



Key Stage 3 National Strategy

Guidance

Curriculum and
Standards

Literacy in design and technology

For school-based use or self-study

Heads of design
and technology
Teachers of design
and technology

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General introduction to the Literacy in series

The aim of the subject-specific material in the *Literacy in series* is to exemplify how aspects of the *Literacy across the curriculum* training file relate to individual subjects.

Where appropriate, the relevant section from the *Literacy across the curriculum* training file is indicated so that you can refer to it as and when you wish.

Key principles

- To develop consistent approaches to teaching and learning in literacy across departments, and to build increased awareness of the skills, knowledge and understanding that pupils could be expected to bring to lessons
- To use speaking and listening to develop subject learning
- To develop active reading strategies to increase pupils' ability to read for a purpose and engage with text, and to realise the learning to be gained from it
- To demonstrate the sequence for writing and modelling writing for a key text type within the subject; seeing how it is done helps pupils to achieve it for themselves more quickly
- To make suggestions for the learning of subject-specific vocabulary

English Framework objectives

The objectives from the *Framework for teaching English: Years 7, 8 and 9* which apply across the curriculum appear in an appendix: most are the key objectives (in bold) but others have been added for clarity or exemplification. This will help you to set literacy curricular targets and ensure common approaches through the objectives.

Developments in cross-curricular literacy

As expertise grows, schools may wish to decide which department teaches a particular aspect of literacy, such as explanations in non-fiction writing, and how other subject areas can support and develop pupils' learning by reinforcing it and applying it to their subject as appropriate. This will save time and ensure that pupils have a consistent approach to specific aspects of literacy.

As expertise develops in, for example, active reading strategies or managing group talk, and pupils know the expectations across the curriculum, their confidence will grow and their ability to take responsibility for their learning will also develop. This, again, will save time for teachers as they will not have to keep teaching the skills.

Making use of the Literacy in materials

Each subject is available on its own CD. On the disc you will find both the text (a combination of information, guidance, case study materials, mini tasks and ideas for practical application in classrooms) and the video clip(s) that accompany it. Where a short task has been suggested, you are invited to check your responses against those of other teachers in the examples provided.

The materials can be used by an individual teacher to reflect on current practice and identify fresh approaches. However, we recommend collaborative use by a department team, so that the activities and discussion topics can be used to promote joint review and collective action. In this way, approaches can be trialled and discussed, and greater consistency of practice ensured.

Contents

1	Word level	page 4
2	Speaking and listening	page 9
3	Reading	page 16
4	Writing	page 29
5	Planning for literacy objectives	page 39
Appendix	Objectives from the <i>Framework for teaching English: Years 7, 8 and 9</i>	page 44

Aim

- To suggest approaches to spelling and vocabulary in the design and technology lesson

1.1 Teaching spelling

You may have a list of key spellings (like the list below, taken from the *Framework for teaching English: Years 7, 8 and 9*), which you encourage pupils to learn. This may be in the form of word walls or lists in student planners. This section aims to go beyond the learning of spelling lists and to consider ways of teaching spelling and understanding the subject-specific meanings of words.

Design and technology spelling list

aesthetic	machine
brief	manufacture
carbohydrate	mineral
component	natural
design	nutrition
diet	polyester
disassemble	portfolio
evaluation	presentation
fabric	production
fibre	protein
flour	recipe
flow chart	sew
hygiene	specification
ingredient	technology
innovation	tension
knife/knives	textile
linen	vitamin

Printed below are some words taken from the above list with others added. Take a few moments to think about how you currently help pupils learn to spell these words.

adaptable	process
appearance	resilient
component	suitable
design	technology
ingredient	temperature
manufacture	versatile

Now compare your ideas with the suggestions from other teachers that follow.

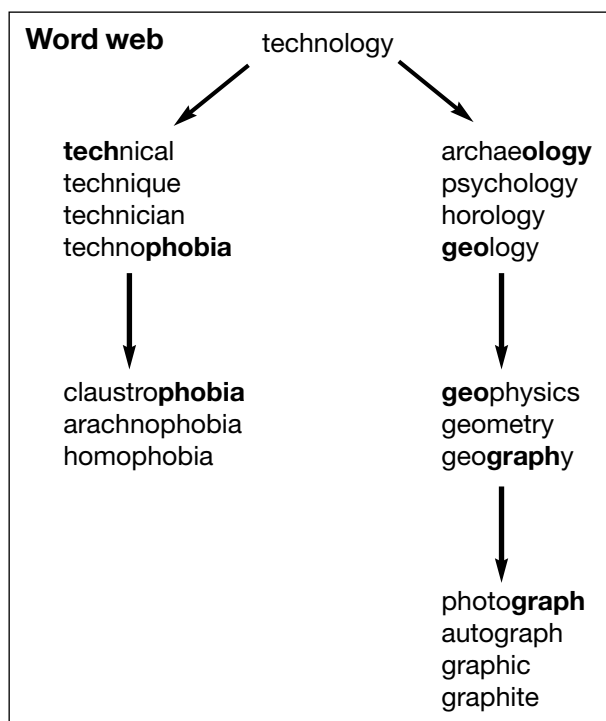
Examples of spelling strategies to consider

- Refer to root meanings – for example, *proto* = original
- Break it into sounds – for example, c-o-m-p-o-n-e-n-t
- Break it into syllables – for example, e-val-u-a-tion
- Break it into affixes – for example, re-search
- Apply a rule – for example, *I before E except after C*, for *brief*
- Refer to a word in the same word family – for example, design, sign, signature
- Use a key word – for example, *process* as a key word for excess, recess, and so on
- Look for words within words – for example, *one* in *component*
- Say it as it looks – for example, *technology*
- Use a mnemonic – for example, one collar, two sleeves, for *necessary*
- Encourage the use of visual memory (look – say – cover – write – check)

Of course, a number of words will yield to more than one strategy – for example, several words contain other smaller words within them. What matters is suggesting a *range* of appropriate strategies to pupils so that they can decide what is appropriate for them.

Design and technology is rich in root words drawn from Latin and Greek. Although pupils may find these words difficult to spell, they are useful in developing an understanding of what the words mean. This understanding can be transferred to other subjects and thus further support pupils' learning.

Printed below is a word web involving the roots *tech*, *ology*, *phobia*, *graph* and *geo*. The left-hand column under *technology* takes *tech-* as its starting point; the right-hand column takes *-ology* as its starting point. The other roots are picked up as the web develops.



Take a few moments to decide on the meaning of the roots.

The following notes will help you to check the meanings if you are unsure.

tech = make, do

ology = study

phobia = fear

graph = draw

geo = earth

It is possible to work out the meaning of a root, and to spell new words by analogy with known words by using the root. This is important to pupils as they can transfer their understanding of roots across the curriculum. As a department, or with a colleague, you could develop further examples for use in the classroom – for example, starting with *manufacture*, *process*, *carbohydrate*, *production* or *polyester*.

It might be useful to keep an etymological dictionary in the department for your own and your pupils' reference.

1.2 Subject-specific vocabulary

Subject-specific terminology enables precise meaning to be conveyed. However, not all words used in design and technology are free of ambiguity. Pupils may use design and technology-specific vocabulary differently in other contexts.

Using words in different contexts

Printed below is a grid which includes some words that have very specific meanings in design and technology, but that may have different, or less specific, meanings in other contexts. Take a few moments to think of the design and technology meaning and then any other meaning pupils might bring to the word. There are blank rows so that you and/or the department can add other words that might confuse pupils. It might be useful for pupils to do such an activity at the beginning of a topic or project to assess their prior knowledge and support you in deciding what needs to be taught.

Using words in different contexts

Word	Everyday/other context	Design and technology context
bias		
current		
discrimination		
grain		
mould		
smart		
tension		

It is worth noting that:

- the best learning is achieved not through a test, but through an active task
- it is best to introduce terminology at the time it is in use in the topic, so that pupils can see how it is used in context
- there are often moments in a lesson when word level activities can take place; these might be when work is being given out, or at the beginnings and ends of lessons.

1.3 Teaching subject-specific vocabulary

Take a few moments to note down some ways in which you might teach subject-specific vocabulary in your classroom. Compare your ideas with the following suggestions from some other teachers which have proved helpful.

Possible activities for learning subject-specific vocabulary

- *Laminate a set of key term and definition cards for matching activities. Read the definitions aloud and ask teams to provide the matching key terms.*
- *Delete the subject-specific terminology from a passage and ask pupils to write in the correct terms.*
- *Display terms and definitions for a current topic on the wall.*
- *Set a crossword puzzle in which the words sought are terms and the clues are definitions.*
- *Set a key terms word search in which definitions are given as clues and terms have to be located in the grid.*
- *Feed subject-specific words into a hand-held spell-checker so that they can be used for the word games.*
- *Ask groups of pupils to devise A3 posters to illustrate the terms.*

Aims

- *To consider the ways in which speaking and listening can support the development of concepts in design and technology*
- *To identify teaching strategies to support this development*

2.1 Introduction

Before starting on this section, it is worth thinking about talk (i.e. speaking) and some of the issues surrounding it.

- We often use group work and pair work, so pupils will benefit from being taught how to use these ways of working effectively.
- We often assume talk is natural and easy, but for many pupils it isn't.
- We don't always take full advantage of the range of types of talk available.
- Talk has as many, if not more, 'text-types' than writing; the main categories (e.g. explanation, instruction, description, information) are used in talk as well as in written text.
- Talk is also quick, fluid and shared: it can do some things better than writing – for example, exploratory work, quick sharing of ideas.

2.2 Oral frames

Oral frames can be used in the same way as writing frames: to provide structures for pupils at text, sentence and word level.

Printed below are some useful phrases for analysing and evaluating a product.

To begin with
 At first
 Firstly
 Initially
 There are several reasons why
 In order to
 I now know that
 One problem was
 A possible solution would be
 This shows that
 Perhaps I could have
 To improve this I need
 The result is
 As a result

You will recognise these immediately as phrases that can be deployed in both speech and writing when evaluating a design or product.

