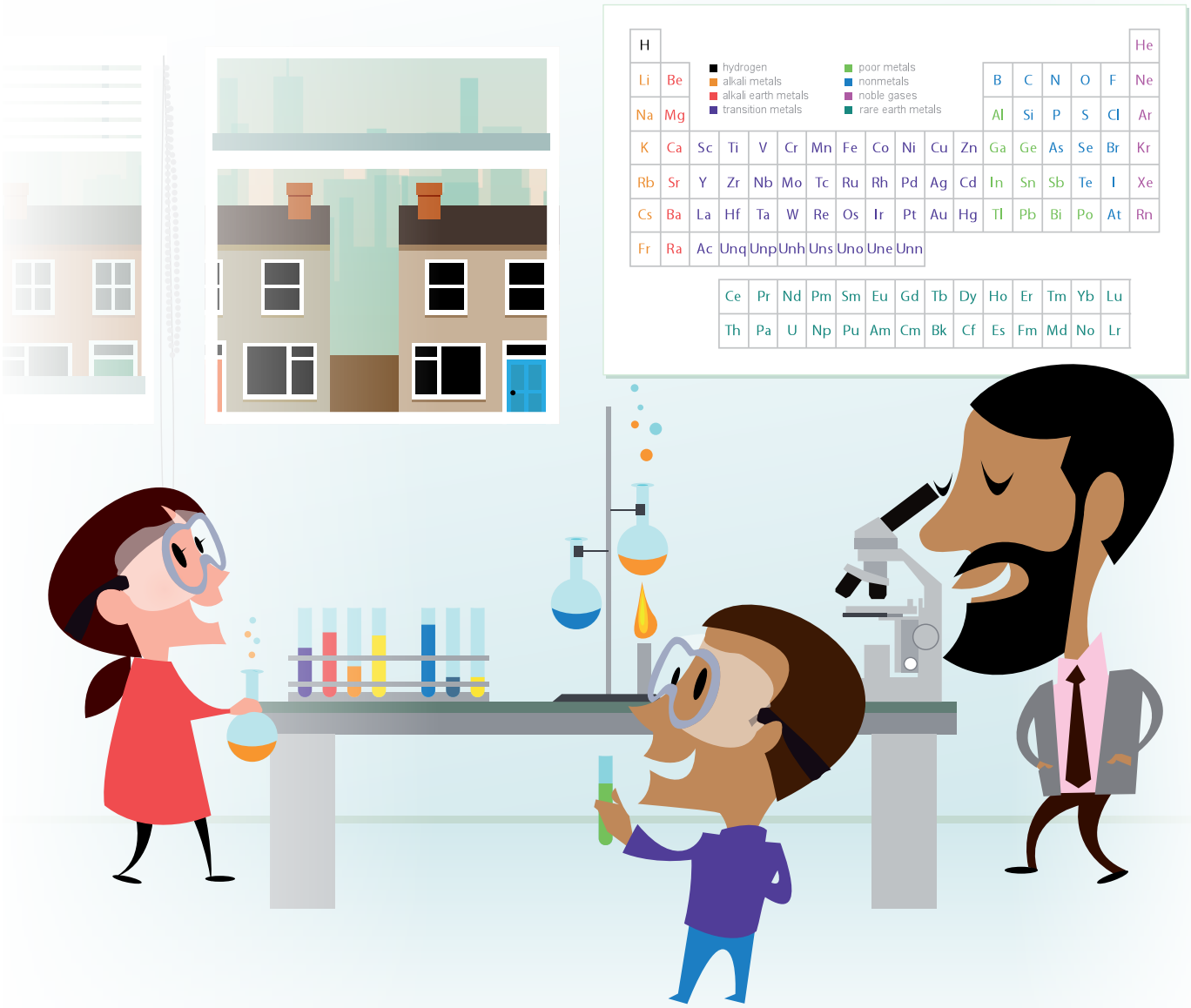
The National Strategies

Secondary

Functional Skills Support Programme

Developing functional skills in science



department for children, schools and families

BIS Department for Business Innovation & Skills

LSIS Learning and Skills Improvement Service

Functional Skills Support Programme

Developing functional skills in science

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Please check all website references carefully to see if they have changed and substitute other references where appropriate.

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Contents

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Key to references

This booklet contains three contexts that highlight opportunities for pupils to develop and apply functional skills (FS), and personal, learning and thinking skills (PLTS). Coloured boxes indicate which specific skills are being developed. Within the boxes the following references have been used:

Reference	Explanation
FS.Eng.L1/SLC	Functional English level 1 – Speaking, listening and communication
FS.Eng.L1/R	Functional English level 1 – Reading
FS.Eng.L1/W	Functional English level 1 – Writing
FS.Ma. L1/	Functional mathematics level 1 followed by reference to one of the three interrelated process skills: representing, analysing and interpreting
FS.ICT.L1/Using ICT	Functional ICT level 1 – Using ICT
FS.ICT.L1/F&S	Functional ICT level 1 – Finding and selecting information
FS.ICT.L1/DP&CI	Functional ICT level 1 – Developing, presenting and communicating information
PLTS	Personal, learning and thinking skills followed by reference to one of the six groups of skills

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Developing functional skills in science

What are functional skills?

'The study of science fires pupils' curiosity about phenomena in the world around them and offers opportunities to find explanations. They learn to question and discuss issues that may affect their own lives, the directions of societies and the future of the world…'

The importance of science, National Curriculum 2007[1]

Functional skills underpin and complement many of the key processes in science. They are the core elements of English, mathematics and ICT that enable pupils independently to:

- apply and adapt their knowledge and understanding to a range of contexts
- solve problems in familiar and unfamiliar situations
- gather, interpret and communicate information effectively and confidently.

