/I	Resources	Evidence of achievement
	1Eo4 1Eo5	**Consider evidence and approach** • Make comparisons. • Compare what happened with predictions.	I can compare myself with others. I can say if my prediction was correct.				
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
As an introductory lesson, this needs to be very teacher-led. Any other adult support can be helpful in making and recording observations. SEN learners may need 1:1 assistance, depending on their particular level of need.				Assess SE skills: there is a lot that could be assessed here. Either choose a focus group for another adult to observe and record their responses on a checklist of skills or focus on 1 or 2 SE objective/s for a group and/or all children to make recording easier. Display the bar chart produced and refer to it throughout the week, asking pertinent questions. Homework: find out eye colour in your own family – invite them to bring in photos or send a letter home requesting that they be allowed to bring them to the next lesson.		**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work	

Stage 1: Unit 1A, 1.1 Ourselves

Week beginning: 2nd week of term				**UNIT: 1.1 Ourselves**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr	1Bh2	Recognise and name the main external parts of the body.	I can name the parts of my body that I can see.	Play games e.g. "Simon Says".	**W**		**O**
				Sing songs which encourage the children to touch and name external body parts e.g. "head, shoulders, knees and toes" type songs.	**W**	CD's or downloaded children's songs	**O**
				Matching games where children match cards with the same body part on.	**G**	Card games	**O**
				Draw a body outline and get the children to draw and/or make a collage of clothes for him/her. Use as display and ask children to make labels for main parts:- Head/body/arms/legs/feet.	**W/G**	Art materials Papers, fabrics, glue, paint, writing materials etc.	**M**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
							Q&A: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 2: Unit 1A, 2.1 Light and Dark

Week beginning: 1st week of term				**UNIT: 2.1 Light and Dark**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr	2PI1	Can identify different light sources including the Sun.	BA I can identify the Sun as the main light source for Earth A I can identify 3 different light sources HA I can identify 5 different light sources	Read a story or poem about light and dark – or read a story by candle-light. Children to talk about their experiences of night-time. Sun game – on playground Walk round the school to look for sources of light. Lights for festivals and celebrations.	**W** **W** **W** **W** **G**	Storybooks with stories of light and dark in them A sunny day Photos of festivals and celebrations using lights	**Q&A** **D** **O** **O** **D**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
All adults to encourage all children to join in activities – listening to the story, joining in discussion, playing games and walking around the site. Work with a small group to discuss ideas re uses and festivals of light – help with recording/remembering feedback for rest of class.				Visually impaired children will need particular support during this unit – using any residual vision and sensing light sources as heat sources and via touch. It is important for teachers to help other children to be sensitive to and aware of those who are visually impaired. **SAFETY** – All naked flames are best used in a sand tray *e.g. baking tray filled with dry sand.* Children should be kept away from flames.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 2: Unit 1A, 2.1 Light and Dark

Week beginning: 2nd week of term				**UNIT: 2.1 Light and Dark**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr	2PI2	Know that darkness is the absence of light.	I can tell someone why it is dark.	Create a 'dark area' in the classroom. Learners take it in turns to play there and experience being in a darkened environment. Black box/torch activities. Learners explore how to discover what is inside the box or cave in the dark and predict, then identify the objects in light (natural or artificial).	**G/I** **I**	Curtained off corner of classroom. Blackout curtains or dark/heavy fabric. Construct e.g. a cave scene? Torches Feely objects	**O** **D**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Adults observe role-play and record relevant observations. Ask open-ended questions to find out how the learners identify unseen objects. Assist with assessment activity – collage by discussing finished pictures.				Children often have no experience of total darkness and sometimes say they can see in the dark because street lights light up their room when they are in bed. ASSESS Make a night/day, dark/light collage or picture *e.g. 'What we can see in daylight' and 'What we can see when it is night'.* Discuss what their pictures/collages show.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 3: Unit 1A, 3.1 Life Processes

Week beginning: 1st week of term				**UNIT:3.1 Life Processes**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
2 hrs	3Bh6	Can sort living things into groups, using simple features and describe rationale for groupings.	BA I can sort living things into groups. A I can sort living things into groups and, with help from an adult, tell you why. HA I can sort living things into groups and tell an adult why.	Identify what all living things can do – move, grow, reproduce, breathe, feed, use senses Set up a circus (different activities on different tables) of sensory activities – as a reminder of what our senses are:– Taste/smell tests Feely bags Blindfold games Listening activities – identifying sounds Grouping activities	**W** **G/I** **G/I**	Photographs Hoops Feely bags Magnifying glasses	**D** **D/O**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Adult to supervise table activities and question completed grouping activities.							**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 3: Unit 1A, 3.1 Life Processes

