

Key Stage 3

National Strategy

Framework for teaching ICT capability:

Years 7, 8 and 9

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Foreword



I am very pleased that we are able to publish this *Framework for teaching ICT capability*. The Framework is an integral part of our Key Stage 3 Strategy. It draws on the experience gained from the pilot programme and existing good practice in schools.

Information and communication technology (ICT) is more vital now than ever. We must ensure that young people have a knowledge and understanding of hardware and software, and also that they can harness the power of the Internet and the rapidly expanding world of digital communications. By giving them the skills and confidence to use ICT effectively, we are making it easier for them to find good jobs.

I hope that you find this practical advice on planning, teaching and assessing ICT in schools to be useful in making a difference to the opportunities and lives of our young people.

A handwritten signature in black ink, which appears to read 'David Miliband'.

David Miliband MP
Minister of State for School Standards

September 2002

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Introduction

The Government has set ambitious national targets for pupils' achievements in information and communication technology (ICT) at the end of Key Stage 3. By 2007, 85% of pupils are expected to reach level 5 and above, with a milestone target for 2004 of 75% at level 5 and above. To reach these goals will need effective, knowledgeable teaching and high expectations for all pupils.

The National Strategy for Key Stage 3 is part of the Government's support for schools as they strive to reach their targets. It began in schools in September 2001 with the introduction of two strands: English and mathematics. Three other strands, focusing on science, ICT and the foundation subjects, are being introduced in 2002–03.

The pilot of the ICT strand involved 40 schools across five LEAs from January 2001 to March 2002 and was extended to 16 LEAs and nearly 200 schools from April to July 2002. Case studies illustrating how these schools have tackled aspects of the Strategy will be posted on the DfES Standards website: www.standards.dfes.gov.uk/keystage3.

What the Strategy involves

As part of the Strategy schools are asked to:

- audit standards, teaching and learning;
- make effective use of the Strategy's Frameworks for teaching and sample teaching units, and the QCA schemes of work for Key Stage 3, either directly or to customise their own schemes of work and lesson plans;
- take part in the Strategy's training programmes and follow them up in school;
- develop literacy and numeracy across the curriculum;
- support transition from Key Stage 2;
- provide mentoring for Year 8 pupils who are falling behind and becoming disaffected;
- offer 'booster' support for Year 9 pupils before the national tests for Key Stage 3.

In its initial stages, the ICT strand will focus mainly on the first five of the bullets above.

About this Framework

This *Framework for teaching ICT capability: Years 7, 8 and 9* is similar to the Frameworks for teaching English, mathematics and science. It gives practical advice on meeting the National Curriculum requirements for ICT capability. It interprets the National Curriculum programme of study for ICT in Key Stage 3, building on the DfES/QCA publication *ICT: a scheme of work for Key Stage 3*, referred to in this document as the QCA scheme of work for ICT.

The purposes of the ICT Framework are:

- to bring together in one place the experience of the ICT pilot and best practice in secondary schools, much of which will already be familiar to teachers;
- to set out teaching objectives for ICT for each of Years 7, 8 and 9 that:
 - are based on the National Curriculum programme of study for ICT in Key Stage 3;
 - build on what pupils have learned in Key Stage 2 and develop their knowledge, skills and understanding in Key Stage 3;
 - ensure that ICT skills are integrated with and taught alongside knowledge and understanding in a range of contexts;
- to advise ICT teachers and trainee teachers on how to use the teaching objectives to:
 - establish high expectations for pupils' achievements;
 - plan and teach appropriately challenging and engaging lessons;
 - assess the progress of individual and groups of pupils;
 - set targets for pupils' future achievements.

The ICT Framework is addressed mainly to heads of ICT departments (ICT subject leaders), ICT teachers and those training to teach ICT. It will also be of interest to ICT coordinators, other senior managers in secondary schools, and all those who support and monitor ICT teaching and standards.

The contents of the ICT Framework

The expected development of pupils' knowledge, skills and understanding of ICT is outlined in section 3 by teaching objectives for each of Years 7, 8 and 9.

Section 5 recommends that, to ensure rigour and progression in pupils' learning of ICT, all schools with Key Stage 3 pupils provide time for specific ICT lessons in each of Years 7, 8 and 9. Typically, this time amounts to 1 hour per week in each year group. To be properly effective, this dedicated time has to be supplemented by significant opportunities for pupils to apply and develop their ICT capability in other subjects, as the National Curriculum requires.

The rest of the document gives advice on planning, teaching, assessing and managing the ICT curriculum for Key Stage 3. Sections that are relatively brief, such as those on planning, on differentiation and on teaching in special schools, are dealt with in greater detail in the Strategy's training programmes and in the publications listed in appendix 3. Technical issues, such as the provision, organisation and maintenance of hardware and software, are not discussed in this document. Advice on these and other ICT matters is available online at BECTa's website: www.ictadvice.org.uk.

Three appendices supplement the main sections of the document:

Appendix 1 describes what most pupils should have learned in ICT by the end of Year 6.

Appendix 2 is a checklist of the key vocabulary used in the yearly teaching objectives and the Strategy's sample teaching units for ICT.

Appendix 3 is a list of related publications and websites.