They complement *How science works* (HSW), the skills and processes that are the foundation of science as a discipline. Some functional skills, such as the effective communication of information, form part of HSW; other parts of HSW are more distinctive to science, such as the use of scientific models to explain phenomena.

Each of the three skills has a set of performance statements based on three key areas.

Functional English	Functional mathematics	Functional ICT
• Speaking, listening and communication • Reading • Writing	• Representing – selecting the mathematics and information required to model a situation • Analysing – processing and using mathematics • Interpreting and communicating the results of the analysis	• Using ICT • Finding and selecting information • Developing, presenting and communicating information

The skills are embedded through the programmes of study in the new secondary curriculum at both Key Stage 3 and Key Stage 4 and form an essential part of GCSE and new Diploma courses. Alongside the new Framework for personal, learning and thinking skills, functional skills are fundamental to learning across the curriculum and are key to success for pupils, both now and in their future.

For further information about the functional skills visit: www.ofqual.gov.uk/2578.aspx and www.qcda.gov.uk/6062.aspx

'Functional skills provide a fantastic opportunity to join up thinking. Our learners are happier and harder workers knowing that the skills they are learning will apply in real terms to their future.'

Science subject leader

1 The importance of science, National Curriculum 2007. © Qualifications and Curriculum Authority. Used with kind permission.

The curriculum opportunities in the programmes of study for all subjects, combined with many of the key processes, have been designed to ensure that pupils have **planned** opportunities to transfer the functional skills they are developing to as many varied and relevant situations as possible.

For more information relating to the role of functional skills in Foundation Learning, GCSEs, Diplomas and apprenticeships visit: www.dcsf.gov.uk/14-19/

What does this mean for learners?

Pupils who are able to apply functional skills effectively will make better progress in science and in the rest of their studies. They will not only engage in the content of what is being taught but will become more actively involved in the learning process. They will understand the purpose of the English, mathematics and ICT skills they are transferring and securing and will take greater responsibility for furthering their own progress.

What does this mean for me as a science teacher?

The diagram on page 8 captures the learning process that you will need to support, in order to ensure that pupils secure their functional skills. This process is not linear but cyclical and should respond to the needs of the learners and inform their future learning.

Effective teaching will enhance the development of skills. Pupils need planned opportunities to 'have a go' – to select from and experiment with the skills they have learnt elsewhere in the curriculum, applying them with an increasing degree of independence to new and varied contexts. These should have both relevance to the learner and a real purpose in relation to the subject.

Through peer-assessment, self-assessment and teacher feedback they then need to reflect on the progress they are making and to identify particular aspects of their skills development that need further reinforcement.

What functional skills can be developed and applied to science?

Real-world contexts and problems provide a rich opportunity for pupils to draw from and apply a range of functional skills. The increased emphasis on HSW and Assessing Pupils' Progress (APP) means that science teachers will naturally be providing more open-ended, problem-solving tasks that require pupils to take greater ownership of their learning to:

- devise and refine their own hypotheses
- plan and carry out investigations
- select and deploy evidence to reach and justify their conclusions.

Pupils develop competence and confidence in using functional skills in an interrelated way. Their functionality develops over time as they learn to select and apply skills to tackle tasks accordingly. Subject teachers can support this process by ensuring that pupils have access to the full range of skills. The tables below outline a few examples of ways in which functional skills can be deployed in science.

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Functional English

Learning through discussion from text, and through writing, is integral to functional English and to the activities that you will ask your pupils to complete as part of your science syllabus. However, pupils will also need to deploy specific functional English skills such as those listed in the table below.

Functional English	Example of how applied in science
Make relevant and extended contributions to discussions, allowing for and responding to others' input *(Speaking, listening and communication)*	Discussions in science, for example, when exploring different perspectives on scientific and technological discoveries
Detect point of view, implicit meaning and/or bias *(Reading)*	When looking at various sources and data relating to scientific discoveries
Use language, format and structure suitable for purpose and audience *(Writing)*	Communicate the results of scientific investigations in writing, using formats and styles that are suitable for the purpose and audience

Functional mathematics

Mathematical skills of **representing, analysing** and **interpreting** can be developed in a wide range of science activities.

Functional mathematics	Example of how applied in science
Interpret statistical data *(Interpreting and communicating)*	To identify trends and critical shifts over time and *present* justifications, using appropriate mathematical diagrams such as charts, tables, graphs (e.g. infant mortality rates, changes in death rates due to diseases)
Represent and interpret scientific data in a variety of forms or use quantitative measures *(Representing)*	To compare within and across periods of time (e.g. predator-prey populations, biodiversity fluctuations)
Use logical reasoning and analysis *(Analysing)*	To explain the reasons for investigative outcomes during practical work

Functional ICT

Science provides a rich vein of opportunity for pupils to use, apply and secure ICT skills in new contexts.

Functional ICT	Example of how applied in science
Interact with and use ICT systems to carry out a straightforward task in a familiar context *(Using ICT)*	Selecting appropriate digital assets to create or process the information when investigating a scientific question or solving a problem
Take account of currency, relevance, bias and copyright when selecting and using online information *(Finding and selecting information)*	Recognise validity of online sources when researching information such as scientific articles, newspapers, for evidence to support or contradict a scientific hypothesis
Enter, develop and refine information, using appropriate software *(Developing, presenting and communicating information)*	Using text, images and graphs as part of a presentation to evidence the conclusions drawn as a result of a practical investigation

How can I secure the development of functional skills within my lessons?