Week beginning: 2nd week of term				**UNIT: 3.1 Life Processes**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
2 hrs	3Bh2	Can describe differences between living and non-living things using knowledge of life processes.	I can tell the difference between something that is alive and something that has never been alive.	Revise living vs non-living – how can we tell? Distinguish between living vs non-living – agree definitions Explore different ways of moving. Investigate how we breathe	**W** **W** **W** **G**	Secondary soruces – Internet, books, CD roms Mirrors	**Q&A** **D** **D** **O** **O**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Adults supervise mirror/breathing activity.				Link with PE. when exploring different ways of moving and how we breathe.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 4: Unit 1A, 4.1 Skeleton and Muscles

Week beginning: 1st week of term				**UNIT: 4.1 Skeleton and Muscles**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
2 hrs	4Bh1	Know that humans (and some animals) have bony skeletons inside their bodies.	BA I can tell you what is inside my body. A I can tell you what my skeleton is. HA I can tell you the names of some of the bones in my skeleton.	Talk about skeletons they know about e.g. dinosaurs. Organise a museum visit to see some skeletons. Talk about known names of bones and locations in their bodies. Body map exercise – draw a life-size body outline; cut and stick major bones inside it; class activity – use for display.	**W** **W** **W** **W**	Video evidence – Internet/TV/DVD Skeleton (plastic)	**D** **Q&A** **O** **O** **D** **Q&A** **O**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Supervise a small group on museum visit. Organise body map exercise and supervise learners.				Skeletons are not scary – we all have one inside of us! Adhere to school policy re educational visits.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 4: Unit 1A, 4.1 Skeleton and Muscles

Week beginning: 2nd week of term				**UNIT: 4.1 Skeleton and Muscles**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
2 hrs	4Bh2	Know how skeletons grow as humans grow and support and protect the body.	I can tell you 3 words to describe what our skeletons do for us.	Look at x-rays of bones in children and adults. Compare. Discuss fractures – if evident. Compare long bone measurements between adults and children in the classroom. Look at some invertebrates; compare them to our bodies – what does our skeleton do for us apart from helping us grow? (support)	**W** **G/I** **G**	Local hospitals ***sometimes*** can make x-rays available. Tape measures Secondary sources, Internet/books/ CD-roms	**D** **Q&A** **Q&A** **O** **M** **D** **Q&A** **M**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Adults to assist with measuring activities – helping with recording and accuracy of measurements. Supervise BA learners doing research from secondary sources.							**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 5: Unit 1A, 5.1 The Way We See Things

Week beginning: 1st week of term				UNIT: 5.1 The Way We See Things		CLASS:	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr	5PI6	Know that we see light sources because light from the source enters our eyes.	I can name several different light sources.	Revise the fact that light travels by asking children to demonstrate this using torches.	**G/I**	Working torches Spare batteries an bulbs Collection of opaque objects.	**Q&A** **D** **O**
			I can explain how we see light from a source.	Explain and record how we can see light.	**W**		**O** **M**
1 hr			HA I can explain and show how shadows are formed using appropriate scientific vocabulary. A I can explain and show how shadows are formed. BA I can show how shadows are formed, with help.	Revise and ask the children to demonstrate how shadows are formed.	**I/G**		**Q&A** **D** **O**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Learners split into three ability groups; HA = high achievers / A = average / BA = below average Teacher to support BA Adults other than teachers (AOTT's) to support A group.				**Note**: A common misconception is that light comes from our eyes. **Extension**: How can shadows be made bigger/smaller? **Homework**: Find some everyday uses of shadows or bring ideas to discuss where you see shadows before next week's lesson.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 5: Unit 1A, 5.1 The Way We See Things

Week beginning: 2nd week of term				**UNIT: 5.1 The Way We See Things**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
2 hrs	5PI7	Know that beams/rays of light can be reflected by surfaces including mirrors. Know that reflected light enters our eyes and we see the object.	BA and A I can show how a beam of light can be reflected by a mirror. HA I can explain how we are able to see objects.	Discuss everyday uses of mirrors. Mirror activities – using them to see behind you etc. Depict direction of light beams by arrows on straight lines.	**W** **W/G** **G/I**	Plastic-coated mirrors Torches	**D** **O** **M**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Adults to supervise and assist with mirror activities. Assist BA to record findings in book.				Safety – mirror edges need to be bound.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 6: Unit 1A, 6.1 Human Organs and Systems