Using the ICT Framework

The Government believes that ICT teachers will find the Framework a helpful tool for reviewing and adjusting their practice. Many will wish to use it for planning their lessons. There is, after all, no point in individual teachers re-inventing solutions to problems and challenges that are common to all. Schools should make a professional judgement about how to implement the advice in this Framework, once they have studied it, evaluated their current practice and considered their professional development needs.

The factors below should influence the degree to which an ICT department adjusts its current practice:

- pupils' past, current and expected attainment in ICT and the extent to which the school is likely to meet its target for raising standards in ICT;
- the extent to which teaching objectives and expectations of pupils in ICT compare with the detail and challenge of the objectives in this Framework;
- the extent to which the school is clear about the relationship between the teaching of ICT and its use to support learning in a range of subjects;
- the curriculum expertise and leadership in the department and its effectiveness in determining action to achieve higher standards;
- the extent to which the department is staffed by teachers not qualified in ICT, who may need support with their planning, teaching and assessment.

The ICT curriculum at Key Stage 3

The interaction, responsiveness and speed of communication offered by ICT command interest and attention among pupils of all ages. ICT gives them a strong feeling of being in control. The ICT curriculum needs to capitalise on this interest and motivation and set high expectations for pupils' learning.

Progression from Key Stage 2

The starting point for ICT in Key Stage 3 is the knowledge, skills and understanding that pupils have developed in Key Stage 2. In practice, it can be difficult for you as an ICT teacher to know what levels of attainment pupils bring with them as they enter Year 7. Pupils acquire ICT skills and understanding through contact with the technology at school, at home and at leisure, and from its portrayal in the news and media. Some will have had extensive previous experience with ICT, while for others their use of ICT will have been limited. In addition, there are at present no standard test results or teacher assessments to indicate ICT attainment on transfer from Key Stage 2.

Visits to primary schools to observe lessons and local meetings to discuss samples of pupils' work can help to improve continuity. Appendix 1, pages 65–66, which outlines what most Year 6 pupils should have learned in ICT, provides a starting point.

The challenge is to plan and teach units of work in Year 7 that check and build directly on the concepts and skills pupils have already acquired and that stimulate interest and learning in both experienced and less experienced ICT users. The aim is to ensure that the former do not lose motivation through lack of recognition of their skills and the latter are brought quickly up to speed.

ICT capability in Key Stage 3

ICT capability involves information gathering, presentation and technical processing skills, underpinned by understanding of key concepts related to the nature of information and of technology. It includes but is much broader than a set of technical competences in common software applications.

The aim is to ensure that by the end of Key Stage 3 all pupils can use ICT securely, creatively and independently, are confident enough to keep their skills up-to-date and are able to generalise from their ICT experiences. The knowledge, skills and understanding that they need in the subject are closely intertwined and may be summed up as follows.

- **Knowledge:** Pupils need some knowledge of the technology, for example, that a computer requires different driving software to control peripherals such as printers or scanners, or that Internet search engines use different methods to find information, which affects results from a search. They also need to know the technical terms associated with the ICT facilities that they are using.
- **Skills:** To handle information efficiently, pupils need both technical skills in using ICT facilities, such as how to use a particular software package to reorganise information for a new purpose, and information skills, such as skimming and sifting. They also need interpersonal skills, for example, in cooperating with others, both present and remote, in an ICT-based task.

- **Understanding:** Pupils need to understand the concepts that underpin effective use of ICT, for example, when and when not to use ICT for a given purpose. They should appreciate how their use of ICT, or an ICT product, might be improved, for example, to make it more efficient, versatile, interesting or robust. Understanding helps pupils to become reflective and responsible users of ICT, with an awareness of its impact on daily life and society.

The National Curriculum programme of study for ICT in Key Stage 3 groups the knowledge, skills and understanding that pupils need to acquire into themes. These themes, which characterise what people normally do when they work with ICT, are:

- **Finding things out**
- **Developing ideas and making things happen**
- **Exchanging and sharing information**

A critical feature of the development of ICT capability, which needs to be integrated into each theme, is:

- **Reviewing, modifying and evaluating work as it progresses**

Elements of all the themes are likely to occur in most units of ICT work. Schools will often teach certain units earlier in the year so that pupils are familiar with ICT tools and techniques required by teachers of other subjects. What is crucial is that in each of Years 7, 8 and 9:

- pupils experience a balanced programme covering all the yearly teaching objectives;
- the programme combines objectives from each of the themes, including reviewing, modifying and evaluating their work;
- the programme provides breadth of study through a variety of experiences, as required by the National Curriculum;
- the programme acknowledges and draws on contexts and ICT applications used in other subjects.

The next few pages consider each theme in turn, describing:

- what is important about it;
- pupils' experience of the theme in Key Stage 2;
- what knowledge, skills and understanding teachers should check in Year 7;
- what they should move on to teach throughout the key stage;
- how the theme can be reinforced in routine ways, including by teachers of other subjects.

Finding things out

What is important about *Finding things out*?

The ability to find likely sources of relevant information empowers a pupil who is working independently. But finding the sources is just the start. The wealth of material now available through CD-ROM resources and the Internet can be daunting. There is little mediation – people have access to information through computers in homes, shopping centres, libraries and Internet cafés, and through digital television and mobile telephones.

This theme is about understanding what makes information, about motivating enquiry and making pupils' independent study more focused and productive. Pupils need to learn:

- how to access information from an increasingly wide variety of sources;
- to recognise the origin of information and to judge its accuracy, validity and possible bias;
- to assess how useful and relevant a source of information and its contents will be for a particular enquiry or piece of research.