Try taking the first four words or phrases from the list and think about how variations on a key phrase can be used to fit any sentence – for example, *To begin with, we looked at a range of toys to assess their use for young children; To begin with, I decided to use red and green acrylic ...*

This sort of grammatical reshaping is a valuable asset to speakers because evaluations are often started in both speech and writing before the sentence has been grammatically polished and hence may not be as clear as the speaker or writer intended.

Now take a few moments to think about similar phrases for exploratory, hypothetical, speculative talk – for example, *What if ...*

Here are some further suggestions:

<i>Supposing ...</i>	<i>I wonder if ...?</i>
<i>Imagine ...</i>	<i>Ought we to ...?</i>
<i>Conceivably ...</i>	<i>What about ...?</i>
<i>Perhaps ...</i>	<i>Why would ...?</i>
<i>Maybe ...</i>	<i>It's possible that ...</i>
<i>Could we ...?</i>	<i>It's probable that ...</i>
<i>It might ...</i>	<i>It could be that ...</i>

You may want to think about introducing an activity that involves gathering key phrases as a good starter activity prior to group work; this would also feed into written work.

Another useful way of developing spoken language is to place pupils in groups of four and ask them to generate suitable phrases as part of ongoing work. Examples might include the language of:

- collaborative problem-solving – for example, generating a design proposal
- drawing out similarities and differences – for example, in different products
- explaining a process – for example, a design proposal.

The department may feel it would help to draw up a list of its own before asking pupils to do so.

2.3 Using talk to deepen understanding

Talk is often referred to as a 'tool' for learning because it can help us to:

- think through ideas
- express thoughts, feelings and opinions
- influence other people
- articulate ideas
- share knowledge
- feed back and review ideas
- adapt and refine ideas
- reach closure, accommodation or acceptance of different ideas
- negotiate solutions

and much more.

The next section involves video sequence 1, which shows how talk is used to develop understanding.

About the video sequence

Dawn Barraclough-Green is teaching a Year 7 class, focusing on developing their understanding of what a design specification might be. The video sequence shows the class using talk to evaluate a range of bread products.

The lesson was an hour long and was structured as follows.

- 1 *Introduction and discussion with whole-class feedback.*
- 2 *Discussion to arrive at criteria for judging a product.*
- 3 *Discussion of a bread product in the light of pupils' suggested criteria.*
- 4 *A plenary where the teacher drew out the similarities between their criteria and those of a company called Buns R Us.*

The speaking and listening objectives taken from the *Framework for teaching English* were:

- SL1 use talk as a tool for clarifying ideas
- SL10 identify and report the main points arising from a discussion.

The video has been edited to focus on the discussion and feedback.

The grid below can be photocopied and used to focus your thinking as you watch the video, especially if you are working as a department.

Video grid

SL1 use talk as a tool for clarifying ideas

SL10 identify and report the main points arising from a discussion

How are pupils organised?	
What type of questions does the teacher use?	
What strategies are used to encourage purposeful talk?	
How does the teacher encourage pupils to use design and technology-specific language?	
How successful are the pupils in meeting the speaking and listening objectives?	

As you watch the video sequence, take a few moments to think about the aspects of the lesson that contribute to its success. Afterwards, compare your ideas with the way some other teachers thought about the lesson, as noted below.

- The lesson structure permits the discussion to move through several phases to a conclusion.
- The teacher has formed the groups so that all pupils can participate.
- The objectives and purpose for the talk are clear.
- The teacher models the kinds of questions to ask; these are open questions that permit discussion to develop and continue.
- Dawn focuses pupils' talk onto specific aspects of design and technology.

- By the time pupils present their findings, they have been enabled to use much more specific vocabulary as well as understand the nature of the importance of a target group to the design specification.

Printed below are strategies for making group discussion purposeful and promoting a range of speaking and listening. They are taken from *Managing group talk*, which you will find in the training material for literacy across the curriculum. As you read them, think how you could plan them into your classroom activities.

Strategies for making group discussion purposeful and promoting a range of speaking and listening

Pair talk

Pupils work together in pairs – possibly friendship, possibly boy–girl, etc. Each pair then joins up with another pair to explain and compare ideas.

Listening triads

Pupils work in groups of three. Each pupil takes on the role of talker, questioner, recorder. The talker explains something, or comments on an issue, or expresses an opinion. The questioner prompts and seeks clarification. The recorder makes notes and gives a report at the end of the conversation. Next time, roles are changed.

Envoys

Once groups have carried out a task, one person from each group is selected as an ‘envoy’ and moves to a new group to explain and summarise, and to find out what the new group thought, decided or achieved. The envoy then returns to the original group and feeds back. This is an effective way of avoiding tedious and repetitive ‘reporting back’ sections. It also puts a ‘press’ on the envoy’s use of language and creates groups of active listeners.

Snowball

Pairs discuss an issue, or brainstorm some initial ideas, then double up to fours and continue the process, then into groups of eight in order to compare ideas and sort out the best or to agree on a course of action. Finally, the whole class is drawn together and spokespersons for each group of eight feed back ideas. A useful strategy to promote more public discussion and debate.

Rainbow groups

A way of ensuring that pupils are regrouped and learn to work with a range of others. After small groups have discussed together, pupils are given a number or colour. Pupils with the same number or colour join up, making groups comprising representatives of each original group. In their new group pupils take turns to report back on their group’s work.

(continued)

Jigsaw

The advantage of a 'jigsaw' is that it offers a structure for group work, and promotes a range of speaking and listening. This is a four-stage process involving home groups and expert groups:

Home groups

The teacher divides the whole class into small groups (commonly four pupils per group). These are teacher-initiated in order to make each group reflect the balance of the whole class – gender, ability, attitude.

Each group is given a common task. Handouts are employed in order to set the task. Reading material is kept to a manageable length and complexity. If the home groups are of four, then there are four questions or tasks within the main task – one for each member of the group. Questions or tasks are allocated within each group, through negotiation between the pupils.

Expert groups

All the pupils who have selected a particular question or task regroup and work together on what is now a common problem and outcome. By the time this stage of the section is completed, each has become an expert on this matter, through discussion and collaboration with the other 'experts'.

Return home

Original groups reform. Dissemination begins. The pupils know that there will be a follow-up task requiring understanding of all four questions or sets of information, not just their own speciality. All the pieces of the jigsaw have to fit together.

Final task

The home groups are set a final task. This could be a group outcome, or an individual task. The crucial element is to ensure that pupils have to draw on the combined 'wisdom' of the home group in order to complete it successfully.

2.4 Moving on

The department shown in the video sequence is in the early stages of looking at the way it uses talk to develop design and technology. It decided to focus on Year 7 in the first year of implementing the strategy. As mentioned above, Dawn used two objectives from the *Framework for teaching English* to support her planning:

- SL1 use talk as a tool for clarifying ideas
- SL10 identify and report the main points arising from a discussion.

Take a few moments to think about how you build in, or could build in, these two Year 7 objectives to your own scheme of work.

Now look at the following Year 8 objectives for speaking and listening from the *Framework for teaching English*.

- SL5 ask questions to clarify understanding and refine ideas
- SL10 use talk to question, hypothesise, speculate, evaluate, solve problems and develop thinking about complex issues and ideas
- SL11 recognise and build on other people's contributions
- SL3 make a formal presentation in standard English, using appropriate rhetorical devices.

Take a few moments to decide how the Year 8 objectives build on the Year 7 objectives, and then think about where and how you might build the Year 8 objectives into your own scheme of work.

You may want to discuss this with your department in the near future so that you are all working to common approaches.

Take some time to consider the ideas listed below, which show what other teachers have thought about the place of speaking and listening in design and technology.

- Design and technology is dependent on pupils being able to hypothesise, speculate and solve problems.
- Explicitly teaching the language to do this helps pupils think more clearly, express themselves with precision and develop the language skills needed in writing.
- Using Framework objectives helps the teaching of the skills required of an effective speaker and listener.
- Planning for speaking and listening ensures that the talk supports the learning in design and technology and ensures progression in the talk.
- The ability to use standard English with confidence when appropriate is a skill needed throughout life and supports the development of a clear writing style.

Aim

- *To be able to use a variety of ways to support pupils in their reading in design and technology*

3.1 Introduction

It's obvious that the kind of reading demanded depends very much on the task pupils are required to do and their reason for reading.

Just to remind you, the following list sums up the kinds of reading pupils might undertake.

Continuous reading:	reading a text in an uninterrupted, linear way
Close reading:	careful reading involving detail, reflection, referring back, checking
Skimming:	glancing quickly through to get the gist – is it worth a read?
Scanning:	searching for particular information

Take a few moments to think about how the approaches noted above are used in your lessons and compare your ideas with those listed below.

- Continuous reading – for example, reading for pleasure an article about food.
- Close reading – for example, reading to prepare a presentation about an aspect of a discovery, invention or technique; reading instructional work sheets.
- Skimming – for example, to see if a book contains any information on a resistant material.
- Scanning – for example, to look for specific information (for example, on a web page).

3.2 Reading work sheets and textbooks

It is likely that textbooks are rarely used in your design and technology lessons, but you may well use support sheets and instruction sheets as pupils move through Key Stage 3.

Your instruction sheets may contain a variety of ways of conveying information such as words (to give instruction), pictures (how to do the action in a safe manner) and graphics (e.g. arrows to show a sequence).

Activity

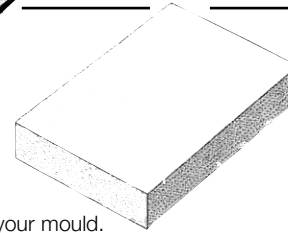
Either use the sample work sheets given below or look at some of the sheets you use in your lessons and take a few moments to think about the following points.

- What do pupils need to know in order to read and follow the instructions?
How do you support your pupils in reading your work sheets?
- What problems might pupils encounter as they try to follow the instructions?
How do you ensure that they can read your instruction sheets with confidence?



Your sensor could look like this. It has a thin 3mm base and a vacuum formed polystyrene top. Your electronics will go inside.