Week beginning: 1st week of term				**UNIT: 6.1 Humans Organs and Systems**		**CLASS: 5**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
1 hr	6Bh2	Can identify the position of major organs in the body.	I can identify the position of the major organs in the body.	Class activity – draw around a pupil, then identify the positions of known major organs. ***Or. . .*** dress up a willing volunteer in a boiler suit and Velcro organs inside the suit. Pretend to be a doctor and "remove" the organs – discuss what they are and what they do. Identify and draw major organs in a body outline in books. (Stomach/intestines, lungs, kidneys, heart, brain)	**W** **W** **I**	Paper or fabric cut-outs of organs. Boiler suit with Velcro attachments. 3D fabric "organs".	**D** **Q&A** **O** **D** **Q&A** **O** **M**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Assist with class activities. Support BA in recording findings in books.				Be sensitive to the learners' codes of acceptable behaviours.			**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

Stage 6: Unit 1A, 6.1 Human Organs and Systems

Week beginning: 2nd week of term				**UNIT: 6.1 Humans Organs and Systems**		**CLASS: 5**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of achievement**
				Description	**W/G/I**		
2 hrs	6Bh3	Can describe the main functions of the major organs of the body.	HA I can describe the main functions of the major organs of the body. A I can describe the main functions of some of the major organs of the body. BA I can describe the main function of a major organ in the body.	Complete a table depicting main functions. Stomach/intestines = digestion Lungs = breathing Kidneys = excretion Heart = circulation Brain = control Discuss each in turn. Demonstrate using a model or using secondary sources. Illustrate on body outlines – write about functions.	**I** **W** **I**	Model or Internet/ books/CD-roms Templates	**M** **D** **O** **D** **Q&A** **M**
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
Adult to work with BA in completing table and written work.							**Q&A**: question/ answer **D**: discussion **O**: observation **M**: marked work

APPENDIX D: OPPORTUNITIES FOR ICT IN THE PRIMARY SCIENCE FRAMEWORK

ICT is a valuable resource which should be used appropriately to help develop students' scientific knowledge, skills and understanding.

The following suggestions are not exhaustive. They are designed to be illustrative and demonstrate a range of opportunities where ICT can be utilised in the teaching of Science.

General

There is potential for the use of ICT throughout the Science curriculum and the ideas presented in this section can be applied to most areas. In addition, where an approach is particularly relevant to the aspect being studied, it is listed against that aspect.

Interactive whiteboard hardware and software: This resource is available in many educational settings and has huge potential, which is not always tapped. The software can be installed on learners' computers and used away from the board to support teaching and learning. Even where the physical board is not available, there are often "lite" or open source versions of the software, which can be installed and used:

1. The interactive whiteboard provides a very useful way of displaying scientific ideas etc. The tools can be used to highlight elements, as well as to drag and drop text etc. This supports the creation of simple activities to support science learning.
2. Most interactive whiteboard software has banks of Science resources, ranging from still images and text to animations, flash-based activities and sound files. These are a useful support in teaching, but could also be used by learners working independently. Teachers are strongly advised to explore these before looking elsewhere.
3. All interactive whiteboard software has the potential to combine text, graphics and sound in a simple way, allowing learners to match words to pictures and/or sounds by dragging and dropping. Such activities can be used to support teaching of varied Science concepts as well as being used independently by pupils to consolidate their understanding.

4. As the software allows hyperlinks to be included, this can be used to guide pupils to a specific website or resource for an activity or further study. Learners can also use simple tools within the software to capture any resources they have been using online.

5. As interactive whiteboard software is very simple to use, learners can develop their own games and activities to support an area of learning and then use these with their peers. As learners have to understand the teaching point to develop the activity, this can be an excellent approach to help consolidate learning.

6. Sound files (normally MP3) can easily be attached to writing or an image using interactive whiteboard software. This can be used to support learners in understanding Science concepts. For example, a bean seed could describe what it needs to germinate.

Handheld devices/tablets: There are an increasing number of handheld devices and tablets on the market, which either have their own bespoke software or can run apps, which can be downloaded for free, or for a small charge from the internet. There is a huge number of such apps, some of which provide excellent support for learners and their learning, although there are many which are not so appropriate and time needs to be taken to ensure quality. The management of handheld devices in a classroom would also need to be considered carefully, with potential issues around charging and syncing the devices.

Class response systems: If the educational setting has such hardware, it will normally be linked to the interactive whiteboard and the software can be used by teachers and learners to assess scientific understanding around a certain topic, as well as in a more open way to support investigative work. There are now software options some of which use the learners' own handheld devices, which could provide an alternative to dedicated hardware.

Visualisers: Where these are available, they can be used to share work, model Science activities and capture still and moving images in the class during discussion and investigations.

Dataloggers: These devices can be used to capture data by monitoring the physical environment (for example, sound, light and noise levels, motion and speed). The data can be downloaded, reviewed, and copied to a spreadsheet for further analysis. Such devices are particularly relevant in joint Mathematics and Science investigations and support the development of data-handling in Science.