The theme also addresses how to use ICT to find things out from collected data, and in particular how pupils might:

- identify exactly what information is required to solve a problem, complete a task or answer a question;
- assess the value and validity of what they read, see and hear;
- find, collect and store data efficiently, and use data appropriately to draw conclusions based on evidence.

This theme is one that most subjects in the curriculum will draw on and, by its nature, reinforces pupils' literacy and numeracy skills.

Pupils' experience in Key Stage 2

During Key Stage 2 pupils are likely to have gathered data from books, CD-ROMs, weather stations and the Internet, and collected data from experiments and simple surveys for very specific purposes. They will have categorised and stored data, and displayed the data in simple graphs, charts and tables. Most pupils will be aware that errors or omissions in a set of data can lead to strange effects in graphs or on a calculator. Most will be very familiar with selecting and copying text and images from CD-ROMs or websites and pasting them into documents and presentations they create.

Some pupils will have used search engines and learned how to use AND or OR to refine their searches. They will be aware of the need for care in framing questions and checking the accuracy of information before using it.

You can build on this foundation by finding out through discussion and early tasks how far pupils have progressed in information handling and research skills. The tasks that you use for this purpose need to be interesting and to allow scope for pupils with different backgrounds in ICT to learn, clarify and consolidate the necessary skills and knowledge.

Finding things out in Key Stage 3

Using data and information

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- Information items come in different forms, for example, text, numbers, sounds or images. The way in which these items are mixed and joined together determines overall meaning and impacts on an audience or viewer.
- Information is stored in many sources – libraries, books, directories, films, computer memories, files of various sorts and websites. Well-designed sources have indexes or displays which catalogue in different ways what the sources contain and how items may be accessed.
- Pages of information, such as maps, timetables, mail-order catalogues, designs or graphs, contain keys and titles which indicate meaning. Where these are missing – for example, when the axes of a graph are not labelled or a map has no orientation or scale – the page can be confusing or misleading. Items of information can also be misleading, for example, if a newspaper article tells only one side of a story, a price label has no currency unit or a time of 10:35 fails to indicate whether this is am or pm.

Once these aspects have been established teach pupils to know and understand that:

- A variety of electronic media is used to store information.
- Much information is written from a point of view or particular perspective, with the intention that it influences or persuades. The user of the information has to be discerning and to make an informed judgement about the plausibility of information, its degree of accuracy, whether it contains errors or is presented in a way that is likely to mislead. Any data have to be considered to decide whether the size of the sample is appropriate or whether or not the data are representative of the whole population.
- It is helpful to develop and use criteria for reviewing and comparing websites and other sources of information, for example, on an organisation, a product, an event or a controversial issue. The criteria may depend on the purpose for which the user is seeking the information.
- It may be possible to identify improvements that could be made to a source of information, for example, to improve the clarity of the display, the suitability of the material for younger readers, the ease of navigation by people with visual or hearing impairments, or to improve the accuracy and representative nature of data.

- All published information, whether based on fact or opinion, commerce or entertainment, has been provided by someone investing time and resources to assemble it. Its current owner is entitled to expect those who use the information to acknowledge the source and, where expected, to pay for it.

Searching and selecting

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- Search engines on the Internet give direct access to websites containing a variety of forms of information. The engines have different characteristics and ways of interacting with people who use them.
- Search engines, or options in application programs such as 'find' or 'filter', can be used to locate text items, graphics and numbers, and to speed up access.

Once these aspects have been established teach pupils to know and understand that:

- Different search engines on the Internet use different search techniques. Some are more suitable for some purposes and users than others – for example, some have already categorised information and can appear to find information more quickly. Search engines cover only part of the Internet. Specialised database searching online may be needed to access particular data.
- The choice of information for use in a study should be justified by considering its relevance, quality, accessibility and any bias. It is important to distinguish fact from opinion, and to choose what is appropriate to the purpose of the search.
- AND, OR and NOT can be used to combine search conditions and make comparisons with words, short phrases or numbers. Refining search conditions is one of the best ways to narrow down the search.
- The search method for selecting information should if necessary be modified after considering the results of an enquiry, or if there are any changes to its purpose or scope.

Organising and investigating

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- The purpose and scope of an enquiry, and how one intends to process the data, determine what information is collected, how it is obtained and how it is structured for ease of retrieval and processing.
- A database, such as one arising from a traffic survey, can be used to answer detailed questions and draw more general conclusions in an enquiry.
- Software helps a user to construct and amend an effective database structure, and to enter collected data in text, date or numerical form. The user can specify the type and range of the data so that each entry is checked for accuracy.
- File directory structures allow data, including sounds and images, to be stored and retrieved more efficiently.