How to make it



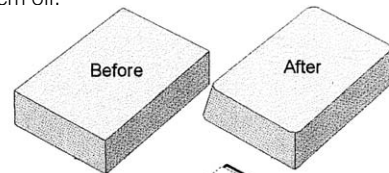
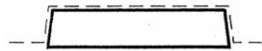
- 1** You will be given a piece of thick MDF (pre cut). This will become the top part of your mould.

You will need to shape it to look like your design. Cut your shape out using a coping saw or scroll saw.

You must keep it simple with no large indentations.

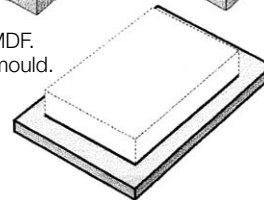
- 2** You need to make the sides of this thicker piece of MDF slant inwards and round them off.

This also helps the removal of the mould.



- 3** You will now be given a piece of 3mm MDF. This will become the base part of your mould.

Draw around the larger piece of MDF on to your thinner piece. Now add 5-8mm to your line all the way around.

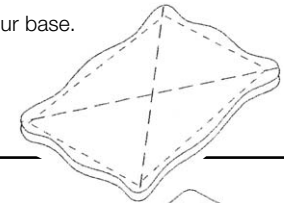


Sensor case Possible manufacturing plan

- 4** Try to leave the corners of the base part curved. This will save your plastic from splitting.
The base piece does not need a draught angle. You want it to be a tight fit and not to come out of the plastic case easily.

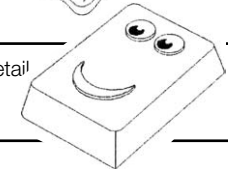
- 5** You can if you wish add extra shapes to your base. File the straights a little.

DO NOT GO OVER THE INSIDE LINE.
YOUR BASE MUST BE LARGER THAN
THE TOP PART OF YOUR MOULD.



- 6** You will need to file and abrade (sand) your edges of both pieces.

- 7** You may wish to add an image to the top as a detail.
This needs to fit within the space on top. Keep it simple. Make it out of thin MDF, thin card.

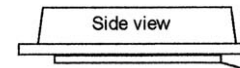


- 8** You now need to sanding-seal both elements of MDF separately. Then abrade with fine glass paper.

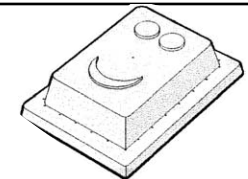
- 9** You need to stick both parts together temporarily with double-sided tape.

- 10** Using a 3mm drill bit drill 1 hole in the middle of your mould all the way through and around the edges of the thicker piece with a 1mm drill.

- 11** You are now ready to vacuum form.



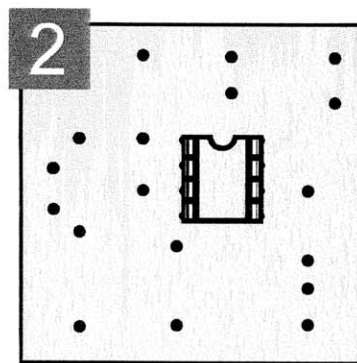
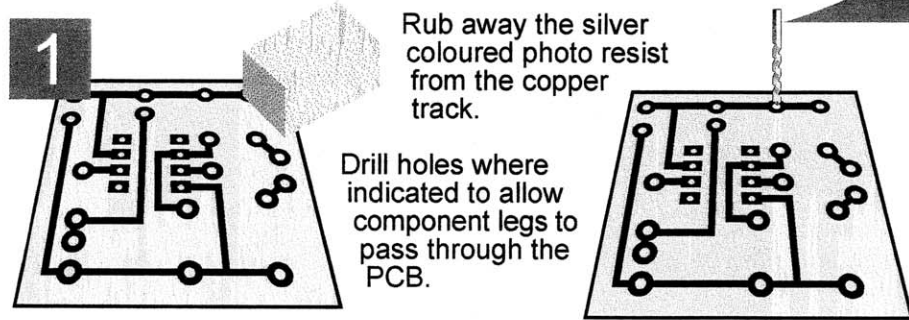
Put a small 3mm spacer underneath your mould.
It helps makes the plastic a good fit.



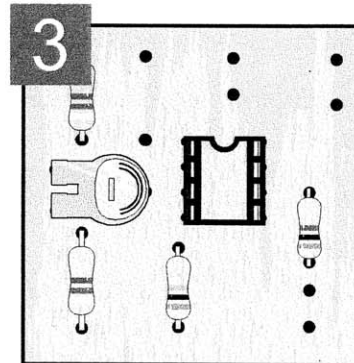
- 12** You now cut around the base using a knife. Cut off most of the waste first.
Then trim by leaning the blade onto your MDF base.

Electronic Sensor

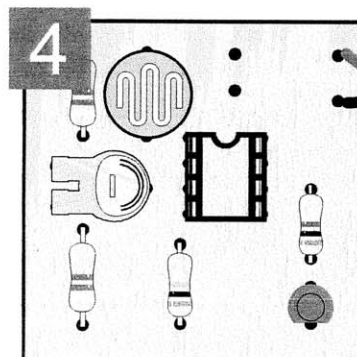
Printed circuit board preparation and population



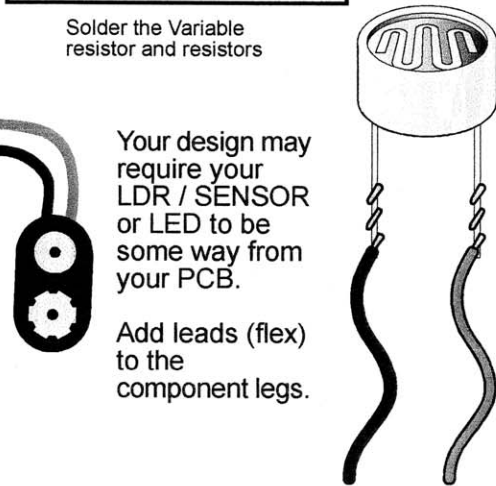
Solder the DIL holder



Solder the Variable resistor and resistors

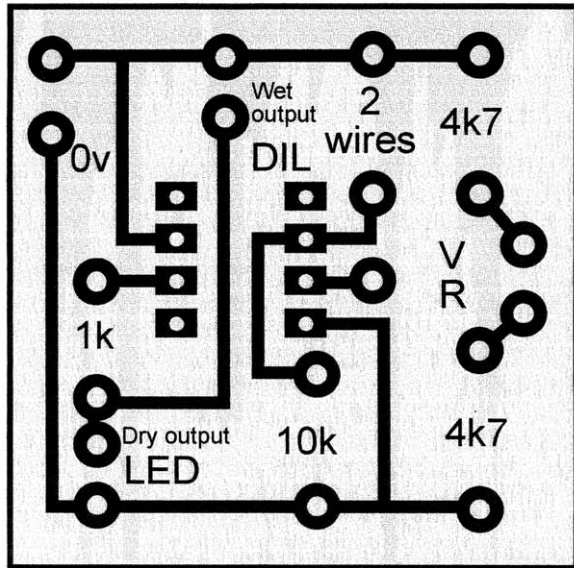


Add the Battery snap, LED and LDR.



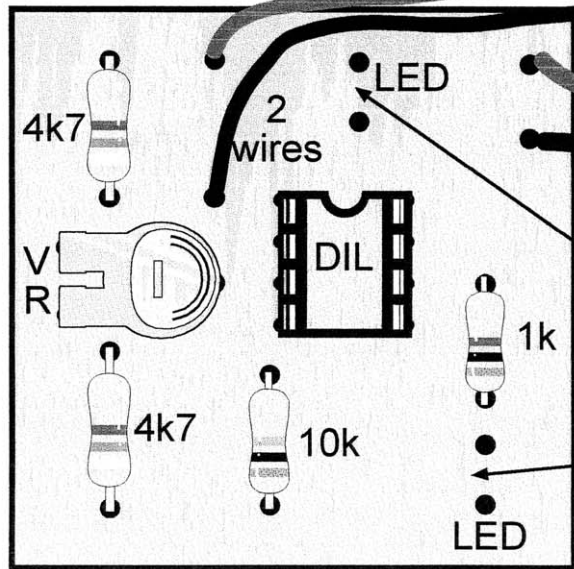
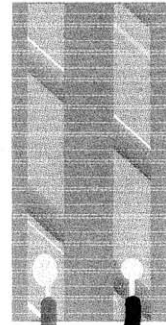
Electronic Sensor

Dry sensor/Moisture sensor



Solder side.

Copper track.



For the moisture sensor put the LED here.

For the dry sensor put the LED here.

Component side.

Some other teachers' thoughts about the sample work sheets (Sensor case diagram and Electronic sensor diagrams) are shown below. You may want to check your own work sheets with these comments in mind.

Sensor case diagram

- This handout contains subject-specific vocabulary for equipment and for instructions such as step 12, where the blade has to *lean on to* the MDF and step 5 (*File the straights a little*).
- The title is on the right-hand side, which may suggest that the sheet should be read from right to left, which is not usual in English.
- The picture of the sensor will influence pupils to produce a similar one.
- The word *could* might be overlooked.
- There is no list of what is needed to make sure pupils have gathered all the necessary equipment before they start.
- The numerical sequence is clear.
- Block capitals are used for emphasis in step 5.
- The diagrams support the text, though pupils will need to study them carefully to see the difference between *before* and *after* in step 2.

Electronic sensor diagrams

- The sheets of this handout are not numbered and the second sheet does not have numbers adjacent to the instructions.
- Subject-specific vocabulary is applied to kit and actions.
- Symbols are used a great deal.
- There is no list of the equipment that will be required.
- Step 3 is presented alongside step 2; the others follow down the page, one after the other.

Now take a few moments to consider any changes you might make to your own work sheets or to your practice when using work sheets, using the following prompts to support your reflections.

- Pupils need to be secure in the subject-specific vocabulary to be used.
- They need to be clear about words like *could* and *may*, which ensure the suggestions are perceived as suggestions and not instructions.
- They need to be shown the route through the sheet before they start.
- They need the support of an appropriate 'key to symbols', in the form of, say, a wall chart.
- They need to know that capital letters indicate importance.
- They need to know how the pictures or graphics support the written text.
- Common approaches to the layout of instruction sheets across the department will help pupils to read more quickly.