Spreadsheets: This software can be used to record and analyse scientific data, supporting learners in the understanding of the results of experiments and investigations. It is also helpful in supporting data-handling activities, especially with the use embedded charts.

Databases: This software provides essential support in data handling, enabling learners to search and sort data and create reports and charts from the information. Learners can also create and use databases exploring object properties in specific areas of Science.

Organisational tools: Mind-mapping software can be used to develop ideas and plans for experiments and investigations activities. Word processing software, interactive whiteboard and spreadsheet software can all be used to collect and organise information around an area of Science work. This approach supports learners in capturing their ideas and approaches during experiments and investigations and investigative activities.

Cartoons: Creating cartoons can help learners explore Science rules, strategies and concepts, providing an engaging way for them to record their thinking and understanding.

Sound recording: Sound can help young learners and those with limited English writing skills, express and share scientific concepts. Much standard software, MS Windows, Apple etc., has the capability to record sound direct to a computer. Alternatively MP3 player/recorders, able to capture and playback sound as well as download to the computer, are generally available. There are also many quick capture devices able to record a few seconds of sound, which are useful for short activities. Recorders, microphones etc. can be sourced from general electronics suppliers. See resources list for open source sound editing software.

Digital still and film capture: Still and film cameras can be used by learners to capture their learning, especially in investigations and other activities. Learners can also make short films around certain scientific concepts and share them with their peers to support their learning.

Image animation software: Animating images, avatars and vokis and writing and recording scripts for them provides good opportunities for learners to rehearse their scientific understanding around a specific topic. (Bespoke software is normally needed for this.)

Other multimedia software: Generic and/or open source resources exist to combine pictures into slide shows, and/or to animate the picture and graphic elements. These can be used to support learners in presenting their learning or sharing ideas as well as being used by both teachers and learners to create resources to support learning.

Online spaces: There are many generally available online spaces for saving, sharing and commenting on materials. The educational setting may have its own learning platform or Virtual Learning Environment (VLE). If this is not the case, teachers will need to ensure that the space is safe and reliable before encouraging learners to use it. Learners should also be taught to respect others' work online, understanding the rules for copyright, ownership and safe and responsible use. Learners' activity on the site/s should be monitored to ensure the rules for safe and responsible use are being applied.

1. Learners can be encouraged to save and share work online, providing the opportunity to discuss, review and improve their work.
2. Leaners and teachers can create blogs to explore and develop ideas around a topic or theme.
3. Groups of learners can create wikis around an area of Science learning or to support an investigation or problem-solving activity.
4. Learners can engage in online discussion around a topic or idea, or use a discussion board to develop an investigation.

Opportunities for ICT in STAGE 1

SCIENTIFIC ENQUIRY:		Opportunities for ICT:
		Learners should
Stage 1	1Ep1	Try to answer questions by collecting evidence through observation. 1. Use digital still and film image of Science activities in class and use these to begin to answer questions. 2. As a group, observe objects under a digital microscope. Discuss what they can see.
Stage 1	1Ep3	Make predictions. 1. Watch Science film clips related to a class Science activity. Teacher pauses film and asks pupils to predict what will happen next.
Stage 1	1Eo3	Record stages in work. 1. Use simple software or audio recording devices to record the stages in their work.

BIOLOGY:		Opportunities for ICT:
		Learners should
Stage 1	1Bp2	Know that there are living things and things that have never been alive. 1. Use online/interactive activities to sort objects on screen into living and never been alive.
Stage 1	1Bp3	Explore ways that different animals and plants inhabit local environments. 1. Extend their personal experience of animals and plants in their habitats with film clips and images. Discuss how the habitats differ.
Stage 1	1Bh2	Recognise and name the main external parts of the body. 1. Use online and interactive activities to support recognition of parts of the body. 2. Use interactive whiteboard or interactive software to match labels to parts of the body. (Talking software can support pupils who cannot read.)

CHEMISTRY:		Opportunities for ICT:
		Learners should
Stage 1	1Cp3	Recognise and name common materials. 1. Use interactive software activities to sort and label common materials.

PHYSICS:		Opportunities for ICT:
		Learners should
Stage 1	1Ps3	Recognise that as sound travels from a source it becomes fainter. 1. Use sound recording software to capture and play back sounds made from different distances (eg a drum being hit). Compare the different sounds.