Once these aspects have been established teach pupils to know and understand that:

- Different programs and storage formats for handling data have different advantages and disadvantages. Appropriate data formats and methods need to be used to store, retrieve and transmit material efficiently and quickly.
- Design, development and testing all have to be considered when a database system is produced for a specific purpose and identified users.
- The review, modification and evaluation cycle needs to be undertaken at every stage of a development project, especially if tasks are allocated to individuals in a production team.
- The collection of data for a database can be simplified, for example, by using software templates or optical character recognition (OCR) equipment.
- Dataloggers capture measurements of physical properties electronically. The data they collect can be displayed and analysed in real time or, if the experimental data can be stored, after an experiment is finished. Discovering an anomaly or association in the behaviour of readings when these are displayed or analysed is the essence of research.
- The collection of data can also be automated by scanning coded information, such as barcodes or magnetic strips. Scanned data (for example, from products paid for at a supermarket till, from fingerprints of authorised people at protected entrances) can be fed directly into data handling software and analysed.
- Databases can be used to explore relationships between different data sets or variables and to find out how measures of characteristics are distributed. Hypothesising about and investigating the possible relationships between them can lead to interesting discoveries, for example, that a pupil's neck measurement is roughly double a wrist measurement, or that most road traffic accidents happen in the morning and early evening.
- New items of data can be calculated or derived from the 'raw data', for example, the average of a set of marks, journey time between departure and arrival, the probability of a particular event. New items can also be calculated from items that are themselves derived, for example, the highest average mark in a subject for a class of pupils.
- Frequency graphs, scatter graphs and measures calculated from others help the user to test hypotheses and draw conclusions.
- Product and people databases and automated logging (for example, of sales) have an impact on commercial and service practices. For example, they can affect stock levels in shops, what people are charged for household bills or whether or not a person may have a credit card. Because data like these could be abused there are laws to regulate access.

Routine reinforcement across the curriculum

You can reinforce this knowledge and understanding of finding things out routinely when you are teaching pupils the skills of information retrieval, as can teachers of other subjects when they are using ICT in their lessons. For example, you can:

- Teach pupils to **acknowledge the sources**, including websites and parental advice, from which they have gained ideas, images, statistics, quotes and so on. Teachers of all subjects should ensure that pupils do this.
- Encourage pupils to **reflect on the relative merits of different information sources** on topics of interest to them, such as computer game software, popular sportswear or current events.
- Encourage pupils to **articulate reasons why some websites or advertisements are more compelling** and attractive than others.
- Help pupils to **use skim reading and more discerning reading techniques** in a research task, particularly to identify quickly whether material is based on fact or opinion, or contains bias.
- Expect pupils to **use correct technical terms** related to the retrieval and storage of data, and to know how they might use these processes and ICT in their school work.
- Make pupils aware of the **accuracy with which data are stored and displayed** in various analogue and digital devices, for example, clocks, meters and laboratory scales, and how they should record the data.
- Teach pupils to be sensitive to errors. Expect them to **use regular mental checks to ensure accuracy** when working with calculators, wordprocessors and data handling software, particularly where data are stored in a database for later use.

Developing ideas and making things happen

What is important about *Developing ideas and making things happen*?

This theme is about what users can do with information once it has been collected. They can transform, develop or display information in various ways to understand it better and communicate it more effectively to others. They can observe, describe and try to explain what happens as a result of introducing certain changes in the information or its processing. The use of ICT increases the efficiency with which data can be processed – automated processing allows large quantities of data to be handled very rapidly.

Modelling allows someone to define or use a representation of a situation or process and to observe how it works and what happens when something changes. Modelling activities carried out with pencil and paper alone are slow. Speculative modelling is greatly enhanced, speeded up and made more dynamic and exciting if suitable ICT is available. For example, data collected from a science experiment can be stored in a spreadsheet, presented graphically, and the model explored by changing the values of the independent variables to test hypotheses.

The same principles underpin the organisation of information as sets of instructions to exercise control or to achieve desired physical effects. For example, using the menu shown on a TV screen to program a video recorder, a viewer can define instructions that are activated in the correct sequence when they are triggered; similarly, a program can be developed to control the movement and actions of a robot at a car manufacturing plant.

Pupils' experience in Key Stage 2

During Key Stage 2 most pupils will have collected information and measurements about environments. For example, they may have considered the effect of altering the organisation of furniture in a classroom or flowerbeds in a garden, or of varying the conditions in which seeds are grown.

Many pupils will have had extensive experience of computer games, which will have developed their ability to visualise complex maps and to represent pictorially real or imaginary environments. They will have also experienced object-oriented graphics, in games or in familiar ICT tools, to move objects in a simulated scenario or around the screen.

Some pupils will have used simple spreadsheet models, for example, to investigate a rule that transforms one number into another, or to find the total of a shopping bill when the number or price of the items varies.

Most pupils will also have been given straightforward control problems, such as programming a floor robot, and will have developed, tested and modified a series of instructions to solve the problem. Some pupils will have contributed to a class project in which a sequence of physical events, such as lighting up a building, is controlled by routine instructions. In some cases, this will have incorporated input from sensors.

Pupils are usually excited about this aspect of ICT study as it offers scope for experimenting and collaborative problem solving. Primary schools are gradually acquiring the resources to teach this aspect of ICT but it is possible that pupils entering Year 7 will not have developed work in monitoring and control to the same level as their other work in ICT.

Developing ideas and making things happen in Key Stage 3

Analysing and automating processes

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- The use of ICT can increase the efficiency of information processing. Tools to spell-check, to create a table, or to cut and paste, for example, enable tasks that would otherwise be laborious to be carried out quickly and accurately.
- It may be possible to break down a model, or representation of a system, into smaller procedures, each with its own input, processing and output. This makes the model or system easier to review.
- Systems and environments can be easier to understand if they are represented graphically through flow charts and tables. These can be translated into well-structured sets of instructions for computer software.