As a science teacher you can support a cohesive and planned approach to the skills development of your pupils by:

- familiarising yourself with the functional skills criteria (see reference on page 3)
- talking to your colleagues, for example, those in the English, mathematics and ICT departments, about how and when certain functional skills are being taught
- talking to colleagues about how these skills complement the delivery of HSW in science lessons
- making clear from the beginning of a teaching sequence both the subject learning objectives, covering range and content and HSW that will need to be achieved, and the functional skills that will be developed and applied
- referring at regular intervals in lessons to the objectives and to the functional skills that are being used, encouraging pupils to assess their progress and to inform where they next need to focus
- designing problem-based activities, both within science and, where possible, in conjunction with other subject areas, that provide pupils with the opportunity to make choices about which functional skills they will use, individually and in combination, to seek solutions to challenges that are real, relevant and purposeful
- encouraging pupils to reflect on their learning, using probing questions that require them to identify how they have used their functional skills and how they can transfer and apply these skills to other contexts within and beyond science and the school.

What's in this booklet?

Three teaching sequences

The booklet contains three worked examples of teaching sequences that support how an organisation might embed and support the development of functional skills within science, as follows:

1. **Key Stage 3 teaching sequence:** The history of vaccination
2. **Key Stage 3 teaching sequence:** Battery-powered showcase
3. **Key Stage 4 teaching sequence:** Investigating your exposure risk

Each teaching sequence exemplifies three key principles:

- Problem-solving needs to be at the core of planning for functional skills.
- Real, purposeful and relevant contexts are essential for engagement and applied learning.
- Supporting pupils to progress and use both HSW and functional skills independently is the ultimate goal.

Functional skills focus

The teaching sequences support the development of a range of functional skills, for example, speaking and listening as well as reading and writing. In mathematics, pupils will usually deploy the skills of representing, analysing and interpreting in an integrated way to solve problems. Similarly the functional skills of using ICT, finding and selecting information, developing, presenting and communicating information will be used together.

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However, within each sequence, particular functional English, mathematics and ICT skills have been highlighted as part of the learning focus to show how they can be explicitly developed and applied. A science teacher would need to consider how, over a period of time, teaching sequences support the development and application of a broad skills set.

Functional skills progression

In line with the English, mathematics and ICT programmes of study, functional skills have been mapped at level 1 to the Key Stage 3 examples and at level 2 to the Key Stage 4 example. However, it is important to note that these are target levels to be achieved **at the end of** each of these key stages and that some learners will be working towards securing their functional skills at lower levels and some at higher levels. The teaching sequences can be tailored to the needs of your learners, as appropriate.

A learner's **level of performance** in functional skills and the level of demand of a task depend on the interplay of four factors that are critical to success:

- the **complexity** of tasks and problems and the contexts in which they are embedded
- the **technical demand** of the content that might be applied in these contexts
- a learner's level of **familiarity** with the type of task or problem and context
- the level of **independence** required of the learner.

The need for **problem-solving** underpins all of them. The four factors are a key to reflection on **progress** in functional skills. For more detail see the diagram on page 8 and visit the functional skills qualifications criteria on the Ofqual website.

Personal, learning and thinking skills

Functional skills and personal, learning and thinking skills work together to build independent, confident and successful learners. Therefore, references to opportunities to develop specific personal learning and thinking skills have also been provided.

For more information relating to personal learning and thinking skills visit:
http://curriculum.qcda.gov.uk/key-stages-3-and-4/skills/plts/

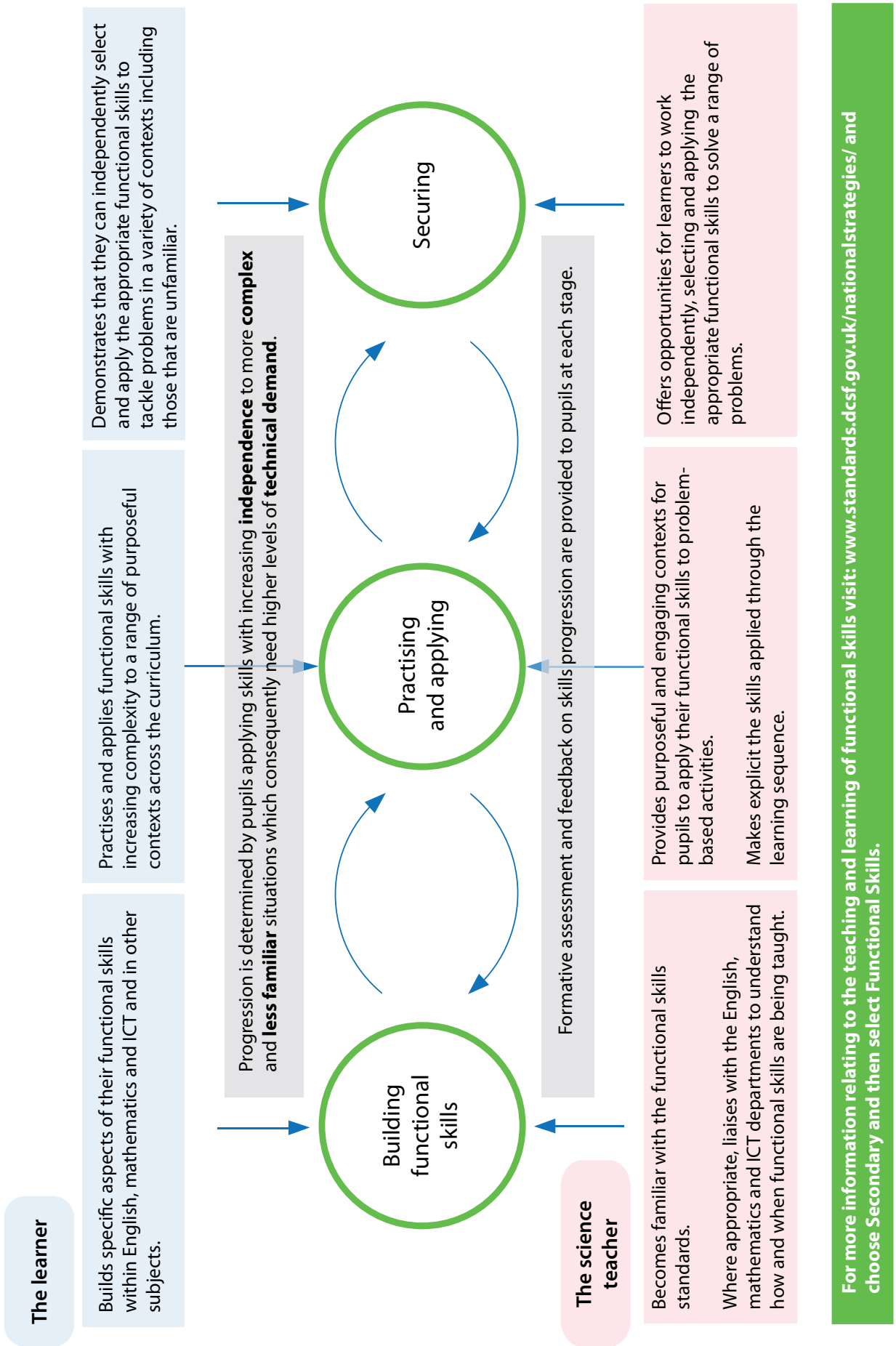
How can I use this booklet?

