

WORKING SCIENTIFICALLY IN THE PRIMARY CLASSROOM:

Progression of Enquiry Skills from EYFS to KS3



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"The posters were very well received when I used them in a staff INSET to identify the expected progression in working scientifically! Each class now has a copy on their science display."

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"I adapted them slightly, to fit our curriculum planning, and they are laminated and can be found on the children's tables. They are used as targets for learning and year 1 and 2 love them especially. I also used the statements to create Science 'I can' tracking sheets that are consistent with maths and literacy."

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"I have tried the poster with my class for one of the activities and it worked really well. It was easy for the Year 1 class to use. Next term I will build it in to my planning. I will be taking the first staff meeting of next term and I'm going to propose that we roll it out throughout the school."

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WORKING SCIENTIFICALLY IN THE PRIMARY CLASSROOM: PROGRESSION OF ENQUIRY SKILLS

INTRODUCTION

This booklet has been produced to help teachers understand how to 'work scientifically' within the primary science curriculum for England¹.

Each page contains a summary of information intended to enable teachers to:

- plan science lessons during which children can show progress in their learning
- ensure continuity and progression of essential enquiry skills
- differentiate activities and add challenge for more able children
- make accurate assessments, and facilitate high quality peer and self-assessments

The notes below provide guidance for teachers using and sharing the posters and progression grids in their own school and beyond. We do hope that these are useful to as many colleagues as possible in English primary schools, and would appreciate feedback on how they are used to ciec@york.ac.uk

ENCOURAGING CHILDREN TO WORK SCIENTIFICALLY

There are three aims in the English primary science curriculum, to ensure that all pupils:

- develop **scientific knowledge and conceptual understanding** through the specific disciplines of biology, chemistry and physics
- develop understanding of the **nature, processes and methods of science** through different types of science enquiries that help them to answer scientific questions about the world around them
- are equipped with the scientific knowledge required to understand the uses and implications of science, today and for the future

This guidance provides support particularly for the second of these aims. In order for primary school children to operate as successful scientists, they should be taught a wide range of essential enquiry skills. These skills should build upon earlier opportunities they have had to play, explore, create, engage in active learning, and think critically in the Early Years Foundation Stage.

By carefully examining the statutory requirements for Working Scientifically at Key Stage One, Lower Key Stage Two and Upper Key Stage Two, it is possible to create a list of generic science enquiry skills common to all children across the primary age phase:

- | | |
|---|--------------------------------|
| ● Asking questions | ● Observing and measuring |
| ● Planning and setting up different types of enquiries | ● Identifying and classifying |
| ● Performing tests | ● Gathering and recording data |
| ● Reporting, presenting and communicating data/findings | ● Using equipment |

By further 'teasing apart' the statutory requirements and non-statutory notes and guidance for Working Scientifically, it is possible to see subtle differences in the way that each skill is described as children increase in age and ability. It is important that teachers understand the progression route for each skill to enable them to plan high quality science lessons.

¹ The National Curriculum in England Key Stages One and Two framework document September 2013, Department for Education

PROGRESSION OF SKILLS: GRIDS EXPLAINED

EARLY YEARS FOUNDATION STAGE TO KEY STAGE ONE

Progression of Enquiry Skills Early Years Foundation Stage to Key Stage One, is a succinct overview of science enquiry for our youngest scientists. Teachers can use this grid to see how emergent science skills act as precursors to the statutory requirements of Working Scientifically found in the English National Curriculum for Science for Key Stage One. The document has been separated into rows of distinct skills so that teachers can easily understand the expected standards as well as plan for differentiation and progression within each skill. The information in bold shows where each statement comes from; whether it is an Early Learning Goal or a Characteristic of Effective Learning found in the non-statutory guidance 'Development Matters'.

Teachers could also use this document to formulate Working Scientifically learning objectives and ensure that all areas of enquiry have been taught throughout the academic year. It could be used for both formative and summative assessment purposes whereby teachers highlight particular skills that have been achieved by either individuals or groups of children and then use this information to target areas of weakness as well as to indicate 'next steps' in learning. Note: Pupils are not expected to cover each aspect for every area of study.

KEY STAGE ONE TO KEY STAGE TWO

Progression of Enquiry Skills Key Stage One and Two is an organised summary of the statutory requirements and non-statutory notes and guidance for Working Scientifically from Years 1 to 6. It has the same purpose as the EYFS – KS1 grid and will enable teachers to understand and make quick reference to the expected national standards across the full primary age range.