Once these aspects have been established teach pupils to know and understand that:

- ICT allows some aspects of data handling (for example, data capture) to be undertaken in one environment and the outcomes transferred to another environment (for example, for analysis, display or presentation).
- Design and implementation of ICT systems to process information, model, monitor and control involve:
 - specifying a problem, or design requirement, and refining it by negotiation with the eventual user;
 - discussing and deciding whether any or all of the system needs to be ICT-based;
 - producing a system diagram detailing the functions, inputs and outputs for each module and showing the relationships between various modules;
 - writing and testing detailed sets of instructions, using software to build the necessary procedures and modules;
 - testing the whole system, and updating it as necessary;
 - annotating the system to explain and justify the system's development;
 - evaluating the product, its features and usability, together with users.
- The automation of data processing in commerce, manufacturing and public services is affecting daily life and society. It impacts on, for example, safety of travel, maintenance of levels of medical supplies in hospitals, and access to a bank account.

Models and modelling

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- A model is a representation of a system which has some initial conditions, some input data, and rules for handling the initial conditions and input data to produce outcomes. For example, a typical computer game contains a model which has some initial settings, the user gives input through pressing keys, and there are rules which determine the frequency and size of the reward.
- Modelling starts with a specification of what the model is intended to achieve.
- The rules governing a model must be translated into exact instructions – formulae, relationships or timings – in the format required by the modelling software, and arranged in the right order. (The same principles apply to a control program.)
- The most versatile models allow the user to change not only the data but also the rules. For example, a user can store and change the formulae or rules for generating new items of data in a spreadsheet. New items are recalculated automatically whenever the items on which they depend are changed.
- A model must be tested thoroughly to ensure that it works as intended.

Once these aspects have been established teach pupils to know and understand that:

- Many computer models used by scientists and geographers, for example, are transparent in that they show the underpinning rules and how changes are made. This is not always the case.
- A spreadsheet program is an example of computer software that allows users to see changes to the model. It allows a model to be specified in terms of:
 - initial conditions, for example, what menu will be offered in a three-course dinner and how many units of various food products are needed per person for each course;
 - input data, for example, how much a unit of each food product costs and how many people are estimated to eat each course; and
 - rules, or formulae, which combine the data to give the total cost of each food product.
- Spreadsheets and control programs which support the building of models at this level have space for storing instructions and usually offer facilities to:
 - allocate cells or variables for storing values in the form of numbers or dates;
 - perform arithmetic operations on numerical values in cells;
 - wait for a specified time to elapse before undertaking the next instruction;
 - repeat a set of instructions a specified number of times or until a certain condition is satisfied;
 - compare the value in one cell with another in order to determine subsequent action, for example, when using a cell as a counter.

- It is essential to test the whole model and each procedure using a representative sample of the input data in various combinations to ensure that the rules work correctly and that the model matches the situation or system being represented. The test must find out how different instructions may interact, for example, whether circular references occur.
- Different computer software tools for modelling, such as spreadsheet programs, Logo, control applications and simulations, offer varied facilities that suit different contexts, for example, in economics, mathematics, control technology or design.

Control and monitoring

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- Control programming allows people to represent a system or control problem to help them plan, predict and gain a better understanding of the system.
- A control program is built to respond to a problem or design requirement. For example, to keep a very sunny room at a required temperature, the control program has to have:
 - initial conditions, for example, the initial state of all components of the system, particularly the activity of the cooling unit and the position of the blinds;
 - input data, for example, the current readings of the temperature and brightness sensors in relation to the temperature setting selected by the user; and
 - rules that determine how the cooling unit and the mechanism controlling the blinds have to respond to current sensor readings and the selected temperature.
- A control program must be checked to see how closely it conforms to the specification of the task.

Once these aspects have been established teach pupils to know and understand that:

- A particular environment can be developed by measuring its physical properties and detecting any changes over time or under varying conditions. Analogue and digital instruments are used to measure, store, display or transmit physical data. Each device is suitable for use in a particular environment. It has a certain level of sensitivity to the properties it measures, such as light, and has a certain degree of accuracy with which it stores or displays the measurements made, based on appropriate units.
- Software which supports the building of control programs at this level will have similar features to modelling software. In addition, it will have facilities to allocate initial states to units and switch them on or off, and to ascertain the on/off state of a sensor.

- Testing of a control program should include every possible combination of valid data and every path of control through the set of instructions to find out how different instructions or procedures interact. The use of state tables helps to do this. Documentation of the program should indicate the tests that have been undertaken.
- Control applications are the most common application of microelectronics in daily life and in industry. Sets of instructions are used to automate certain processes, for example, to assemble cars using robotics or to generate electricity in a nuclear power station.

Routine reinforcement across the curriculum

You can reinforce this knowledge and understanding routinely in the context of teaching pupils the skills of developing ideas and making things happen. Most of the skills can be reinforced by teachers of other subjects, especially of mathematics, science, geography and design and technology. For example, you can:

- Expect pupils to **be sensitive to magnitudes**, to **specify units** whenever they work with measurements, whether in ICT lessons or other subjects, and to **avoid spurious accuracy** in displays of data.
- Remind pupils of the **accuracy** with which data are captured, stored, displayed or transmitted in various sensors, instruments and datalogging devices they meet, and how to use this equipment and data.
- Expect pupils to **use relevant technical terms** associated with modelling, monitoring and control activities, and with the analysis of data, and to use these terms appropriately in all their school work.
- Encourage pupils constantly to **be alert to displays on screens, switches and peripheral indicators** and to information on the current state – and safety – of the systems they are using.