Opportunities for ICT in STAGE 2

SCIENTIFIC ENQUIRY:		**Opportunities for ICT:**
		Learners should
Stage 2	2Ep1	Collect evidence by making observations when trying to answer a Science question 1. Use digital still and film cameras to capture and record evidence. 2. Use simple handheld microscopes to capture evidence. 3. Use these images to support them when answering Science questions.
Stage 2	2Ep3	Use simple information sources. 1. Use simple online and CDROM sources to find information, beginning to use features of the source to find information
Stage 2	2Eo3	Make and record observations 1. Use digital still and film cameras to capture and record evidence. 2. Use simple digital audio recording devices to record questions, observations and ideas etc.
Stage 2	2Eo4	Take simple measurements 1. Use interactive whiteboard and/or ITP capacity measuring tools to support them in understanding how to take measurements.
Stage 2	2Eo5	Use a variety of ways to tell others what happened. 1. Use digital images and sound recordings they or others have captured to support them when talking about their Science work.

BIOLOGY:		**Opportunities for ICT:**
		Learners should
Stage 2	2Be2	Understand ways to care for the environment. Secondary sources can be used. 1. Use online/interactive activities to develop their understanding of how to care for the environment. 2. Watch film clips related to caring for the environment and discuss with others.
Stage 2	2Be3	Observe and talk about their observation of the weather, recording reports of weather data. 1. Use simple pictogram software to record the weather for a series of days. Discuss the data, making simple statements. 2. Watch learners' weather reports and discuss what they mean.

CHEMISTRY:		**Opportunities for ICT:**
		Learners should
Stage 2	2Cp2	Know that some materials occur naturally and others are man-made. 1. Use interactive whiteboard activities to sort materials into naturally occurring and man-made. 2. Watch film clips/animations of some materials being made (e.g. glass, steel etc.).

(Continued)

CHEMISTRY:		Opportunities for ICT:
		Learners should
Stage 2	2Cc2	Explore and describe the way some everyday materials change when they are heated or cooled. 1. Watch film clips/animations showing how materials change when they are heated or cooled. 2. Capture still and moving images of materials changing in classroom experiments and use these to support discussion.
Stage 2	2Cc3	Recognise that some materials can dissolve in water. 1. Capture film images of materials in water and compare those which dissolve and those which do not. The teacher can pause the film, to give pupils the opportunity to predict for each material.

PHYSICS:		Opportunities for ICT:
		Learners should
Stage 2	2Pl1 2Pl3	Identify different light sources including the sun. Be able to identify shadows. 1. Identify shadows, light and sources of light in still images and film clips. 2. Capture shadows made during class shadow puppet activities. Use these to support them when talking about shadows.
Stage 2	2Pm1 2Pm2	Recognise the components of simple circuits involving cells (batteries). Know how a switch can be used to break a circuit. 3. Use simple circuit simulations to build circuits including cells and switches. 4. Film circuits they have created in class and use these to explain how electrical circuits work.
Stage 2	2Pb1 2Pb2	Explore how the sun *appears* to move during the day and how shadows change. Model how the spin of the Earth leads to day and night. 5. Use simple simulations of the sun in the sky and the spin of the Earth creating night and day to support their understanding.

Opportunities for ICT in STAGE 3

SCIENTIFIC ENQUIRY:		Opportunities for ICT:
		Learners should
Stage 3	3Ep1 3Eo2	Collect evidence in a variety of contexts to answer questions or test ideas. Measure using simple equipment and record observations in a variety of ways. 1. Use still and film cameras to capture evidence to support scientific enquiry. 2. Use dataloggers to capture environmental data (e.g. sound or light levels) in different locations/situations. Download the data and use this to answer questions about environmental conditions. 3. Use ICT word processors, tables and spreadsheets to record observations.

(Continued)

SCIENTIFIC ENQUIRY:		Opportunities for ICT:
		Learners should
Stage 3	3Eo3	Present results in drawings, bar charts and tables. 1. Use spreadsheet and graphing software to create tables and charts to present results.

BIOLOGY:		Opportunities for ICT:
		Learners should
Stage 3	3Bp1	Know that plants have roots, leaves, stems and flowers 1. Use simple simulation software to identify and label the common parts of a plant.
Stage 3	3Bp5	Know that plant growth is affected by temperature. 1. Place plants in locations with different temperatures and use dataloggers to track the temperature over a set period. 2. Use a digital camera to record the plants at the beginning and end of the experiment. 3. Present the pictures and the downloaded datalogger records. Discuss the findings and draw conclusions.
Stage 3	3Bh3 3Bh4	Explore and research exercise and the adequate, varied diet needed to keep healthy. Know that some foods can be damaging to health, e.g. very sweet and fatty foods. 1. Use online and other digital sources to investigate diet and food. 2. Use a word processor table or spreadsheet software to record their diet for a week. Use a digital camera to add photographs of some of the food they have eaten. Use this to support a discussion on diet and healthy eating.
Stage 3	3Bh6	Sort living things into groups, using simple features and describe rationale for groupings. 1. Use an interactive whiteboard activity to sort living things into groups. 2. Use a branching database to categorise living things, using high level questions.