Remember that those who struggle with reading will struggle even more with busy pages containing a variety of ways of presenting information.

3.3 Active reading strategies

This section reminds you about 'active reading strategies' (often referred to using the acronym DARTs, which stands for 'directed activities related to texts'), which are designed to enable pupils to engage with texts in an active way – for example, by having something specific to do with the text (such as sequencing it), supplying missing words or highlighting specific information.

The teaching skill lies in choosing the activity that will help pupils achieve the lesson objective.

The table below, which you might want to print out, shows some tasks with objectives, and some active reading strategies that might be used to fulfil these objectives. Take a few moments to look at it and decide which reading activities might best fulfil the objectives. The tasks may lend themselves to more than one strategy.

Link the task to the appropriate reading activity. Some may link to more than one.

Use the tasks' objectives to guide your choice.

Task	Activity
<p>A set of notes for an outline plan for designing and making</p> <p>You want the pupils to evaluate the plans, order into a sequence and add additional ideas</p>	<p>Cut the passage up</p> <p>Pupils have to sort into the correct sequence</p>
<p>A prose description of a product that uses a range of modern materials</p> <p>You want pupils to understand some of the key terminology used</p>	<p>Highlight or underline key words and phrases</p>
<p>A set of instructions for making a simple product</p> <p>You want pupils to identify and retain the sequence</p>	<p>Pupils have to label an illustration</p>
<p>A magazine article profiling the work of a contemporary designer</p> <p>You want pupils to identify and appreciate how the designer is influenced by the needs and values of intended users (audience)</p>	<p>Pupils have to label an illustration</p>

It is worth remembering that there are benefits and some limitations to using DARTs in your lesson. Take a few moments to consider the following as examples of benefits and limitations.

Active reading tasks:

- oblige close reading
- engage pupils and encourage participation
- make daunting passages more accessible
- give purpose and focus to the reading
- go beyond 'just reading', to constructing meaning
- draw out key points very clearly.

However:

- beware of over-use
- they only work if they match the objective
- they take time to prepare
- they can diminish the content to the status of a game
- you still need to draw out the learning.

Tips

- Laminate materials for durability.
- Always debrief pupils after an activity; this helps you to check that they have gained the knowledge or understanding required, and gives you a chance to evaluate the chosen strategy and whether it achieved the objective(s).

3.4 Reading activity example

The following activity takes you through various reading strategies to access information and develop understanding. You might be able to use it with your pupils or work through it yourself or as a department and then plan one like it to fit your own schemes of work.

As part of a Year 8 unit on exploring materials (QCA unit 8Aii), pupils have been asked to explore the properties of materials when designing so they will be able to identify appropriate materials for a task.

The more able have been given a passage from the QCA website (www.qca.org.uk/ca/subjects/dandt/smart_modern).

The task is based on design and technology objectives. You will need to look at pages 23–25 before proceeding.

What is a smart/modern material?

Modern materials are developed through the invention of new or improved processes, for example, as a result of 'man' made materials/ingredients or human intervention, in other words not naturally occurring changes. They are altered to perform a particular function. Many smart and modern materials are developed for specialised applications but some eventually become available for general use.

Smart materials respond to differences in temperature or light and change in some way. They are called smart because they sense conditions in their environment and respond to those conditions. Smart materials appear to 'think' and some have a 'memory' as they revert back to their original state. The term 'smart' can be ambiguous as in some cases it is difficult to distinguish between modern and smart.

Food smart/modern materials

Many naturally occurring food ingredients are smart in that they respond to heat and light and some changes are reversible. Such working characteristics are already frequently exploited in food technology.

Modified starches respond to differences in temperatures, for example, they swell (thickening) in hot water or when heated, but return to a flow when cool. This working characteristic is used in pizza toppings. The topping thickens when heated in the oven and so does not run off the base, but on slight cooling the topping is runny again ready for eating. Other modified starches are used in instant desserts, which thicken without heating but do not return to their original state.

Examples of modern food materials include genetically modified foods, anti-oxidants, modified enzymes, probiotic yoghurts/drinks, TVP, Quorn and Tofu.

Smart/modern textiles

Fibre and fabric technological developments have created a whole range of smart and modern textiles which can be used in many applications. These textiles have been used in functional sportswear, medical and safetywear, and fashion clothing. Smart fabrics have been developed which can create a sense of well-being – they have anti-stress or calm-inducing properties. One manufacturer, for example, has developed a range of well-being tights micro-encapsulated with fragrant oils, moisturisers or vitamins.

Smart textiles have a number of medical uses. Fabrics can be encapsulated with substances required by the body or antiseptics. Allergy control fabrics can be used in bedding for people with breathing problems caused by dust mites.

Other smart textiles include sanitised fabrics for sportswear and socks which have anti-microbial protection. Anti-bacterial and anti-fungal fabrics have been used in clothing, linens, towels and carpets. Many synthetic fibres now have moisture management properties.

(continued)

SOFTSWITCH technology is currently under development. It combines composite and conductive textile technology to produce wearable electronic fabrics. Further information can be found at www.softswitch.co.uk.

Resistant materials and systems of control

Smart/modern materials

Examples of these smart and modern materials include conductive polymers, colour-changing liquid crystals and motion control gels.

Although there is a fine dividing line between modern and smart materials, several increasingly common materials, such as shape memory alloys (SMA), exhibit behaviour characterised by intelligent responses within a defined product context. Graphite-loaded polymer can provide a self-regulating heating element. As the material warms, it expands and reduces conductivity between the graphic particles. SMAs can be conditioned to change structure (and shape) at predetermined temperatures – producing desirable shape changes in garments interwoven with SMA wire.

Many modern and smart materials perform essential roles in a wide range of ubiquitous products. Motion control gels (e.g. smart grease) regulate the movement of components in contact to provide the right 'feel' or desirable characteristics. Sliding microscope barrels, variable resistors and slow spring-return CD drawers all incorporate motion control gels.

Statement	True	False	Proof
Modern materials are not natural			
Smart materials start off in general use			
Smart and modern materials are the same			
Smart and modern materials are unnatural			
Smart materials respond to heat			
Smart materials think			
Pizza topping can be smart			
Smart fabrics get up your nose			
Tights can make your skin soft			
Smart socks make your feet smell			
Genetically modified food is smart			
SMAs can be made to change at certain temperatures			
Smart and modern materials are found in many common products			

Starter activity

The lesson could start as outlined below, which will enable you to assess what pupils already understand about the key terms.

Ask them the following questions. Pupils use whiteboards or paper to record their responses and then hold them up to show you.

- 'What do we mean by *smart* in everyday life?' Count to three, then say 'Show me.'
- 'What do we mean by *modern* in everyday life?' Count to three, then say 'Show me.'

In following the above sequence, prior knowledge is activated and pupils are cued in to the topic. You can also see at a glance what pupils understand so you can monitor their progress through the activities and intervene when necessary.

Next, pupils are asked to check the everyday meanings of the terms against the design and technology-specific meanings used on pages 23–24. A possible approach is outlined below.

- 1 Ask pupils to scan pages 23–24 and highlight the words *smart* and *modern* in the text, using a different-coloured highlighter pen for each word.
- 2 Ask pupils to read closely the sentences surrounding the highlighted words, and decide on design and technology-specific meanings for *smart* and *modern*.

In order to check understanding, you could then ask pupils to write the subject-specific meaning for *smart* on their whiteboards; count to three and then say 'Show me.' Do the same for *modern*.

This will allow you to monitor understanding and intervene with the class, a group or an individual to ensure the meanings are clear before the pupils proceed.

You could ask pupils, in pairs, to read pages 23–24 closely and then go to page 25 where there are statements about *smart* and *modern* materials. Pupils will then decide on the truth of the statements by returning to the passage and reading closely, annotating page 25 according to their thinking.

When using such activities in class, think about the following aspects.

- The number of statements per pair. Those who find reading more difficult may have fewer statements to consider.
- Using a variety of responses – for example, definitions and examples under headings, information posters, and so on, as appropriate, to permit all pupils to respond to the texts.
- Using different texts containing the same information to support the levels of ability within the class. The department could consider spending some time in meetings or on training days rewriting or amending challenging texts for the less able. Asking older pupils to prepare more challenging texts for younger pupils would also be a useful check on how well the older pupils understand the information contained in those texts.

Consider the completed grid shown below.

Statement	True	False	Proof
Modern materials are not natural	✓		Changes depend on human intervention
Smart materials start off in general use		✓	Some eventually become available for general use
Smart and modern materials are the same		✓	However, it is sometimes hard to distinguish smart from modern materials/ fine dividing line
Smart and modern materials are unnatural		✓	Many naturally occurring food ingredients are smart
Smart materials respond to heat	✓		Starches respond to differences in temperature
Smart materials think		✓	Materials can't think: they appear to think
Pizza topping can be smart	✓		Thickens when heated, runs when cooled
Smart fabrics get up your nose		✓	Smart fabrics can have allergy controls in them
Tights can make your skin soft	✓		One manufacturer has tights with e.g. moisturisers
Smart socks make your feet smell		✓	Anti-microbial protection can stop the growth of bacteria which make feet smell
Genetically modified food is smart		✓	GM food is an example of a modern food product
SMA's can be made to change at certain temperatures	✓		Can be conditioned to change at predetermined temperatures
Smart and modern materials are found in many common products	✓		Perform essential roles in a wide range of ubiquitous products. Ubiquitous means everywhere

It is worth noting the process that has just been completed. Take a few moments to think about the sequence of activities and what they permitted you or the pupils to do.

In completing the activity based round *smart* and *modern* materials, you or the pupils will have:

- located information
- adopted an appropriate reading strategy
- interacted with the text
- monitored their understanding
- made a record
- evaluated the information
- communicated their information.

Now take a few moments to decide how you or the pupils were supported in the reading and to compare your ideas with what other teachers thought, as noted below.