KEY STAGE TWO TO KEY STAGE THREE

Progression of Enquiry Skills Upper Key Stage Two to Key Stage Three has the same purpose as outlined above, with a focus on enabling teachers to see how the skills pupils learn at primary school can be extended beyond Year 6. Upper Key Stage Two teachers can use this information to create activities which challenge their most able children and make purposeful links to the additional mathematics required to carry out higher level science.

ENCOURAGING CHILDREN TO WORK SCIENTIFICALLY

A poster is provided for each of the following age ranges:

- Early Years Foundation Stage
- Key Stage One
- Lower Key Stage Two
- Upper Key Stage Two

The information from the grids has been converted into child-friendly 'I can' statements and presented in a format that may be used for both peer and self assessment.

Teachers may wish to replace the poster image with photographs of individual children in their class. Each child can use their own poster and personalise their learning by identifying the enquiry skills being taught in weekly science lessons. They could highlight, tick or date a skill when they feel they have achieved the expected standard of attainment. Teachers can use the posters as a quick and easy reference for age appropriate expectations when planning enquiry activities. The statements have been written in hierarchical order around the posters so that it is possible to refer to an earlier or later age group's poster to help with differentiation and challenge. This order is not intended to be explicit to children, and should therefore avoid 'labelling' or levelling themselves or each other.

PROGRESSION OF ENQUIRY SKILLS FROM EARLY YEARS FOUNDATION STAGE TO KEY STAGE ONE

EYFS	Key Stage One
Show curiosity about objects, events and people Playing & Exploring Questions why things happen Speaking: 30-50 months	Explore the world around them and raise their own simple questions
Engage in open-ended activity Playing & Exploring Take a risk, engage in new experiences and learn by trial and error Playing & Exploring	Experience different types of science enquiries, including practical activities Begin to recognise different ways in which they might answer scientific questions
Find ways to solve problems / find new ways to do things / test their ideas Creating & Thinking Critically Develop ideas of grouping, sequences, cause and effect Creating & Thinking Critically Know about similarities and differences in relation to places, objects, materials and living things ELG: The World	Carry out simple tests Use simple features to compare objects, materials and living things and, with help, decide how to sort and group them (identifying and classifying)
Comments and asks questions about aspects of their familiar world such as the place where they live or the natural world The World: 30-50 months	Ask people questions and use simple secondary sources to find answers
Closely observes what animals, people and vehicles do The World 8-20 months Use senses to explore the world around them Playing & Exploring	Observe closely using simple equipment With help, observe changes over time
Make links and notice patterns in their experience Creating & Thinking Critically Choose the resources they need for their chosen activities ELG: Self Confidence & Self Awareness Handle equipment and tools effectively ELG: Moving & Handling	With guidance, they should begin to notice patterns and relationships Use simple measurements and equipment (e.g. hand lenses, egg timers) to gather data
Create simple representations of events, people and objects Being Imaginative: 40-60+ months Answer how and why questions about their experiences ELG: Understanding Make observations of animals and plants and explain why some things occur, and talk about changes ELG: The World	Record simple data Use their observations and ideas to suggest answers to questions Talk about what they have found out and how they found it out
Develop their own narratives and explanations by connecting ideas or events ELG: Speaking Builds up vocabulary that reflects the breadth of their experience Understanding: 30-50 months	With help, they should record and communicate their findings in a range of ways and begin to use simple scientific language