CHEMISTRY:		Opportunities for ICT:
		Learners should
Stage 3	3Cp2	Sort materials according to their properties. 1. Use a handheld microscope or visualiser to view and capture different materials under magnification. 2. Label these images of materials with their properties. Use this process to categorise the materials and sort them using onscreen Carroll or Venn diagrams. 3. Create a flat file database of materials and their properties.
Stage 3	3Cp3	Explore how some materials are magnetic but many are not. 1. Use simple animations related to magnetism of different materials to explore magnetic properties. 2. Use a digital film camera to capture experiments with magnetic and non-magnetic materials in the classroom.

PHYSICS:		Opportunities for ICT:
		Learners should
Stage 3	3Pf1 3Pf2	Know that pushes and pulls are examples of forces and that they can be measured with forcemeters. Explore how forces can make objects start or stop moving. 1. Use onscreen simulation to explore examples of forces, how they move and how they are measured. Make some estimate of force in each case.
Stage 3	3Pf4	Explore how forces, including friction, can make objects move faster or slower or change direction. 1. Watch film clips, including their own, of examples of forces and the effect of friction. Pause these and explain what will happen and why.

Opportunities for ICT in STAGE 4

SCIENTIFIC ENQUIRY:		Opportunities for ICT:
		Learners should
Stage 4	4Ep4	Design a fair test and plan how to collect sufficient evidence. 1. Use different software (word processing tables/format; spreadsheet software, bespoke Science software), to design and plan the test.
Stage 4	4Eo2 4Eo3	Measure temperature, time, force and length. Begin to think about the need for repeated measurements of, for example, length. 1. Use appropriate equipment to capture and record measurements (e.g. dataloggers, digital clocks/stop watches, digital length measuring devices). 2. Use word processor tables/spreadsheet software to record the data. Review and consider if further measurement might be necessary.
Stage 4	4Eo4	Present results in drawings, bar charts and tables. 1. Use ICT to support presentation of results, including using spreadsheet and graphing software and presentation software.
Stage 4	4Eo5	Identify simple trends and patterns in results and suggest explanations for some of these. 1. Analyse data recorded in datalogger graphs, spreadsheets and graphing software. Use these to identify trends and patterns. Suggest explanations.

BIOLOGY:		Opportunities for ICT:
		Learners should
Stage 4	4Bh1	Know that humans (and some animals) have bony skeletons inside their bodies. 1. Use onscreen simulations to explore the human skeleton.
Stage 4	4Be2	Use simple identification keys. 1. Use branching database software to create identification keys for different plants and animals.

(Continued)

BIOLOGY:		Opportunities for ICT:
		Learners should
Stage 4	4Be3	Recognise ways that human activity affects the environment e.g. river pollution, recycling waste 1. Watch film clips showing the environmental impact of human activity and measures taken to combat this. 2. Make a multimedia presentation or sound recording about human impact on the environment in their local area.

CHEMISTRY:		Opportunities for ICT:
		Learners should
Stage 4	4Cs2 4Cs3 4Cs4	Investigate how materials change when they are heated and cooled. Know that melting is when a solid turns into a liquid and is the reverse of freezing. Observe how water turns into steam when it is heated but on cooling, the steam turns back into water. 1. Watch film clips of changing materials. Capture stills from the film and annotate to explain the physical changes. 2. Make their own films and/or presentations of physical changes in materials and related investigations in the classroom.

PHYSICS:		Opportunities for ICT:
		Learners should
Stage 4	4Ps1 4Ps2 4Ps3	Explore how sounds are made when objects, materials or air vibrate and learn to measure the volume of sound in decibels with a sound level meter. Investigate how sound travels through different materials to the ear. Investigate how some materials are effective in preventing sound from travelling through them. 1. Use a datalogger and the related software to capture sound in different conditions, observing how the levels are affected by those conditions. Compare the measurements to perceived sound levels.
Stage 4	4Pm1 4Pm2 4Pm3	Construct complete circuits using switch, cell (battery), wire and lamps. Explore how an electrical device will not work if there is a break in the circuit. Know that electrical current flows and that models can describe this flow, e.g. particles travelling around a circuit. 1. Use detailed onscreen simulations to create and model circuits including cell, wires and lamps. 2. Test the circuit. 3. Use an onscreen simulation to explore current flows in different electrical circuits.