- A structured way into the text, which contextualises the content and focuses on subject-specific meaning, was provided.
- The statements direct the reader to the nature of the materials.
- Both statements and texts have to be read carefully to decide on the veracity of the statements.
- The statements encourage thinking and understanding about the ambiguity in the two terms.
- The speaking and listening involved in pair work supports understanding and the development and refining of ideas.
- Using the statements makes copying impossible.
- Readers are not left alone and vulnerable in developing their understanding.
- You have a recording sheet to use in assessment, and the pupils have a grid for revision or to use as a reminder as they work.

The following list sums up the content of this section.

- Pupils need to access prior knowledge to provide a context for their reading.
- Pupils need to be shown the reading skills they need to apply in their reading.
- Pupils need a clear purpose for their reading.
- Pupils need to transform what they read into another kind of text to ensure they have processed and internalised the knowledge they have gained.

You can find further support and ideas in *Literacy across the curriculum* in module 5 (Active reading strategies) and module 6 (Reading for information).

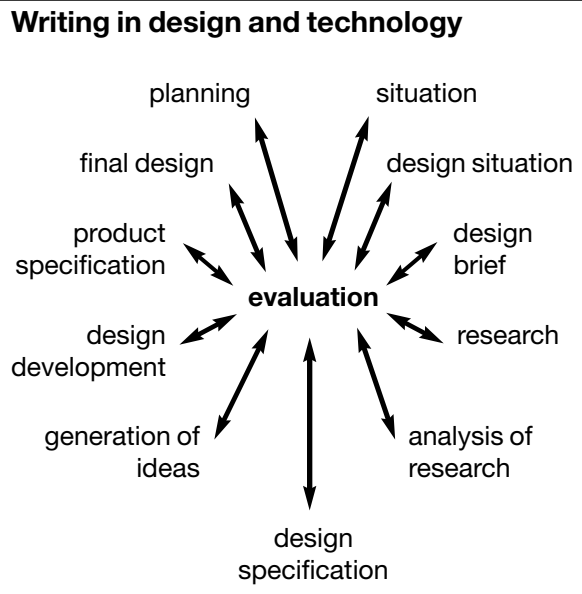
Aims

- *To be aware of the different forms and purposes for writing in design and technology*
- *To demonstrate how to support and improve the quality of pupils' writing*

4.1 Understanding writing in the design process

The accompanying diagram illustrates the design process, but it also describes the range of writing required in design and technology:

- each part of the process has its own text structure and characteristic ways of using language which pupils need to be aware of
- evaluation is central to the design process.



Take a few moments to decide on typical phrases or words that pupils may need for the range of forms of writing. You could record your thoughts on page 30, which can also be used with pupils in your classroom. Compare your version with the completed grid that follows.

Different kinds of writing in design and technology

Process stage	Purpose for writing	Forms of writing	Some typical phrases
Situation	to describe purpose for which the product is required	short notes/ paragraph	
Analysis	to discuss the requirements of the situation	summary/ concluding notes	
Design brief	to outline the task, then adapt as developments are made	bullet points/ list	
Specifications	to record the required features of the product	list of priorities	... must have ... will be ... in addition the product might also ...
Research	to show similar products, possible materials, to communicate main findings	short notes/ annotation	
Generation of ideas	to show ideas, thinking and exploration	visual representation with notes/ annotation	
Design development	to clarify / rework ideas to present ideas	detailed notes/ annotations, presentations, drawings and notes	
Planning	to describe how making will take/took place	flowchart, recipe, plan of making (including list of equipment and sequence)	
Evaluation	to evaluate throughout the design process to reflect on learning and future targets	extended writing divided by sub-headings, short notes, annotation, visual presentation	... went well because was a problem because ... However, although ... Despite the fact that ...

Different kinds of writing in design and technology

Process stage	Purpose for writing	Forms of writing	Some typical phrases
Situation	to describe purpose for which the product is required	short notes/ paragraph	...might need ...might be helped by
Analysis	to discuss the requirements of the situation	summary/ concluding notes	I/We need to find out...
Design brief	to outline the task, then adapt as developments are made	bullet points/list	I am/we are going to...
Specifications	to record the required features of the product	list of priorities	...must have ...will be In addition the product might also...
Research	to show similar products, possible materials, to communicate main findings	short notes/ annotation	I/We found out... I/We measured... I/We looked at...
Generation of ideas	to show ideas, thinking and exploration	visual representation with notes/annotation	...might work well because... ...might be difficult because...
Design development	to clarify /rework ideas to present ideas	detailed notes/ annotations, presentations, drawings and notes	I/We might use... I/We decided...
Planning	to describe how making will take/took place	flowchart, recipe, plan of making (including list of equipment and sequence)	I/We intend to... I/We need to... The next step will be...
Evaluation	to evaluate throughout the design process to reflect on learning and future targets	extended writing divided by sub-headings, short notes, annotation, visual presentation	...went well because... ...was a problem because... However, although... Despite the fact that...

The following points summarise why such a grid can be helpful in the writing process.

- A design and technology department can complete such a grid so that there is a jointly agreed structure, and then repeat the exercise with pupils as appropriate.
- An appropriate grid could be put on the classroom wall for support and as a reference point.
- Pupils go through the process before the grid is posted up, as it is during the process that understanding develops.
- The approach ensures consistency across the department, which is vital for pupils, especially those for whom writing is more difficult or who are learning English as an additional language.

4.2 Modelling annotations

The diagram below shows the sequence for teaching writing that is promoted by the National Key Stage 3 Strategy.

Establish clear aims	The purpose of the writing is to evaluate the project: you will need to assess your product against your success criteria from your design brief
Provide examples	Pupils need to be taught the principles of evaluations using high quality text which exemplifies the text type at text, sentence and word level
Explore the features of the text	They need to analyse the features with the teacher to develop an understanding of the text structure, the sentences which are required to do the job and the kinds of vocabulary which make meaning clear and precise
Define the conventions	A writing frame may be devised as the reading and teaching/learning proceeds
Demonstrate how it is written	The teacher will demonstrate to the class how to write a section of the required text type, talking as s/he does it to show the kinds of decisions which writers make as they write
Compose together	Pupils write sentences or small sections to share with the class and the teacher for constructive criticism
Scaffold the first attempts	Offer the writing frame mentioned above or offer guidelines as to the structure required
Independent writing	Pupils work on the writing themselves
Draw out key learning	Remind pupils of the structure, sentences and words they have been using in their writing so they can do it quickly and with less and less support when they meet the text type again

The following points explain why the sequence is successful in supporting pupils who are learning to write a range of text-types.

- The provision of models of text is vital to enable pupils to understand what is required at whole-text, sentence and word level.
- Being shown how to write by the teacher, who explains the choices made, helps pupils succeed in their early attempts rather than setting them up to fail by simply asking them to do the task, unsupported.
- Sharing the composition with the teacher and their peers helps pupils develop their ideas and check that they are on the right track before they work independently.
- Drawing out the key learning helps pupils to internalise what they have learnt and to move more quickly to being able to write successfully and independently.

This section is supported by video sequence 2.

About the video sequence

Julie Donnachie is working on annotating a product, in this case headwear, in order to find out how it was made and why it was made that way, prior to pupils drawing up a design specification for a similar product. She wants pupils to go beyond simple statements and move into fitness for purpose and construction. In order to elicit more

details, she models how to annotate an item of headwear. She has selected an example from her own research and starts to develop the annotation straight away. Listen particularly to what the pupils say at the end of the clip about how the modelling has supported their learning.

Play the video sequence, then take a few moments to think about how the pupils are supported by the teacher to ensure a more detailed, and hence successful, outcome.

Compare your response with the following points.

- The pupils are clear about what they are writing and why.
- The teacher has modelled the annotation process and explained her thinking as she does it. This draws out both what to note and why it is important.
- The pupils work to criteria to ensure they cover the points required.
- The pupils share the writing with a peer so they are supported and have the opportunity to clarify and amend their thinking.
- Sharing with the whole class provides challenge in a supportive environment.
- The teacher draws out key learning at the end and is then able to note improvements for next time – in this case more work is required on the construction of the item.

4.3 Working on evaluations

Writing an evaluation, although key to design and technology, is often not done well by pupils. Consider how far the following points match your own experience.

- It is difficult because it involves higher-order thinking.
- It is often rushed at the end of a unit of work.
- There is a lack of awareness about the difference between formative and summative evaluations.
- Pupils find it difficult to extend their response and justify their reasons for choices, actions and changes they would make.
- There is often a lack of clear success criteria against which to measure the process or product.
- Writing frames and questions may limit the response.

Printed below is a question sheet, which is designed to guide pupils through the writing of an evaluation, in this case designing and making a clock. One pupil's response follows it. Take a few moments to decide on the strengths and weaknesses of the evaluation and how far the question sheet supported the task.

- 1 What are the good things about your design?
- 2 How does it comply with what your clients wanted?
- 3 What changes would you make if you could make the clock again?
- 4 Does your clock work as a design?
- 5 Did your product turn out as you had hoped from your design?
- 6 Were there any difficulties to overcome as you made the clock?
- 7 Did you change any aspect of your design as you made your clock?

Evaluation

1. The good things about my solution are :-
 - It is bright and colourfull
 - It hangs so I don't need to cut the hands shorter
 - I have only 2 pieces of plastic on top of each other so I didn't need to drill a wider hole half way through
2. Other people think my clock is good because of the ~~two~~ colours and the shapes as the colours go well together
3. I don't think I would change anything as I am happy with it as it is.
4. Yes my clock does work as I wanted it to, as it will tell the time - perfect
5. No, I really really like my design as it is just what I wanted.
6. I didn't have any difficulties so I couldn't overcome anything.
7. The only thing I changed the colour of the circle is red instead of blue, as there wasn't a piece of blue acrylic

Some responses from other teachers are listed below.

Strengths

- It is concise.
- It responds to the questions.
- It picks up on aspects of design, especially colour and the fact that the clock works.

Weaknesses

- The pupil is obviously answering questions.
- The response does not actively engage with the success of the design – it does not go beyond colour and the fact that the clock tells the time.
- It is brief and gives few examples of changes.
- It makes little attempt to give reasons for any changes or evaluate the effect of any changes – it just mentions using blue acrylic because it was there.