You can use these examples that follow, plus the additional information contained within this booklet, to:

- provide ideas that will inform your own planning (see planning tool on page 18)
- open a dialogue with teachers in your school who have the primary responsibility for delivering functional skills to find out more
- begin a discussion with other colleagues within your department about how to enhance functional skills development within science
- raise challenges and opportunities concerning working within and between subjects in your organisation.

For the key to the functional skills references that have been used in each context, please see the grid on page 2.

Developing and securing functional skills



For more information relating to the teaching and learning of functional skills visit: www.standards.dcsf.gov.uk/nationalstrategies/ and choose Secondary and then select Functional Skills.

Context 1: Key Stage 3 – The history of vaccination

Aims and overview

This module will enable learners to develop selected functional and HSW skills and processes while studying scientific concepts; they will use them to analyse, make sense of and respond to information exploring the scientific enquiry that led to the discovery of smallpox vaccine. This module is often taught as part of science in Key Stage 3 and develops a range of skills and processes.

The big question

Should all vaccinations be compulsory?

Learning focus – science

Pupils should be able to:

- obtain, record and analyse data from a range of primary and secondary sources, including ICT sources, and use their findings to provide evidence for scientific explanations
- explain how scientific ideas can be used to explain phenomena and generate and test theories
- consider the ethical and moral implications of using and applying science
- present and organise accounts and explanations about the science that has led to modern vaccination programmes that are coherent, structured and substantiated, using scientific vocabulary
- explain how biological factors can disrupt life processes
- explain how the body responds to microbial attack and how immunisation has been developed.

Learning focus – functional skills target: level 1

This teaching sequence supports the development of a range of functional skills. However, particular functional English, mathematics and ICT skills have been highlighted and annotated below to model, for illustrative purposes, how they can be explicitly developed and applied.

English	**Mathematics**	**ICT**
Speaking, listening and communication, reading and writing.	Representing, analysing and interpreting	Using ICT systems, finding and selecting information, developing, presenting and communicating information
Writing: Write a range of texts to communicate information, ideas and opinions, using formats and styles suitable for their purpose and audience.	*Interpreting*: Interpret and communicate solutions to practical problems, drawing simple conclusions and giving explanations.	*Finding and selecting information:* Use search techniques to locate and select relevant information. Select information from a variety of ICT sources for a straightforward task.

Stage and focus	Learning outcomes
Stage 1 – The context You have been asked to produce an information leaflet, to be given out to parents at antenatal classes, explaining how immunisation works and the advantages and disadvantages of the childhood immunisation programmes (MMR). Introduce the topic by having a class discussion about what pupils already know and the sorts of vaccination they have had. Refer to the big question and challenge the pupils to consider whether these vaccinations should be compulsory. Ask pupils to search and choose relevant materials to help them produce a historical guide to the work of Jenner, explaining the scientific facts, his developing ideas, his methods and how he used them to develop his vaccine. They should explore the controversy surrounding Jenner at the time and consider the ethical implications of testing and implementing a vaccination regime. Pupils should acknowledge their sources of information and recognise the degree of accuracy of online information and the validity and credibility of those sources. Pupils with access to ICT can apply a range of skills relating to the use of ICT, for example, to support the planning of their work, research and storage of online resources for later use.	Pupils make relevant and extended contributions to discussions and research the implications of the work of Jenner to produce the historical section of their leaflet.
Stage 2 – Research and exploration Pupils develop a plan for their leaflet and note the different types of sources and texts they will use, for example, public records, science web pages and text books. Pupils should consider what sort of statistical data would be useful to help them to explain and justify their guidance to parents, for example, death rates before and after a vaccine programme for smallpox. They will need to identify sources of such data and record it appropriately. Pupils should use the evidence to present a persuasive case.	Pupils produce a leaflet that meets the requirements of their agreed criteria. They will acknowledge sources of information.
Stage 3 – Deploying ideas and information Pupils should be encouraged to work in groups to define their arguments for and against childhood vaccination programmes and consider the appropriate form for writing this material – exemplars of NHS leaflets and posters may be useful as stimuli for pupils. This is a particular opportunity for independent application of pupils' own functional skills, and for increased technical demand, which they select and deploy. Ask the pupils to be 'inventive', using aspects of ICT to communicate their findings. Pupils could work in groups, or individually, to compile the leaflet for expectant parents, using formats and styles suitable for their purpose and audience. They should be encouraged to support arguments with appropriate primary and secondary data. Pupils here have the opportunity to use investigative approaches and work critically with the data. They will need to consider how to interpret and present the data, for example, in graphs or charts illustrating death rates before and after a vaccine programme for smallpox, in support of their arguments and to justify their guidance to parents. They should explain how they made sure they were collecting reliable and accurate data, checking the sources of their information regarding potential bias. The leaflet must clearly set out the risks and benefits of following the childhood immunisation programme.	Pupils present and organise accounts and explanations about the science that has led to modern vaccination, using key scientific vocabulary. Pupils interpret and communicate the key aspects of data to construct explanations that support the benefits of childhood vaccination programmes and link those to the possible consequences of contracting the disease.