Exchanging and sharing information

What is important about *Exchanging and sharing information*?

This theme is about the process of communication. It helps to form communities, transmits values, experiences and traditions, and expands horizons. It plays a large part in preparing pupils to be not only learners but also part of a wider community, with a voice and with responsibilities for others. Pupils of all abilities, including those with special educational needs, can gain awareness of their voice and responsibilities through sensitive teaching, and by the support provided by good role models throughout the school.

This theme is the one where there is likely to be the greatest diversity in pupils' experiences and backgrounds, based on what they have done in the primary years and at home. These varied backgrounds play a particularly significant role in what needs to be taught to pupils early in Key Stage 3. At the same time, you may find it difficult to establish, without questioning a pupil extensively, what is the pupil's own work in the information he or she 'shares', and what has largely been contributed by or 'exchanged with' others.

Pupils' experience in Key Stage 2

During Key Stage 2 pupils will have seen ICT as a way to ensure that their work is displayed well, among other things. They will have used various applications to display text, bar charts and pie charts. Many of the displays will have resulted simply from inputting data into a program and pressing a button or an option to produce a graph, but without further evidence of data handling, comment or consideration of quality.

Primary pupils' experience of and expertise in exchanging and sharing information are likely to vary. Increasingly, they will have incorporated graphical displays of data in presentations, with the axes labelled correctly. They may have indicated an awareness of their audience and a wider purpose for the display by adding meaningful titles, arrows and comment, with a description of what they have done and the conclusions they have reached.

Most pupils will also have had opportunities to obtain information from CD-ROMs and increasingly from the Internet. They will have used ICT tools to prepare studies, brochures and sets of presentation slides, sometimes with selected sound clips and some animation effects. In many schools, pupils will have had opportunities to capture images and sound for their presentations with digital cameras and microphones. The transfer of images or sounds into computer files may have been done by adults ready for pupils to use.

The level of sophistication in primary pupils' multimedia presentations, whether in the form of web pages or sets of presentation slides and accompanying materials, may vary considerably. In some pupils' e-mail communications it may be difficult to detect purpose or a need for the speed, informality or convenience of e-mail over ordinary post. In others, there will be a clear focus to the communication to inform a class study, for example, on sports activities in another school, or the style of a

school day in another country. Where the focus is well defined, the activity will have yielded some informative and topical exchanges in text, graphs, charts and digitised images.

Exchanging and sharing information in Key Stage 3

At the very beginning of Year 7 you will first need to find out pupils' experience with this aspect of the subject at home and at school. Offer a variety of activities that will quickly identify pupils' levels of knowledge, skills and understanding. If necessary, follow these activities with some intensive teaching to help those who need it to catch up, without holding up others. The skills, knowledge and understanding that you need to check include their:

- knowledge of basic editing and formatting facilities that handle text and images across common ICT applications;
- skills of navigating efficiently through stored computer work and work in progress on the screen;
- understanding of the cost and time implications of saving or printing text and graphics in monochrome or colour;
- knowledge of a range of software supporting this theme, and ability to use an application and some of its options independently;
- skill of producing a design for a simple publication or multimedia sequence.

Fitness for purpose

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- It is important to be selective and sensitive in what we present to a particular audience or community.
- Critical reflection on how others present fact and opinions, or materials to publicise or entertain, helps the development of one's own work for a particular audience.
- Before planning the detail of a communication to an audience, it is important to establish:
 - the overall aim of the communication and how its success will be judged;
 - the environment for the communication, for example:
 - the overall length of the piece,
 - the media to be used (e-mail, published leaflet, booklet, series of revolving slides, talk accompanied by interactive multimedia presentation ...),
 - the facilities available and quality required for any transmission or display;
 - the expectations and needs of the audience, for example:
 - the overall level of language and types of image that would be suitable,
 - the likely attention span of the audience,
 - the general degree of interest in the topic.

- It helps to review and modify an intended presentation by testing it on people who, as reviewers, can empathise with the intended audience.

Once these aspects have been established teach pupils to know and understand that:

- Different presentations and publications are based on familiar forms and conventions. For example, business publications include logos and corporate identities; leaflets for tourists include informative text, photographs and maps; newspapers are set out in columns and have photographs on most pages. There are developing conventions for electronic media, for example, in the way that navigation tools are used on websites. Awareness of these forms and conventions helps in deciding what style and layout are appropriate for a particular task.
- Before planning a communication, more details to establish are:
 - further expectations of the audience, for example: whether they expect to be informed, entertained or persuaded, how critical they are likely to be;
 - the needs of the audience in reality, for example: the levels of language suitable for various groups, whether the audience includes disabled people, how knowledgeable they really are about the topic.
- Readers with particular physical or sensory disabilities can be helped by well-designed presentations and publications. For example, web pages which require less movement and page swopping can be planned, with an option to reduce graphics areas and increase the size of text, or larger hyperlink buttons. Some might benefit from parallel, text-only web pages or a simpler, more obvious structure for access by a text-to-speech browser.
- It is necessary to review the intended work with peers and others before it is finalised. This should be followed by an evaluation of its suitability for its purpose and audience, and of the extent to which it meets the agreed evaluation criteria.