PROGRESSION OF ENQUIRY SKILLS FROM KEY STAGE ONE TO KEY STAGE TWO

Key Stage 1	Lower Key Stage 2	Upper Key Stage 2
Explore the world around them and raise their own simple questions	Raise their own relevant questions about the world around them	Use their science experiences to explore ideas and raise different kinds of questions
Experience different types of science enquiries, including practical activities	Should be given a range of scientific experiences including different types of science enquiries to answer questions	Talk about how scientific ideas have developed over time
Begin to recognise different ways in which they might answer scientific questions	Start to make their own decisions about the most appropriate type of scientific enquiry they might use to answer questions	Select and plan the most appropriate type of scientific enquiry to use to answer scientific questions
Carry out simple tests	Set up simple practical enquiries, comparative and fair tests Recognise when a simple fair test is necessary and help to decide how to set it up	Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why
Use simple features to compare objects, materials and living things and, with help, decide how to sort and group them (identifying and classifying)	Talk about criteria for grouping, sorting and classifying; and use simple keys	Use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment
Ask people questions and use simple secondary sources to find answers	Recognise when and how secondary sources might help them to answer questions that cannot be answered through practical investigations	Recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact
Observe closely using simple equipment with help, observe changes over time	Make systematic and careful observations Help to make decisions about what observations to make, how long to make them for and the type of simple equipment that might be used	Make their own decisions about what observations to make, what measurements to use and how long to make them for
With guidance, they should begin to notice patterns and relationships	Begin to look for naturally occurring patterns and relationships and decide what data to collect to identify them	Look for different causal relationships in their data and identify evidence that refutes or supports their ideas
Use simple measurements and equipment (e.g. hand lenses, egg timers) to gather data	Take accurate measurements using standard units Learn how to use a range of (new) equipment, such as data loggers / thermometers appropriately	Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately. Take repeat measurements where appropriate.
Record simple data	Collect and record data from their own observations and measurements in a variety of ways: notes, bar charts and tables, standard units, drawings, labelled diagrams, keys and help to make decisions about how to analyse this data	Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs
Use their observations and ideas to suggest answers to questions Talk about what they have found out and how they found it out	With help, pupils should look for changes, patterns, similarities and differences in their data in order to draw simple conclusions and answer questions	Identify scientific evidence that has been used to support or refute ideas or arguments
With help, they should record and communicate their findings in a range of ways and begin to use simple scientific language	Use relevant simple scientific language to discuss their ideas and communicate their findings in ways that are appropriate for different audiences, including oral and written explanations, displays or presentations of results and conclusions	Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas, Use oral and written forms such as displays and other presentations to report conclusions, causal relationships and explanations of degree of trust in results
	With support, they should identify new questions arising from the data, making predictions for new values within or beyond the data they have collected and finding ways of improving what they have already done	Use their results to make predictions and identify when further observations, comparative and fair tests might be needed

PROGRESSION OF ENQUIRY SKILLS FROM KEY STAGE TWO TO KEY STAGE THREE

Upper Key Stage 2	Key Stage 3
Use their science experiences to explore ideas and raise different kinds of questions	Ask questions and develop a line of enquiry based on observations of the real world, alongside prior knowledge and experience
Talk about how scientific ideas have developed over time	Understand that scientific methods and theories develop as earlier explanations are modified to take account of new evidence and ideas, together with the importance of publishing results and peer review
Select and plan the most appropriate type of scientific enquiry to use to answer scientific questions	Select, plan and carry out the most appropriate types of scientific enquiries to test predictions, including identifying independent, dependent and control variables, where appropriate
Recognise when and how to set up comparative and fair tests and explain which variables need to be controlled and why	
Use and develop keys and other information records to identify, classify and describe living things and materials, and identify patterns that might be found in the natural environment	
Recognise which secondary sources will be most useful to research their ideas and begin to separate opinion from fact	
Choose the most appropriate equipment to make measurements with increasing precision and explain how to use it accurately	Make predictions using scientific knowledge and understanding
Take repeat measurements where appropriate	Use appropriate techniques, apparatus, and materials during fieldwork and laboratory work, paying attention to health and safety Evaluate the reliability of methods and suggest possible improvements Evaluate risks Pay attention to objectivity and concern for accuracy, precision, repeatability and reproducibility
	Apply sampling techniques Apply mathematical concepts and calculate results Use and derive simple equations and carry out appropriate calculations Undertake basic data analysis including simple statistical techniques
Make their own decisions about what observations to make, what measurements to use and how long to make them for	Understand and use SI units and IUPAC (International Union of Pure and Applied Chemistry) chemical nomenclature Make and record observations and measurements using a range of methods for different investigations Present observations and data using appropriate methods, including tables and graphs
Decide how to record data and results of increasing complexity from a choice of familiar approaches: scientific diagrams and labels, classification keys, tables, scatter graphs, bar and line graphs	
Look for different causal relationships in their data and identify evidence that refutes or supports their ideas	Interpret observations and data, including identifying patterns and using observations, measurements and data to draw conclusions
Identify scientific evidence that has been used to support or refute ideas or arguments	Present reasoned explanations, including explaining data in relation to predictions and hypotheses Evaluate data, showing awareness of potential sources of random and systematic error
Use relevant scientific language and illustrations to discuss, communicate and justify their scientific ideas Use oral and written forms such as displays and other presentations to report conclusions, causal relationships and explanations of degree of trust in results	
Use their results to make predictions and identify when further observations, comparative and fair tests might be needed	Identify further questions arising from their results

WORKING SCIENTIFICALLY POSTER FOR EARLY YEARS FOUNDATION STAGE



WORKING SCIENTIFICALLY POSTER FOR KEY STAGE ONE



WORKING SCIENTIFICALLY POSTER FOR LOWER KEY STAGE TWO



WORKING SCIENTIFICALLY POSTER FOR UPPER KEY STAGE TWO





CIEC offers support for the teaching of science across the primary age range and beyond. This support includes CPD programmes, bespoke in-school CPD, interactive websites for teachers to use with their pupils, and a wide range of downloadable resources which encourage collaborative, practical problem solving. For more information, please visit our website:

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