PLTS Independent enquirers

FS.ICT.L1/F&S Search engines, queries

FS.ICT.L1/F&S Recognise and take account of currency, relevance, bias and copyright when selecting and using information.

FS.Eng.L1/W Use language, format and structure suitable for purpose and audience.

FS.Eng.L1/W Write clearly and coherently, including an appropriate level of detail. Use language, format and structure suitable for purpose and audience.

FS.Ma.L1/ Interpreting Extract and interpret information from tables, charts, diagrams and graphs.

PLTS Reflective learners

Stage and focus	Learning outcomes
Stage 4 – Consolidating and reflecting (moving towards functional skills level 2) Using the objectives set at the beginning of the work, pupils develop them as success criteria against which to review their own work and then support others by peer-reviewing some leaflets. This shared review makes explicit the opportunity to develop as reflective participators and develop team workers. Pupils could reflect on the way in which they have used functional skills and this could lead to a class discussion, bridging to other areas of work where they have used these skills before.	Pupils evaluate their work against success criteria developed from the learning objectives. Pupils set development points for each others' leaflets to form a learning plan for future work. The key points may include a reflection on the formats used and styles suitable for their purpose and audience.

PLTS
Reflective learners

Extending

- Invite a health professional to share with the class their perspective on the debate.
- Pupils consider appropriate ways of representing key data, for example, in mathematical graphical charts, tables and grids. They think how functional skills learned in a mathematical context can be transferred or applied in a scientific study. They clarify and articulate their choices with regard to decisions about data.
- Pupils create a data bank of information about current vaccination programmes and any new ones currently being explored.
- Pupils could consider the optional protective immunisations for travel abroad and produce fact files for target audiences.
- They could be challenged to use the evidence to construct responses to the concerns that some people have about vaccinations.
- Pupils could research the MMR vaccine controversy, to identify key points about its impact and about causal relationships.

Useful resources

www.jennermuseum.com This website for the Jenner museum offers information about Jenner: follow the link to 'Jenner'.

www.sc.edu Further information and access to historical materials related to Jenner can be found at this website: search on 'Jenner'.

Information about the MMR vaccine controversy can be found at:

- **www.en.wikipedia.org/wiki/MMR_vaccine_controversy**
- **www.discovermagazine.com/2009/jun/06-why-does-vaccine-autism-controversy-live-on**
- **www.immunisation.nhs.uk/Vaccines/MMR/The_vaccine**

Context 2: Key Stage 3 – Battery-powered showcase

Aims and overview

This module will enable pupils to develop selected functional and HSW skills and processes while studying scientific concepts; they will use these skills and processes to analyse, make sense of and respond to information in the context of a scientific enquiry relating to the development of cells. This module is often taught as part of science in Key Stage 3: Energy transfer and electricity – energy transfer by electric current, and develops existing skills and concepts.

The big question

How do metals make power?

Learning focus – science

Pupils should learn to:

- use scientific methods and techniques to develop and test ideas and explanations
- plan and carry out practical and investigative activities
- critically analyse and evaluate evidence from observations and experiments
- obtain, record and analyse data from a wide range of primary and secondary sources, including ICT sources, and use their findings to provide evidence for scientific explanations
- use scientific ideas and models to explain phenomena
- explain how energy can be transferred usefully, stored, or dissipated.

Learning focus – functional skills target: level 1

This teaching sequence supports the development of a range of functional skills. However, particular functional English, mathematics and ICT skills have been highlighted and annotated below to model, for illustrative purposes, how they can be explicitly developed and applied.

English	**Mathematics**	**ICT**
Speaking, listening and communication, reading and writing	Representing, analysing and interpreting	Using ICT, finding and selecting information, developing, presenting and communicating information
Speaking, listening and communication: Take full part in formal and informal discussions and exchanges that include unfamiliar subjects.	*Analysing*: Apply mathematics in an organised way to find solutions to straightforward practical problems.	*Developing, presenting and communicating information:* Enter, develop and refine information, using appropriate software to meet the requirements of straightforward tasks.

Stage and focus	Learning outcomes
Stage 1 – The context An electricity generating company wants to create a display to show how the electric cell has been developed through time. They have asked you to develop a display to go in the foyer of the company headquarters for visitors to see. They would like the display to show the main events in the development of electric cells and batteries, how metals are used in cells and a model demonstrating which metals are best. Your company has decided to make a bid for the work and will present to the electricity company's board a model of what the display will look like. Pupils will be encouraged to use summary and enquiry skills to explore and discuss what they know already and to identify the questions to which they need to find the answers. Encourage pupils to share their thoughts with the class and to propose scientific methods that may be useful. It may be appropriate to share ways in which electricity can be generated by using metal electrodes and citrus fruit.	Pupils explore, research and clarify ideas about how cells work. They identify a range of methods that could be used to research the task and develop a plan.
Stage 2 – Research and exploration Start by asking pupils to work in groups to identify what needs to be considered when developing a plan for creating this display for the company. Encourage pupils to develop a plan showing: • what information they think will need to be displayed, for example, the historical development of the first electric cell, starting with Alessandro Volta, and subsequent landmark developments in electric cell technology up to the present day • what they already know and what they need to find out • what types of source and text they could use. Pupils should consider the practical methods required to find out which metals are best for making electric cells out of citrus fruit. They could be encouraged to use concept-mapping software to arrange their ideas and information. They consider how mathematical data can be presented as tables and graphs, comparing data about which pairs of metals generate the highest voltage, and present information in a manner that expresses clarity, for example, graphs and pie charts. Pupils should identify appropriate formats for the display, such as display boards, posters, an onscreen presentation and multimedia elements. Pupils then share their findings with the rest of the class or other groups, drawing on the sources and data measures they have identified.	Pupils create a project plan demonstrating clarity of scientific language, justifying the methods and reasoning used to make their choices regarding practical methods and data analysis.