Opportunities for ICT in STAGE 5

SCIENTIFIC ENQUIRY:	Opportunities for ICT:	
		Learners should
Stage 5	5Ep1	Know that scientists have combined evidence with creative thinking to suggest new ideas and explanations for phenomena. 1. Carry out research using online and other digital resources into the work of scientists, past and present, highlighting examples of evidence-based work and creative thinking.
Stage 5	5Ep2	Use observation and measurement to test predictions and make links. 1. Record various measurements using digital measurement devices and analyse the findings. 2. Capture class scientific investigations on film and review the filmed activities. 3. Use both of these sources to make links and support predictions.
Stage 5	5Eo2	Measure volume, temperature, time, length and force. 1. Use appropriate digital devices to measure, capturing the results in datalogging, graphing and spreadsheet software.
Stage 5	5Eo4	Present results in bar charts and line graphs. 1. Select the most appropriate from a range of graphing and charting software for the results to be recorded. Create the relevant results and annotate them.
Stage 5	5Eo8	Interpret data and think about whether it is sufficient to draw conclusions. 1. Review digital data from experiments/investigations and comment on whether further data is required and how it should be obtained.

BIOLOGY:	Opportunities for ICT:	
		Learners should
Stage 5	5Bp4	Investigate how seeds need water and warmth for germination, but not light. 1. Place plants in different conditions in the dark (with/without water and warmth). Use dataloggers and time lapse photography to monitor the plants in their environments. 2. Download the data and draw conclusions. 3. Create a report, including charts and images as supportive evidence.

CHEMISTRY:	Opportunities for ICT:	
		Learners should
Stage 5	5Cs (all)	1. Watch film clips of various chemical processes, discussing them and using stills from the films to produce reports.

PHYSICS:	Opportunities for ICT:	
		Learners should
Stage 5	5Pl (all)	1. Use dataloggers to detect and measure light in support of investigations related to light and shadows. 2. Use graphs from the datalogger to support report-writing on the findings.
Stage 5	5Pb (all)	1. Use simulations and film clips to understand the movement of the Earth and sun. 2. Use online and other digital resources to research the lives and discoveries of the scientists who explored the solar system and stars.

Opportunities for ICT in STAGE 6

SCIENTIFIC ENQUIRY:		**Opportunities for ICT:**
		Learners should
Stage 6	6Ep1	Consider how scientists have combined evidence from observation and measurement with creative thinking to suggest new ideas and explanations for phenomena. 1. Carry out research using online and other digital resources into the work of scientists, past and present, considering how their work benefited from the combination of scientific enquiry and creative thinking. 2. Use multimedia software to make a presentation explaining your ideas.

BIOLOGY:		**Opportunities for ICT:**
		Learners should
Stage 6	6Bh1 6Bh2 6Bh3 6Bh4	Use scientific names for some major organs of body systems. Identify the position of major organs in the body. Describe the main functions of the major organs of the body. Explain how the functions of the major organs are essential. 1. Use simulations of the major body organs to understand their functions and how they work to keep the body healthy. 2. Use onscreen/interactive whiteboard activities to identify and label some major organs of the body. 3. Annotate the organs onscreen to describe their functions and explain why they are essential.
Stage 6	6Be3 6Be4 6Be5 6Be6	Know how food chains can be used to represent feeding relationships in a habitat and present these in text and diagrams. Know that food chains begin with a plant (the producer), which uses energy from the sun. Understand the terms *producer, consumer, predator* and *prey.* Explore and construct food chains in a particular habitat. 1. Use online and other digital resources, including film, to explore food chains in different habitats and become familiar with food chain structures and terms. 2. Use interactive whiteboard or mind-mapping software to construct a representation of food chains in a particular habitat.

CHEMISTRY:		**Opportunities for ICT:**
		Learners should
Stage 6	6Cc (all)	1. Use film cameras and time-lapse photography, with magnification if needed, to capture different experiments exploring material change. 2. Edit the film to present ideas and conclusions.

PHYSICS:		Opportunities for ICT:
		Learners should
Stage 6	6Pf2	Recognise and use units of force, mass and weight and identify the direction in which forces act. 1. Use onscreen activities to explore examples of force and identify the direction on which the forces are acting. 2. Use units of force in describing each example.
Stage 6	6Pm5	Represent series circuits with drawings and conventional symbols. 1. Use word processing or interactive whiteboard software to represent series circuits, including conventional symbols.

APPENDIX E: PLANNING TEMPLATES

This contains planning templates with accompanying notes as referred to in Section 2 of the guide.