The part played by the design of the writing task in the responses

- The questions do not invite reasons – they do not ask why or how questions.
- Yes or no questions have received a yes or no answer.
- The questions have not necessarily supported the pupil in evaluating the design and whether it helped make the product or not.
- Products need clear success criteria to evaluate against, and pupils find success criteria difficult.
- The writing frame was not clear enough to support detailed writing.
- It did not support extended response or the use of complex sentences about cause and effect, and connectives such as *although*, *if* and *however*.

It is worth noting the following points about writing frames and evaluations.

- Writing frames and question sheets are very useful in preparing pupils to write in the early stages of learning a text-type and its structures.
- However, they are only ever meant as a short-term measure to start pupils off.
- Products need clear success criteria to evaluate against and pupils find success criteria difficult.

Take a few moments to decide on how using the sequence for writing might help to improve pupils' written evaluations. Compare your ideas to the following.

- Being clear about the purpose of the evaluation would support the writing.
- Offering examples of evaluations and analysing what is required at text, sentence and word level would ensure pupils know how to write the evaluation.
- Modelling a section, articulating the thinking, shows pupils how to do the writing in this context.
- Providing time to share the writing further builds confidence and refines content.
- Drawing out key learning helps pupils move forward and sets targets for next time.

The following example was written after the pupil had gone through the sequence for teaching writing. The piece followed a shared writing section where the pupils were being moved from a writing frame to creating text independently.

Take a few moments to read it and decide on its strengths and weaknesses. The weaknesses might make a useful pupil target for the next evaluation.

27th March 2001

Evaluation

The design brief was to create and make a decorative mirror involving abstract art, especially the painter Mondrian.

The specification demanded that the mirror be, freestanding; adjustable; made from a combination of materials; sophisticated and modern in appearance. I wanted to use mine for make-up.

When I had completed my design, I checked to see how far it complied with the specification. Orthographic projection helped me to visualise in 3D. I felt that, although it met the specifications in terms of being freestanding and adjustable, it seemed to simple and basic in its realisation. However, I decided to go ahead and see how it looked as I made it.

The design proved useful to guide me through the process, but I changed it as I made my product. In order to meet the specification to involve designs based on Mondrian, and to make it appear more complicated, I added clear stars. This improved the appearance and, because it could stand in front of a window, light could shine through it.

I changed my design to incorporate my improvements, including the colour of the main star. I changed it from a pale orange to a bright orange because I felt it was too dull for my bedroom and wouldn't fit in with the other colours on the mirror.

Overall I felt that I had improved on my original design. I had succeeded in making it free standing, adjustable, and from a combination of materials.

I felt it was modern in design, but when I asked my friends they thought the colours didn't go well together: orange and blue didn't contrast well enough.

Next time, I need to be more careful with the adhesive as my clear stars slid down, taking the paint off as they slid.

The product needs to be flat, rather than standing up as the glue dries.

I think the product could be marketable. However it would need to be in a range of colours to suit varying tastes.

Bear in mind the following.

Strengths

- Describes clearly the design brief against which the product may be evaluated.
- Is clearly structured and, largely, appropriately paragraphed.
- Gives reasons and shows the pupil has reflected on the design and the making process.
- Describes changes and gives reasons for those changes.
- Contains appropriate connectives – for example, *although*, *however*, *overall*.
- Uses appropriate design and technology-specific vocabulary – for example, *orthographic projection*, *specifications*, *realisation*.

Weaknesses

- The title says little about the content.
- The penultimate paragraph is unclear.

Further guidance on teaching writing across the curriculum is provided in *Literacy across the curriculum* module 2 (Writing non-fiction) and module 3 (Writing style).

The following two examples are taken from that material and also look at evaluations. Take a few moments to decide how you might use them in your classroom to support pupils who are learning to write evaluations.

Analysing text types: Evaluation, including self-evaluation	
Purpose <ul style="list-style-type: none"> ■ What is its purpose? ■ Who is it for? ■ How will it be used? ■ What kind of writing is therefore appropriate? 	<ul style="list-style-type: none"> ■ To record the strengths and weaknesses of a performance/product ■ Part of the plan-do-review cycle, which might have an effect on future task setting/performance/target setting ■ Often used as part of assessment process, linked to objective-based teaching, i.e. <i>Did you meet your objectives for this particular piece of work?</i> ■ Sometimes more long-term, e.g. evaluation of performance over module of work/term
Text level <ul style="list-style-type: none"> ■ Layout ■ Structure/organisation ■ Sequence 	<ul style="list-style-type: none"> ■ Title contains value judgement, e.g. <i>How well did your construction work? How well are you progressing in this subject?</i> ■ Sometimes in list form, including strengths and weaknesses, followed by a summary, followed by targets for the future ■ Bullet points, numbered or lettered items ■ Subheadings used to focus attention of writer, e.g. <i>How much did the materials cost? How long did it take you to make it? How successful was the testing period?</i>
Sentence level <ul style="list-style-type: none"> ■ Viewpoint (first/third person, etc) ■ Prevailing tense ■ Active/passive voice ■ Typical sentence structure and length ■ Typical cohesion devices 	<ul style="list-style-type: none"> ■ First person: singular for individual evaluation; plural for group evaluation ■ Past tense to reflect on performance; present to reflect on personal/group characteristics; future for target-setting ■ Active voice ■ Connectives used to balance strengths and weaknesses, e.g. <i>although, however, still, on the other hand</i> ■ Connectives used to indicate the use of evidence, e.g. <i>As in..., I know this because..., This shows that...</i> ■ Connectives used to establish cause and effect, e.g. <i>because, since, therefore, so, as a result</i> ■ Avoidance of meaningless evaluations and targets, e.g. <i>It didn't work very well; I will try harder with my spelling</i>
Word level <ul style="list-style-type: none"> ■ Stock words and phrases ■ Specialised or typical vocabulary ■ Elaborate/plain vocabulary choices 	<ul style="list-style-type: none"> ■ Technical vocabulary related to subject under review, e.g. in English, the spelling of unstressed vowels in polysyllabic words; in maths, the solving of simple quadratic equations ■ Vocabulary of comment, e.g. <i>We all felt that..., Some people in the group thought that...</i> ■ Vocabulary of constructive criticism, e.g. <i>John's suggestions, though inventive, were not generally accepted..., Perhaps at this point, I could have...</i>

Electronics and Materials Project
Plastic Badge with Flashing LED

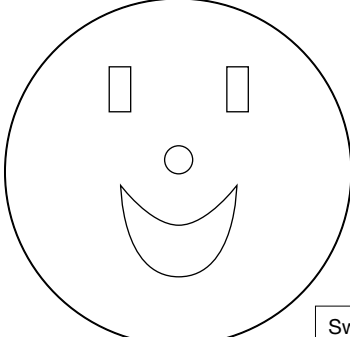
How well did your badge work?

I am very pleased with my badge because the clown face looks good when the nose lights up.

At first I had a problem painting the mould. I now know that when you paint the plastic mould you need to rough up the surface so that the paint sticks to it.

Initially making the circuit was difficult as I cut the copper track too short, however I cut the second piece to the correct length and it worked.

One problem that I found was that the battery tends to run out after about three days. To improve this I need to put a switch on so that it can be turned off when it is not in use.



Switch
The badge needs a push switch to stop you leaving it on.

Title contains value judgement, e.g. *How well did...*

First person: singular for individual evaluation

Past tense to reflect on performance; present tense to reflect on personal/group characteristics; future tense for target setting

Active voice

Connectives used to balance strengths and weaknesses, e.g. *however*

Vocabulary of comment and constructive criticism, e.g. *I felt that... Perhaps at this point, I could have...*

Some other teachers decided that:

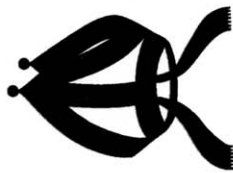
- the handouts support the analysis of text-types for departments, so common approaches and language can be agreed
- the analysis can be repeated by pupils after reading some examples, so they have investigated and agreed the language required.

Aims

- *To consider how literacy objectives can be made clear in schemes of work*
- *To provide an opportunity for you to look at your own schemes or units of work, and consider where you might teach literacy objectives to support learning in design and technology*

It is helpful to plan English Framework objectives into your schemes of work when it is appropriate to do so. Using the objectives helps you clarify what needs to be taught in terms of literacy in order to improve the quality of work done and raise standards in design and technology.

The unit plans that follow on pages 40–43 come from a school that has started to undertake a literacy review of its scheme of work. You will need to print these out as they are 'landscape' pages that do not fit the computer screen. Take a few moments to look at them and think about how the literacy objectives at the end of each unit support learning in design and technology, and how they ensure that relevant literacy objectives are explicitly taught.



Title	Picture It!
Specialist area	Design and Technology
Year	Seven
Duration	Six hours
Unit	7A

Resources
1. Worksheets 7ai, 7aii, 7aiii
2. Finished product
3. Resource box 7a
4. Files
5. Silicon Carbide

Area of study
Design Brief
Analysis
Research
Specification
Ideas
Development
Evaluation

Unit 7A : Description

In this unit, pupils tackle a design and make assignment based on developing an acrylic photo holder to hold a passport sized photograph.

Progression and continuity

7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

Expectations

Level : This unit is expected to take six hours.

Pupils will develop a detailed analysis of the design brief using a task analysis. They will develop a specification that reflects the most important areas included in the task analysis. Specification statements will be objective and attainable. The design proposals will be drawn accurately and through annotation demonstrate consideration of the product specification. Ideas will be coloured and use simple graphical techniques to show the effect of light and shade on the selected material. Finally the product will be evaluated against the specification and the designer will make objective evaluation statements about the photo holder.

Pupils will have considered the working characteristics of the material when developing the design solution. The correct tools and processes will have been used to finish the edges to a high standard and remove any waste material. The decorative element of the product will show a good understanding of the characteristics of the material and the tools and equipment available. The adhesive will have been applied carefully and any excess will have been removed.