FS.Eng.L1/SLC
Make different kinds of contributions to discussions.

PLTS
Team workers

FS.Eng.L1/SLC
Present information/ points of view clearly and in appropriate language.

Stage and focus	Learning outcomes
Stage 3 – Deploying ideas and information Pupils carry out research and begin to collect appropriate information, diagrams and other media that will support the development of the display, with due regard for copyright and acknowledgement of sources. Pupils conduct the practical work required to find out which metals are best for making electric cells based on citrus fruit. They will need to collaborate and share tasks, as agreed in their plan, to collect, record and process the maximum amount of data. Pupils will consider and decide how they should use the data to make meaningful comparisons between the different types of electric cells they have used. They work critically to analyse and interpret the data they collect. They will explain how they made sure they were collecting reliable and accurate data. Encourage pupils to justify their results and connect them to the outcome (the big question).	Pupils collect, analyse and present data, to support arguments and conclusions, using appropriate technical and scientific terminology. They use the model of energy transfer in the explanations of their results.
Stage 4 – Consolidating and reflecting (moving towards functional skills level 2) The groups of learners then collate their information to create a mock-up of the display they will manufacture if they win the contract for the job. They have to present this to the managing director and their board. This task could become competitive, with each group given a fixed time to present their case and persuade the board. Pupils could use a success-criteria grid to identify the degree to which the presentations meet the initial brief as set. They will need to explain how they have reached their conclusions, why they have chosen the metal combination for the working model and what they will do with their information to share it with the class. This is a particular opportunity for independent application of students' own functional skills and for increased technical demand depending on which they select and deploy. Students should be encouraged to be inventive in their use of ICT to communicate their findings.	Pupils present information in their display clearly and using appropriate language. They show persuasive techniques in their writing and clearly explain the role of cells as energy stores and how energy is transferred to and from them.

FS.ICT.L1/DP&CI
Process numerical data.

Display numerical data in a graphical format.

FS.Ma.L1/ Analysing
Collect and record discrete data and organise and represent information in different ways.

PLTS
Independent enquirers

FS.Eng.L1/SLC
Prepare for and contribute to the formal discussion of ideas and opinions.
Present information/ points of view clearly and in appropriate language.

PLTS
Reflective learners

FS.ICT.L1/DP&CI
Apply editing, formatting and layout techniques to meet needs, including text, tables, graphics, records, numbers, charts, graphs or other digital content.

Extending

- Challenge learners to construct explanations for some simple devices to generate electricity for a particular audience.
- Learners could work in groups to select evidence to explore the similarities and differences between small-scale and large-scale methods of electricity generation.
- Structure group activities so that learners can research and use evidence to explain applications of energy transfer by electricity, for example, in hair removal and cardiac resuscitation.
- Provide opportunities for learners to plan and carry out investigations, using a range of circuits, to obtain evidence to identify quantitative patterns in explanations.

Useful resources

www.ideafinder.com Information about Alessandro Volta can be found at this website. Select 'History Facts and Myths', then 'Inventor Biography' and 'V' for Alessandro Volta.

www.inventors.about.com This website offers further information about batteries and Alessandro Volta. Follow the link on the left entitled 'Find: A to Z inventors' then select 'V' for Volta.

www.science-projects.com For information in developing a citrus battery and some ideas about setting up the practical work, select the website index, then 'R' and then 'Reduction potentials'.

Context 3: Key Stage 4 – Investigating your exposure risk

Aims and overview

This module will enable pupils to develop selected functional and HSW skills and processes while studying scientific concepts; they will use these skills and processes to analyse, make sense of and respond to information in the context of a scientific enquiry relating to the making of informed lifestyle choices. This module is often taught as part of science in Key Stage 4 and will build on basic science skills that the pupils have already encountered.

The big question

How can you reduce your personal risk of contracting skin cancer?

Learning focus – science

Pupils should learn:

- that ultraviolet (UV) radiation can damage human cells and lead to skin cancers such as melanoma
- that melanin produced by the skin provides some protection from UV radiation but that everyone is at risk
- how explanations of phenomena can be developed, using scientific theories and ideas
- how to present information, develop an argument and draw a conclusion, using scientific, technical and mathematical language, conventions and symbols and ICT tools
- how to interpret data, using creative thought to provide evidence to test ideas and develop theories
- how to evaluate the risks and benefits associated with electromagnetic (EM) waves of different frequencies and intensities and their effects on body cells.

Learning focus – functional skills target: level 2

This teaching sequence supports the development of a range of functional skills. However, particular functional English, mathematics and ICT skills have been highlighted and annotated below to model, for illustrative purposes, how they can be explicitly developed and applied.

English	**Mathematics**	**ICT**
Speaking, listening and communication, reading and writing	Representing, analysing and interpreting	Using ICT systems, finding and selecting information, developing, presenting and communicating information
Reading: Select, read, understand and compare texts and use them to gather information, ideas, arguments and opinions.	*Representing*: Identify the situation or problems and identify the mathematical methods needed to solve them.	*Using ICT*: Select, interact with and use ICT systems safely and securely for a complex task in non-routine and unfamiliar contexts.