- Long-term planning – 1
- Long-term planning – 2
- Long-term planning – 3
- Medium-term planning – 1
- Medium-term planning – 2
- Short-term planning

Planning Templates

Long Term Planning Template 1

Scheme of Work – An Overview

Stage

TERM 1	TERM 2	TERM 3
1A	2A	3A
1B	2B	3B

Notes:

- *The current model of six units per stage is recommended – two per term. Fewer would give too large a group of objectives to address in one unit. More would be too fragmented to give coherence to the overall scheme, although this can vary with the subject*
- *Terminology can vary although consistency is recommended within a school*
- *An audit of the learning objectives for the whole stage is recommended to ensure coverage*[1]
- *Each objective may be revisited in different ways in different units to continue to develop new skills in different contexts*
- *Some learning objectives will be ongoing throughout the stage – a grid to show this is recommended*[2]
- *Detail of the ongoing objectives may be given in an outline plan*[3]

[1] See audit tool.
[2] See table of ongoing objectives.
[3] See table of ongoing work.

Long-Term Planning Template 2

Learning Objectives – An Audit Tool

Framework Code	Learning Objective	Ongoing (O) Term ref (T1, T2, T3)

Notes for completing the audit (checklist) of objectives

How to complete the sheets:

- *Objectives and framework codes will be entered in the order that they appear in the framework*
- *Learning objectives will appear in full*
- *The final column will give a clear overview of coverage. Where an objective is addressed in more than one unit, all of the relevant units will be listed. If it is an ongoing objective then it will appear as 'O'*

How to use the information collected on the sheets:

- *The right hand column will show how often an objective appears in the whole scheme*
- *If an objective is ongoing then 'O' must be recorded. It will be assumed that work linked to the objective is taught in several (or maybe all) units*
- *For other objectives, how often each one appears in the whole scheme will be recorded. Some objectives will be taught more than once (but not as often as 'ongoing' ones!)*
- *The whole audit will help to achieve a balance, ensuring that coverage is sufficient and/or not too frequent at the expense of others*
- *A final adjustment may be required to make sure that all objectives are taught for, and at, an appropriate time*
- *Also, by doing this alongside the long term planning of units, the grouping of objectives can be changed before too much work has been done on medium term plans*

Long-Term Planning Template 3

Learning Objectives – An Overview

Framework Code	Learning Objective

Notes for completing the overview sheets

How to complete the sheets:

- *Objectives and framework codes will be entered in the order that they appear*
- *Learning objectives will appear in full*
- *The learning objectives can be colour coded:*
  - *Ongoing*
  - *A different colour for each term – once only when it is first introduced:*

    Term 1

    Term 2

    Term 3

How to use the information collected on the sheets:

- *The resulting overview is another kind of checklist to ensure coverage. It also shows whether too much is being introduced in the first term which may not be a balanced way of delivering the framework*
- *By doing this alongside the long term planning of units, the grouping of objectives can be changed before too much work has been done on medium term plans*

Medium-Term Planning Template 1

Stage

Unit: Title:

Framework Codes	Learning Objective	Activities	Resources	Comments	Time

Notes:

- *There may be more than one framework code in each block, e.g. if scheme considers weekly blocks within the whole unit. Objectives will be listed to match the first column*
- *The activities are given in outline only*
- *Main resource needs are required to enable strategic planning, e.g. spending*
- *This plan will require a statement in the opening rationale regarding prior knowledge*
- *Comments will highlight specific details:*
  - *where something requires advance preparation*
  - *where different assessment strategies may be in place, e.g. opportunities for active assessment (details will be in short term (lesson) plans)*

Medium-Term Planning Template 2

Stage

Unit: Title:

Framework Codes	Learning Objective	Activities	Resources

Notes:

- *There may be more than one framework code in each block. It may make sense to address certain objectives together*
- *The activities are given in outline only*
- *Main resource needs are required to enable strategic planning, e.g. spending*
- *No time budget is given for obvious reasons*
- *This plan will require a statement in the opening rationale regarding prior knowledge*

Short-Term Planning Template

Week beginning:				**UNIT:**		**CLASS:**	
Timing	**Framework Ref:**	**Learning Objectives**	**Success Criteria**	**Activities (see notes below re: differentiation details, etc.) W: whole class; G: group; I: individual**		**Resources**	**Evidence of Achievement**
				Description	**W/G/I**		
Organisation: details of differentiation / groups / adult role (linked to activities)				**Notes / extension opportunities / homework**			
							Q&A: question/ answer **D**: discussion **O**: observation **M**: marked work

Notes:

- *The plan can be formatted to view a week at a time and not every lesson –* ***this is important to support manageability***
- *Most of the plan is self-explanatory. It seeks to include most of the desirable elements. It is possible to expand the format to A3 but this risks the planning process taking too long for the time frame – also sometimes the detail required will be brief*
- *Class organisation is crucial to the plan working properly including differentiation and the role of additional adults. Plans can be shared to make expectations clear*
- *SUCCESS CRITERIA:*

  These are an essential part of planning and should be clear and manageable

  These may be part of active assessment activities where students determine the criteria. In planning, teachers need to write a broad outline of anticipated suggestions

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