Summary

Material (s): Acrylic

Design Brief

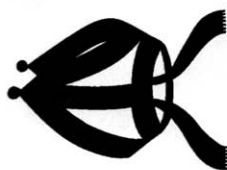
Snappy a photographic company have decided to give customers a promotional gift when they use the company's passport photo booths. The material for a holder and the product specification will be provided by the company. As a product designer you must provide four ideas for improving the presentation of the basic holder. These could include changing the size of the internal viewing window and adding decoration to the holder using waste acrylic. Finally you should evaluate your ideas before submitting your final design proposal.

National Curriculum.

1	Developing, planning and communicating ideas	a				e	f	g
2	Working with tools, equipment and materials			c	d			
3	Evaluating processes and products							
4	Knowledge ... materials and components.			b	c	d		
5	Knowledge ... of systems and control	a	b	c	d	e	f	g
6	Knowledge ... of structures	a	b	c				
7	Breadth of study							

Key : Prior knowledge **a** Included in this unit

Expectations	Cross-curricular links
<p>Finally the student will have worked safely and shown consideration for others in the workshop environment.</p> <p>Level</p> <p>Pupils will develop an analysis of the design brief using a task analysis. They will develop a specification using random factors included in the task analysis. Specification statements will be subjective and the majority will be attainable. The design proposals will be drawn neatly and through annotation demonstrate consideration of the product specification. Ideas will be coloured and use simple graphical techniques to show the effect of light and shade. Finally the product will be evaluated and the designer will make subjective evaluation statements about the photo holder.</p> <p>Pupils will have superficially considered the working characteristics of the material when developing the design solution. The correct tools and processes will have been used to finish the edges to a good but inconsistent standard. Waste material will have been removed using the correct tools but the pupil could have made alterations to the design due to unforeseen difficulties. The decorative element of the product will show a limited understanding of the characteristics of the material and the tools and equipment available. The adhesive will have been applied carefully, excess adhesive will be evident. Finally the student will have worked safely and shown consideration for others in the workshop environment.</p> <p>Level</p> <p>Pupils will develop an analysis of the design brief using a task analysis. They will develop a specification using some factors included in the task analysis. Specification statements will be very subjective and some will be unattainable. The design proposals will be drawn neatly and through annotation demonstrate limited consideration of the product specification. Ideas will be coloured but will not use graphical techniques to show the effect of light and shade. Finally the product will be evaluated and the designer will make subjective evaluation statements about the photo holder.</p> <p>Pupils will not have considered the working characteristics of the material when developing the design solution. The correct tools and processes will have been used to finish the edges to an acceptable but inconsistent standard. Waste material will have been removed using the correct tools but the pupil could have made several alterations to the design due to unforeseen difficulties. The decorative element of the product will show no understanding of the characteristics of the material and the tools and equipment available. The adhesive will have been applied. Finally the student will have worked safely and shown consideration for others in the workshop environment.</p>	<p>Literacy and numeracy</p> <p>Through the activities in this unit, pupils will be able to understand, use and spell correctly words relating to:</p> <ul style="list-style-type: none"> materials and their classifications, e.g. <i>plastic (polyethylene, polystyrene, acrylic, polyester, poly-tetra-fluoro-ethylene, PVC)</i> the characteristics and properties of materials, e.g. <i>low density, bends, breaks, malleable, malleability, shatters, strong</i> <p>Speaking and listening – through the activities pupils could:</p> <ul style="list-style-type: none"> ask questions to gain clarification and further information, e.g. <i>Why...? How...? What...? What then...?</i> share information and discuss ideas in groups, and solve problems <p>Reading – through the activities pupils could:</p> <ul style="list-style-type: none"> use skimming, scanning, highlighting and note-taking as appropriate to different texts <p>Vocabulary and spelling – through the activities pupils could:</p> <ul style="list-style-type: none"> read and use accurately terms which relate to key concepts in D&T
	<p>Science: classification of materials by their working characteristics. Links to unit 7G 'Particle model of solids, liquids and gases' and unit 7I 'Energy resources' in the science scheme of work.</p> <p>English: displaying and communicating information.</p> <p>Art and design: investigating, combining and manipulating materials, taking account of purposes and audiences.</p> <p>Sustainable development: considering the effects of the extraction, use and eventual disposal of some materials on the natural environment and human health.</p>



Title Structures
 Specialist area Design and Technology
 Year Eight
 Duration Seven hours
 Unit 8A

Unit 8A : Description

In this unit, pupils tackle a design and make assignment based on developing a model bridge to span a distance of 300mm and support a 10Kg load.

Progression and continuity

7	a	b	c	d
8	a	b	c	d
9	a	b	c	d
10	a	b	c	d

Expectations

Level :

Pupils will have developed a detailed analysis of the design brief using a task analysis. They will have written a specification that reflects the most important areas included in the task analysis. Specification statements will be objective and attainable. The design proposals will be drawn accurately and through annotation demonstrate consideration of the product specification. The technical drawing will include British standard dimensions and will be drawn using the correct scale. The design itself will show careful consideration of the problem. Through triangulation and bracing the structural properties of the materials used will have been considered and improved. Finally the final scale bridge will be evaluated against the specification and the designer will make objective evaluation statements about the structure.

Pupils will have considered the working characteristics of the material when developing the design solution. The correct tools and processes will have been used to finish the edges to a very high standard and remove any waste material. The adhesive will have been applied carefully and any excess will have been re-

Summary

- Material (s): Balsa, string and card.

Design Brief

- CTW have been commissioned to design a footbridge to cross the river Ouse in York. CTW require you to submit a tender for the construction of the new bridge. You will need to include the following items in your tender
- A detailed costing sheet
 - A range of design proposals based on good research findings.
 - A technical drawing of the bridge including British Standard dimensions
 - A Ghant chart
 - A scale model of the bridge
 - Promotional material to support your tender.

National Curriculum.

1	Developing, planning and communicating ideas								
2	Working with tools, equipment and materials	a						e	
3	Evaluating processes and products			b		c			
4	Knowledge ... materials and components.							d	
5	Knowledge ... of systems and control	a		b		c		d	e f g
6	Knowledge ... of structures								
7	Breadth of study								

Key : Prior knowledge a Included in this unit

Expectations	Cross-curricular links
<p>moved. Finally the student will have worked safely and shown consideration for others in the workshop environment.</p> <p>Level : Pupils will have analysed the design brief using the task analysis. They will have developed a specification that reflects most of the areas included in the task analysis. Specification statements will be subjective but attainable. The design proposals will be drawn accurately and through annotation demonstrate consideration of the product specification. The technical drawing will include British Standard dimensions and will be drawn using a suitable scale. The design itself will show consideration of the problem. Through triangulation and bracing the structural properties of the materials used will have been considered and improved. Finally the final scale bridge will be evaluated against the specification and the designer will make subjective evaluation statements about the structure.</p> <p>Pupils will have considered some of the working characteristics of the material when developing the design solution. The correct tools and processes will have been used to finish the edges to a high standard and remove any waste material. The adhesive will have been applied carefully and any excess will have been removed. Finally the student will have worked safely and shown consideration for others in the workshop environment.</p> <p>Level : Pupils will have produced a basic task analysis diagram. They will have developed a specification that reflects the most obvious areas of the task analysis. Specification statements will be subjective and unattainable. The design proposals will be drawn neatly and through annotation demonstrate consideration of the product specification. The technical drawing will include British standard dimensions and will be drawn using the correct equipment, but will not be drawn to scale. The design itself will show consideration of the problem. Through triangulation or bracing the structural properties of the materials used will have been considered but possibly not improved (redundant members). Finally the final scale bridge will be evaluated and the designer will make subjective evaluation statements about the structure.</p> <p>Pupils will have not have considered the working characteristics of the material when developing the design solution. The correct tools and processes will have been used to finish the edges to a sound standard and remove any waste material. The adhesive will have been applied carefully in some areas. Finally the student will have worked safely and shown consideration for others in the workshop environment.</p>	<ul style="list-style-type: none"> • Science: classification of materials by their working characteristics. Links to unit 'Particle model of solids, liquids and gases' and unit 71 'Energy resources' in the science scheme of work. • Science: this unit links to work in unit 'Forces and their effects'. It also builds on Year 8 work on compounds and mixtures by explaining changes of state of materials and chemical changes in terms of atoms. • ICT: using databases. • English: displaying and communicating information.
<p>Literacy and numeracy</p> <p>Through the activities in this unit, pupils will be able to understand, use and spell correctly words relating to:</p> <ul style="list-style-type: none"> • the properties of materials and their working characteristics, e.g. <i>flexibility, load bearing, strengthening, reinforcing, protecting, structural, hardness, tension, compression, elasticity, aesthetics</i> <p>Reading – through the activities pupils could:</p> <ul style="list-style-type: none"> • select relevant information and link to other information, from a range of sources • undertake independent research using knowledge of how texts, databases, etc are organised and of appropriate reading strategies <p>Writing – through the activities pupils could:</p> <ul style="list-style-type: none"> • organise facts/ideas/information in an appropriate sequence • group sentences into paragraphs that are clearly focused and well developed • link ideas and paragraphs into continuous text which is organised and coherent 	<p>Literacy and numeracy</p> <p>Through the activities in this unit, pupils will be able to understand, use and spell correctly words relating to:</p> <ul style="list-style-type: none"> • the properties of materials and their working characteristics, e.g. <i>flexibility, load bearing, strengthening, reinforcing, protecting, structural, hardness, tension, compression, elasticity, aesthetics</i> <p>Reading – through the activities pupils could:</p> <ul style="list-style-type: none"> • select relevant information and link to other information, from a range of sources • undertake independent research using knowledge of how texts, databases, etc are organised and of appropriate reading strategies <p>Writing – through the activities pupils could:</p> <ul style="list-style-type: none"> • organise facts/ideas/information in an appropriate sequence • group sentences into paragraphs that are clearly focused and well developed • link ideas and paragraphs into continuous text which is organised and coherent

Now look at your own schemes of work and compare the ways in which literacy objectives are planned in and how you and the department set about planning to teach pupils to read, write, speak and listen in design and technology.

It may be that the school has whole-school literacy objectives such as securing paragraphing by the end of Year 9 or securing the spelling of subject-specific vocabulary.