Refining and presenting information

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- Text, images and sounds can enhance meaning. Deliberate mismatch and disharmony can also produce an impact, for example, humour or unease.
- Visual literacy skills are needed to present material to attract and interest readers, for example, wording headings sensitively, using formatting and fonts to assist reading, choosing and positioning images with care.

Once these aspects have been established teach pupils to know and understand that:

- Different multimedia authoring software can address different purposes, and provide good design solutions, for example, web publishing, multimedia presentation and hyperlinked resource banks.
- Critical and mature evaluation of a presentation or publication during its development, by the pupil and by others, will enhance it.

Communicating

At the start of Key Stage 3 check and develop pupils' knowledge and understanding that:

- Developments in telecommunication allow the world community to receive messages instantly. ICT tools enable the message to be accessed, considered, used and developed by many people.
- There is a need to guard against exchange of information that could be misused, for example, personal details about oneself or one's school or place of work.

Once these aspects have been established teach pupils to know and understand that:

- Different file formats and access methods allow greater transmission speed and quality of response or display than others. Material may be organised or animated on a web page in a way that is attractive, informative, quick to download, and easy to navigate and to exit from. It can include tags to allow it to be found easily, efficient automated routines and links to other web pages.
- The time taken to transmit information depends on file size, protocols used and bandwidth. Mail lists can speed up communications.
- Website tagging and hyperlinks can speed up searching by allowing users to move directly to new information or by offering choices more directly matched to their requirements.
- 'Contracts' for joint projects with remote partners need to be agreed by both partners – for example, completion dates, sample size, format of data to be exchanged. Collection of data for a remote partner has to meet the partner's deadline.
- Criteria for judging the effectiveness of a communication project need to be established, especially a joint project negotiated with distant partners.

Routine reinforcement across the curriculum

You can reinforce this knowledge and understanding routinely in the context of teaching pupils the skills of exchanging and sharing information, as can teachers of other subjects when they are using ICT in their lessons. For example, you can:

- Expect pupils to **identify their authorship and ownership** of stored material, and the last date of update, and regularly to **rename the file** that contains the latest successive version of their work.
- Expect pupils to **use technical terms** associated with exchanging and sharing information, particularly in setting out what has been agreed between themselves and any e-mail partners about joint working.
- Draw pupils' attention to the **features of well-presented information** produced by others, including their peers, and also to good use made of e-mail communications in research, networking and project planning.
- Encourage pupils to **use ICT to improve their writing** in whatever subject or topic they are working on.
- Ensure that pupils grow **accustomed to having their work assessed critically**. Set aside regular time in class or for homework for feedback to others on their presentations using agreed or new criteria.
- Ask pupils routinely to **discuss issues that have arisen from their e-mail communications** with remote partners.

Reviewing, modifying and evaluating work as it progresses

This aspect of ICT cuts across and is integrated with each of the themes.

Evaluating work in order to improve it

ICT engenders a culture of development and improvement. Since almost everything pupils do with ICT can be regarded as work under development, it is relatively easy to encourage trying out different approaches to seek something better. The incentive is there to explore different options, compare a new outcome with its predecessor, and debate alternative strategies for solving a problem or creating a design. Annotating and displaying successive improvements during the development stage helps pupils to document how they have evaluated and modified their product.

Pupils should select and store evidence to show development in the content and quality of their work. The evidence might be electronic or paper notes, digital images, video and audio tape, and sequences of project files on disk, linked by a contents list. Notes should justify why ICT was used, or particular programs or options chosen, and how these improved the work at various stages. A bank of work in progress allows pupils to refer quickly to previous approaches to inform their current work, or to return to a previous project to improve it with the benefit of hindsight.

The process of evaluation and modification should increase in rigour throughout the key stage. At first, pupils may react intuitively. But through their growing experience, and greater awareness of the uses and impact of ICT in commerce and daily life, they should identify criteria for evaluating and modifying their ICT work in school. Encourage them to make self-assessments of their work and to involve their peers in these evaluations. This helps to develop their critical skills and ability to respond to critical feedback.

Recognising fitness for purpose

Pupils also need to understand what constitutes improvement or better fitness for purpose. For example, a search for information on a topic may at first yield too many items of interest. By clarifying what they are looking for, and using ICT judiciously, pupils can home in on the most relevant items. Evaluation of the retrieved information, and sharper criteria for focusing the search, lead to further trials and refinement, or even to different approaches to the search.

You can help pupils to appreciate the importance of fitness-for-purpose by giving them regular examples of how ICT is used in school and beyond. Encourage them to consider advantages and disadvantages for particular purposes of different ways of searching, analysing and reporting information, or of communicating with a remote audience. They need to understand why and when tools such as spreadsheets and techniques such as graphical representation are useful.