Stage and focus	Learning outcomes
Stage 1 – The context A primary headteacher wants you to take an assembly to explain to their Year 6 how to protect themselves from UV radiation and reduce their risk of developing skin cancer. During the assembly you are to distribute a leaflet that you have produced for them to take home for their parents or carers. The leaflet should explain how exposure to UV radiation can increase the risk of developing skin cancer and the reasons why a range of protective actions could be taken. Ask learners to discuss what they know about UV radiation and skin cancer. They should then research and identify the key features of the health hazards of UV radiation, how the body protects itself and ways of supplementing this protection. In drawing out the key themes, learners could use concept-mapping software to collect their thoughts and set out in some detail the key questions they think parents and children will want answered. Pupils develop a project plan to identify the key areas of research, style of leaflet and an appropriate format for the intended audience. Encourage pupils to identify how they might collect up-to-date information, how that might be stored digitally (until such time as the final leaflet is to be prepared) and how they will ensure they do not infringe any copyright issues.	Pupils develop an appropriate plan to create a visual graphic using ICT, which demonstrates their understanding of the elements involved, main task and how they plan to complete it.
Stage 2 – Research and exploration The learners are encouraged to discuss and define the types of information they will need to gather and link behaviours with the risks and consequences of exposure to UV radiation. To do this they could: • Construct a questionnaire to find out what is currently understood by Year 6 pupils to gain the views held by their peers and use this data in their work and discuss the most appropriate format for presenting the analysis of their data. • Summarise the pros and cons for taking various actions when keeping safe in UV radiation. Learners should use research skills to review a variety of sources to support their presentation with evidence. Learners should decide what statistical information and processes will be appropriate to help them manage and interpret both primary-source data (e.g. the outcomes from their questionnaires) and secondary-source data (e.g. skin cancer rates in different regions or in different segments of the population, collected from the internet). Learners could use ICT to draft the layout and content of the leaflet and, if appropriate, use ICT to provide visual and aural aids for the assembly.	Pupils work collaboratively to sort and select the most appropriate data and evidence needed for their presentation and leaflet, linking the information to scientific explanations where appropriate. Pupils will have presented appropriately the statistical data and/or primary data from questionnaires and use ICT to process and analyse numerical data.

PLTS
Team workers

FS.Eng.L2/R
Identify the purposes of texts and comment on how meaning is conveyed.

FS.ICT.L2/Using ICT
Manage files, folders and other media storage to enable efficient information retrieval.

FS.Eng.L2/R
Select and use different types of texts to obtain and utilise relevant information.

FS.Ma.L2/ Representing
Decide how to use and interpret statistical measures, tables and diagrams, for discrete and continuous data, using information and communication technology (ICT) where appropriate.

FS.ICT.L2/Using ICT
Select and use software applications to meet needs and solve complex problems.

Stage and focus	Learning outcomes
Stage 3 – Deploying ideas and information Learners collaborate to produce a leaflet and develop the presentation for the assembly. They will need to select the appropriate formats and techniques for their presentation and use comparative data to support their guidance, as presented in the leaflet and the assembly presentation. The group could discuss and use effective reading strategies that help learners to summarise the information. Learners will need to decide how to use statistical processes to transform the data into appropriate displays for the target audience.	Pupils should use ICT to provide rapid generation of different graphical and audio materials to enhance their key messages about risks of skin cancer. They should have considered the visual impact of their leaflet and used accurate and persuasive writing.
Stage 4 – Consolidating and reflecting Pupils would then deliver the assembly presentation to inform Year 6 children and their parents about the most effective ways of staying safe from UV radiation. This provides a large degree of independence and pupils will be able to secure a number of functional skill areas in speaking and listening, as well as writing, which incorporates data to enhance the key messages they are putting across.	Pupils will have shown functionality by the selection and use of relevant source material and data and will have written concisely and persuasively in their leaflets. Pupils will have applied a range of skills when producing the visual presentations they have chosen to use in the assembly.
Extending Pupils could investigate the effectiveness of sun-protection lotions. They can do this by using dataloggers to measure UV radiation. **Note:** Conduct risk assessment beforehand. Pupils could use data to investigate and present their findings on the prevalence of skin cancer in different countries.	

FS.ICT.L2/Using ICT
Select and use software applications to meet needs and solve problems.

FS.Ma.L2/ Representing
Decide how to use and present statistical measures, tables and diagrams, for discrete and continuous data.