Think about how you and the department plan to teach these whole-school objectives.

Long- and medium-term planning is not something you can do on your own, but if the department has not yet begun to plan for literacy in design and technology, you may decide to raise it at the next department meeting so that the department can begin to work as a team to revise the schemes of work.

Year 7 teaching objectives

Word level

Spelling

Pupils should revise, consolidate and secure:

- 7 the spellings of key words in each subject;

Spelling strategies

To continue learning, constructing and checking spellings, pupils should be able to:

- 8 recognise and record personal errors, corrections, investigations, conventions, exceptions and new vocabulary;
- 10 draw on analogies to known words, roots, derivations, word families, morphology and familiar spelling patterns;

Vocabulary

To continue developing their vocabulary, pupils should be able to:

- 14 define and deploy words with precision, including their exact implication in context;
- 21 read accurately, and use correctly, vocabulary which relates to key concepts in each subject, distinguishing between everyday uses of words and their subject-specific use, e.g. *energy*, *resistance*;

Sentence level

Sentence construction and punctuation

Pupils should be taught to:

- 1 extend their use and control of complex sentences by:
 - a recognising and using subordinate clauses;
 - b exploring the functions of subordinate clauses, e.g. *relative clauses such as 'which I bought' or adverbial clauses such as 'having finished his lunch'*;
 - c deploying subordinate clauses in a variety of positions within the sentence;
- 3 use punctuation to clarify meaning, particularly at the boundaries between sentences and clauses;
- 5 use the active or the passive voice to suit purpose;

Paragraphing and cohesion

- 8 recognise the cues to start a new paragraph and use the first sentence effectively to orientate the reader, e.g. when there is a *shift of topic, viewpoint or time*;
- 12 organise ideas into a coherent sequence of paragraphs, introducing, developing and concluding them appropriately;

Stylistic conventions of non-fiction

- 14 recognise and use stylistic conventions of the main forms of writing used in subjects, e.g. *science report, book review*;

Standard English and language variation

- 15 vary the formality of language in speech and writing to suit different circumstances;
- 17 use standard English consistently in formal situations and in writing;

(continued)

Text level – Reading

Research and study skills

Pupils should be taught to:

- 1 know how to locate resources for a given task, and find relevant information in them, e.g. *skimming, use of index, glossary, key words, hotlinks*;
- 2 use appropriate reading strategies to extract particular information, e.g. *highlighting, scanning*;
- 3 compare and contrast the ways information is presented in different forms, e.g. *web page, diagrams, prose*;
- 4 make brief, clearly-organised notes of key points for later use;
- 5 appraise the value and relevance of information found and acknowledge sources;

Reading for meaning

- 7 identify the main points, processes or ideas in a text and how they are sequenced and developed by the writer;
- 8 infer and deduce meanings using evidence in the text, identifying where and how meanings are implied;

Understanding the author's craft

- 13 identify, using appropriate terminology, the way writers of non-fiction match language and organisation to their intentions, e.g. *in campaign material*;

Text level – Writing

Plan, draft and present

Pupils should be taught to:

- 1 plan, draft, edit, revise, proofread and present a text with readers and purpose in mind;
- 2 collect, select and assemble ideas in a suitable planning format, e.g. *flow chart, list, star chart*;
- 3 use writing to explore and develop ideas, e.g. *journals, brainstorming techniques and mental mapping activities*;

Write to inform, explain, describe

- 10 organise texts in ways appropriate to their content, e.g. *by chronology, priority, comparison*, and signpost this clearly to the reader;

Write to persuade, argue, advise

- 15 express a personal view, adding persuasive emphasis to key points, e.g. *by reiteration, exaggeration, repetition, use of rhetorical questions*;

(continued)

Speaking and Listening

Speaking

Pupils should be taught to:

- 1** use talk as a tool for clarifying ideas, e.g. *by articulating problems or asking pertinent questions*;
- 4** give clear answers, instructions or explanations that are helpfully sequenced, linked and supported by gesture or other visual aid;
- 5** promote, justify or defend a point of view using supporting evidence, example and illustration which are linked back to the main argument;

Group discussion and interaction

- 10** identify and report the main points emerging from discussion, e.g. *to agree a course of action including responsibilities and deadlines*;
- 13** work together logically and methodically to solve problems, make deductions, share, test and evaluate ideas;

Year 8 teaching objectives

Word level

Pupils should be taught to:

Spelling

- 4 learn complex polysyllabic words and unfamiliar words which do not conform to regular patterns;
- 5 secure the spelling of key terms and new words from across the curriculum;

Vocabulary

- 9 appreciate the precise meaning of specialist vocabulary for each school subject, and use specialist terms aptly in their own writing;
- 10 extend the range of prepositions and connectives used to indicate purpose, e.g. *in order to*, *so that*, or express reservations, e.g. *although*, *unless*, *if*;

Sentence level

Pupils should be taught to:

Sentence construction and punctuation

- 1 combine clauses into complex sentences, using the comma effectively as a boundary signpost and checking for fluency and clarity, e.g. *using non-finite clauses*;
- 5 recognise and exploit the use of conditionals and modal verbs when speculating, hypothesising or discussing possibilities;

Paragraphing and cohesion

- 6 explore and compare different methods of grouping sentences into paragraphs of continuous text that are clearly focused and well developed, e.g. by *chronology*, *comparison* or *through adding exemplification*;
- 7 develop different ways of linking paragraphs, using a range of strategies to improve cohesion and coherence, e.g. choice of connectives, reference back, linking phrases;

Standard English and language variation

- 11 understand the main differences between standard English and dialectal variations, e.g. subject-verb agreement, formation of past tense, adverbs and negatives, use of pronouns and prepositions;

(continued)

Text level – Reading

Pupils should be taught to:

Research and study skills

- 1** combine information from various sources into one coherent document;
- 2** undertake independent research using a range of reading strategies, applying their knowledge of how texts and ICT databases are organised and acknowledging sources;
- 3** make notes in different ways, choosing a form which suits the purpose, e.g. *diagrammatic notes*, *making notes during a video*, *abbreviating for speed and ease of retrieval*;

Reading for meaning

- 6** recognise bias and objectivity, distinguishing facts from hypotheses, theories or opinions;

Understanding the author's craft

- 10** analyse the overall structure of a text to identify how key ideas are developed, e.g. *through the organisation of the content and the patterns of language used*;

Text level – Writing

Pupils should be taught to:

Plan, draft and present

- 2** re-read work to anticipate the effect on the reader and revise style and structure, as well as accuracy, with this in mind;
- 3** use writing for thinking and learning by recording ideas as they develop to aid reflection and problem solving;

Write to inform, explain, describe

- 11** explain complex ideas and information clearly, e.g. *defining principles*, *explaining a scientific process*;

Write to persuade, argue, advise

- 14** develop and signpost arguments in ways that make the logic clear to the reader;

Write to analyse, review, comment

- 16** weigh different viewpoints and present a balanced analysis of an event or issue, e.g. *an environmental issue or historical investigation*;

(continued)

Speaking and Listening

Pupils should be taught to:

Speaking

1 reflect on the development of their abilities as speakers in a range of different contexts and identify areas for improvement;

5 ask questions to clarify understanding and refine ideas;

Listening

7 listen for a specific purpose, paying sustained attention and selecting for comment or question that which is relevant to the agreed focus;

Group discussion and interaction

10 use talk to question, hypothesise, speculate, evaluate, solve problems and develop thinking about complex issues and ideas;

Year 9 teaching objectives

Word level

Pupils should be taught to:

Spelling

2 spell accurately all high-frequency words and new terms from all subject areas;

Spelling strategies

3 recognise their strengths as spellers, identify areas where they need to improve and use appropriate strategies to eliminate persistent errors;

Vocabulary

7 recognise layers of meaning in the writer's choice of words, e.g. *connotation, implied meaning, different types or multiple meanings*;

Sentence level

Pupils should be taught to:

Sentence construction and punctuation

1 review and develop the meaning, clarity, organisation and impact of complex sentences in their own writing;

3 write with differing degrees of formality, relating vocabulary and grammar to context, e.g. *using the active or passive voice*;

Paragraphing and cohesion

5 evaluate their ability to shape ideas rapidly into cohesive paragraphs;

Standard English and language variation

9 write sustained standard English with the formality suited to reader and purpose;

(continued)

Text level – Reading

Pupils should be taught to:

Research and study skills

- 2 synthesise information from a range of sources, shaping material to meet the reader's needs;
- 3 increase the speed and accuracy of note-making skills and use notes for re-presenting information for specific purposes;
- 4 evaluate the relevance, reliability and validity of information available through print, ICT and other media sources;

Reading for meaning

- 7 compare the presentation of ideas, values or emotions in related or contrasting texts;

Text level – Writing

Pupils should be taught to:

Plan, draft and present

- 3 produce formal essays in standard English within a specified time, writing fluently and legibly and maintaining technical accuracy when writing at speed;

Inform, explain, describe

- 9 integrate diverse information into a coherent and comprehensive account;

Persuade, argue, advise

- 13 present a case persuasively enough to gain the attention and influence the responses of a specified group of readers;
- 14 make a counter-argument to a view that has been expressed, addressing weaknesses in the argument and offering alternatives;

Analyse, review, comment

- 16 present a balanced analysis of a situation, text, issue or set of ideas, taking into account a range of evidence and opinions;

(continued)

Speaking and Listening

Pupils should be taught to:

Speaking

2 use standard English to explain, explore or justify an idea;

Listening

7 identify the underlying themes, implications and issues raised by a talk, reading or programme;

Group discussion and interaction

9 discuss and evaluate conflicting evidence to arrive at a considered viewpoint;

10 contribute to the organisation of group activity in ways that help to structure plans, solve problems and evaluate alternatives;

To conclude, it is worth repeating that further support can be found in the *Literacy across the curriculum* training file, available in your school. Module 9 (Making notes) might prove useful to you.

The training materials in the foundation subjects also contain helpful material, especially in terms of speaking and listening. The teaching repertoire, modules 4 (Questioning), 5 (Explaining) and 6 (Modelling), are very useful, as is module 12 (Thinking together).

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