PLTS
Effective participators

Useful resources

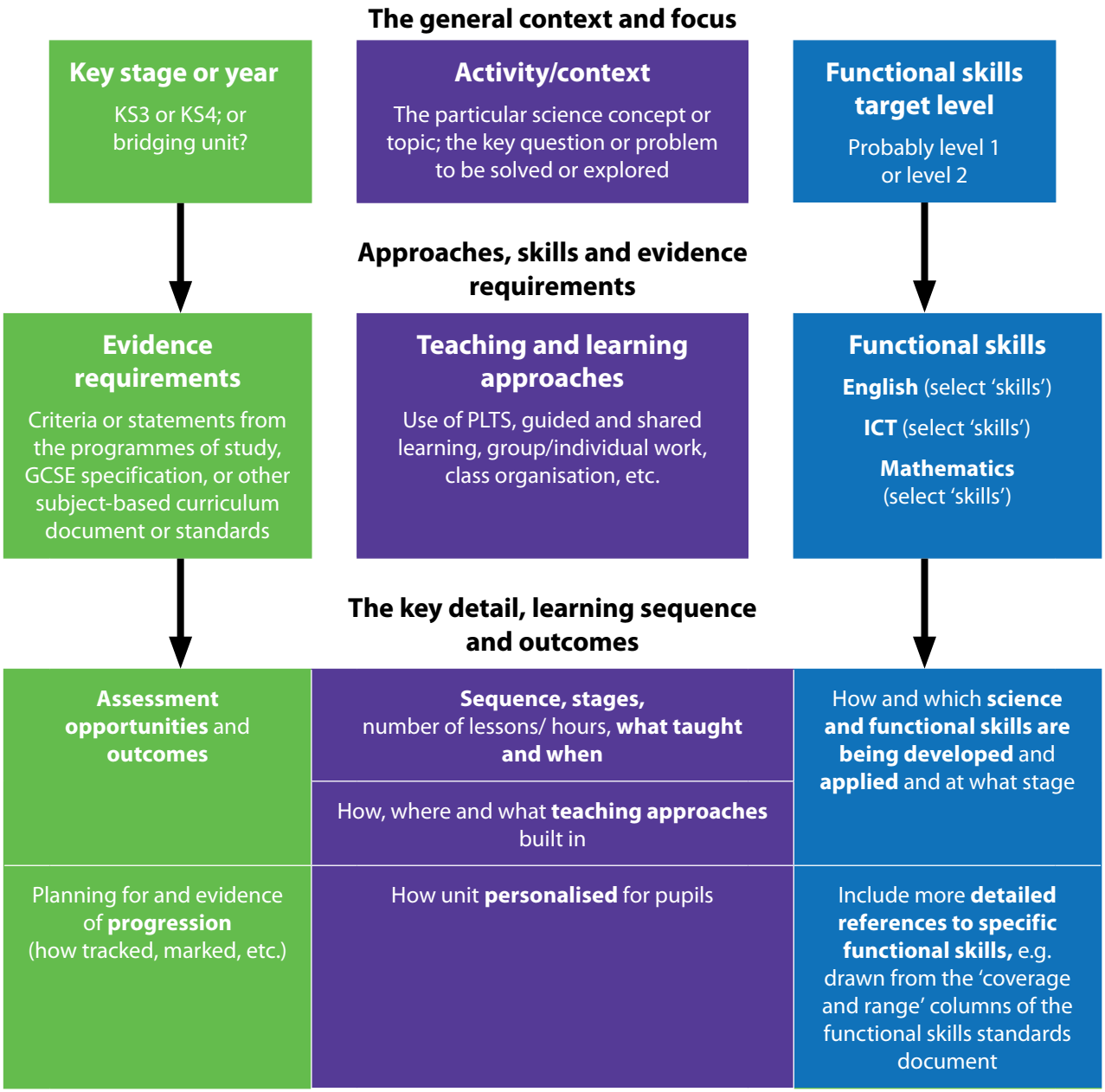
http://info.cancerresearchuk.org For data to support conclusions on risk protection, visit this website and then follow the links.

http://outdoorphysics.educ.umu.se This website offers support in developing practical work related to sun protection lotions. Follow the links to resources (select 'light' in the field drop-down menu).

www.data-harvest.co.uk This website provides materials for use with dataloggers that could link to exploring the measurement of light intensity.

Functional skills in science: A planning process

The planning diagram below provides a structure for planning a science activity or topic that integrates functional skills. Note that it starts from the science activity or topic within HSW and that functional skills are an integral part in the successful completion of the activity. It is a mistake to distort a science activity simply to ensure that it includes functional skills; however, the inclusion of functional skills may well allow for a greater degree of independent learning and skills application. A cross-curricular model would look different insofar as the focus would be on more than one subject area.



Resources

Strengthening teaching and learning in science through using different pedagogies DCSF 0703-2004

This guide discusses how to strengthen teaching and learning in science by using group talk and argument and active questioning, improving the learning climate, using models and modelling techniques and teaching the science of contemporary issues.

Progressing to level 6 and beyond in science with added *How science works*

This is available from: www.standards.dcsf.gov.uk/nationalstrategies

The Framework for secondary science

The *Framework for secondary science* is designed to increase pupils' access to excellent teaching and engaging, purposeful learning that will enable them to make good progress through Key Stages 3 and 4. It is available from: www.standards.dcsf.gov.uk/nationalstrategies

Literacy and learning in science DfES 0656-2004G

The purpose of this booklet is to help science teachers support the development of:

- learning through talk
- learning from text
- learning through writing.

Leading in learning: Exemplification in science DfES 0051-2005G

The purpose of the booklet is to demonstrate how science teachers can contribute to the development of pupils' learning and thinking skills. It provides examples of the 10 teaching strategies contained in the Leading in learning teachers' handbooks for Key Stage 3 (Ref: DfES 0035-2005G) and Key Stage 4 (Ref: 2111-2006DWO-EN), which are the main source of guidance for Leading in learning.

ICT across the curriculum: ICT in science DfES 0178-2004G

The **ICT across the curriculum** (ICTAC) pack is a set of materials designed to promote the use of ICT across all subjects in schools.

Pedagogy and practice: Teaching and learning in secondary schools
DfES 0423-2004G

The **Pedagogy and practice** materials consist of a suite of 20 study guides supported by a series of video sequences on DVD-ROM.

All of the materials listed, along with the 10 other subject booklets in this series and a suite of e-learning modules, are available for download from: **www.standards.dcsf.gov.uk/nationalstrategies**

The Functional Skills Support Programme (FSSP)

A dedicated website for the Functional Skills Support Programme (FSSP) provides a first point of contact for all functional skills support. It includes the Learning and Skills Improvement Service (LSIS) training modules for functional skills for the post-16 sector and a series of booklets to support teaching functional skills in diplomas. The FSSP website can be accessed at: **www.fssupport.org**

For case studies and further guidance about planning for functional skills, visit: **http://curriculum.qcda.gov.uk/key-stages-3-and-4/skills** and select Functional skills.

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