Recognising inappropriate uses of ICT

As pupils gain familiarity with a greater variety of tools and techniques, you also need to help them to recognise when and when not to use ICT facilities to perform certain tasks. For example, they need to appreciate the advantages and disadvantages of using props such as wizards in their work and recognise when it would be appropriate to design their own automated procedures. Make sure that they are aware of uses of ICT that are feasible but inappropriate, for example:

- using an electronic calculator when a calculation should be done mentally;
- generating inappropriate graphs of data, merely because a facility exists – for example, using a line graph to display discrete data that should have been presented in a bar chart or pie chart;
- labouring to input one page of text and figures that could have been handwritten and photocopied, if necessary;
- using ICT for a piece of work that is not enhanced sufficiently to be worthwhile, or for work that is not saved electronically;
- copying passages from CD-ROM or the Internet for reproduction in an essay, without having a strategy for selecting and summarising suitable parts;
- spending more time on minor, repetitive embellishments to a document than on content or a consideration of audience;
- logging data in an experiment, with little consideration of the volume of data that is needed and the effects of the rate of sampling;
- using technically complex ICT facilities to produce material for an audience that does not have access to the facilities required – for example, the latest version of browser software.

Checking outcomes

Another aspect of developing pupils' ability to improve their work is to make sure that, whenever they use electronic devices or software to represent, measure or process data, they check regularly that:

- the material they are processing is complete;
- the tool they are using measures or manages the material exactly as intended.

You should also teach pupils to be sensitive to errors whenever they are working with ICT, including calculators, digital meters and scales. For example, encourage them regularly to:

- check that they are working on the right version of a document;
- preview material before printing it;
- make mental checks of the accuracy of calculations;
- when adding a new cell to the end of a spreadsheet row or column, check that its content is included in the total of the row or column;

- save or record work after a useful result has been obtained, for example, after incorporating a good idea or checking a numerical result;
- check that digital meters are calibrated and yield sensible readings.

Routine reinforcement across the curriculum

You can reinforce pupils' awareness of the need to review, modify and evaluate work as it progresses, as can teachers of other subjects when they are using ICT in their lessons. For example, you can:

- Encourage pupils **regularly to save intermediate versions** of models and control programs they are developing, especially when they are testing partial solutions.
- **Use malfunctions** in ICT systems to teach pupils what might have caused them and how to cure them, for example:
 - an accidental change to an option setting;
 - a safety feature of a peripheral;
 - a programmed response of a system to its environment, e.g. 'out of paper';
 - the mismatch of controlling software to a peripheral.
- Encourage pupils to **use online help facilities** to sort out their problems and to share with others regularly what they have discovered about available options in the software and peripherals they use.

3

Yearly teaching objectives for ICT

The yearly teaching objectives for Years 7, 8 and 9 are central to pupils' achievement in ICT. They identify for each year the core of what pupils should know, understand and be able to do in ICT. Your teaching plans and formative assessments should centre on these objectives.

The objectives cover all of the National Curriculum programme of study for ICT in Key Stage 3. They have been arranged carefully to support pupils' learning as they enter Key Stage 3 from Key Stage 2, and as they make progress from Year 7 to Year 9. They help pupils to make connections across the range of knowledge, understanding and skills that they meet in ICT lessons. They also ensure the breadth of study that the National Curriculum requires.

The objectives are set out year by year to help identify progression. Each year includes objectives for the themes:

- finding things out;
- developing ideas and making things happen;
- exchanging and sharing information.

Objectives for reviewing, modifying and evaluating work as it progresses are integrated throughout the themes and highlighted in colour.

The objectives are intended to help you to challenge and raise expectations. They are sequenced so that the expected attainment of most pupils who started Year 7 at level 4 or 5 is level 5 or 6 by the end of Year 9. In each year of Key Stage 3, the vast majority of pupils in mainstream schools should reach at least the levels shown in the central column of the table below.

End of Year	Expected attainment		
	Pupils who make slower progress	Most pupils	Pupils who make faster progress
7	level 3/4	level 4/5	level 5/6
8	level 4	level 5	level 6
9	level 4/5	level 5/6	level 6/7

Teaching that is structured around these expectations, and which provides the breadth of study that the National Curriculum requires, should help to ensure that at least 75% of pupils achieve level 5 or above in ICT by 2004, with 85% achieving at least this level by 2007.

You should give priority to the yearly teaching objectives when you are planning work, assessing pupils' progress and setting curriculum targets for individuals and groups of pupils. For some pupils a target may need to be broken down into smaller steps. For other pupils, it may be appropriate to choose a target linked to the yearly teaching objectives for the year group below or above. Whatever the targets, assessment of pupils' progress against the yearly teaching objectives gives the next starting points for building pupils' understanding.

Year 7 teaching objectives

Finding things out	Developing ideas and making things happen	Exchanging and sharing information
<p>Using data and information sources</p> <ul style="list-style-type: none"> Understand that different forms of information – text, graphics, sound, numeric data and symbols – can be combined to create meaning and impact. Identify the purpose of an information source (e.g. to present facts or opinions, to advertise, publicise or entertain) and whether it is likely to be biased. Identify what information is relevant to a task. Understand how someone using an information source could be misled by missing or inaccurate information. <p>Searching and selecting</p> <ul style="list-style-type: none"> Search a variety of sources for information relevant to a task (e.g. using indexes, search techniques, navigational structures and engines). Narrow down a search to achieve more relevant results. Assess the value of information from various sources to a particular task. Acknowledge sources of information used. <p>Organising and investigating</p> <ul style="list-style-type: none"> In an investigation: <ul style="list-style-type: none"> design and use an appropriate data handling structure to answer questions and draw conclusions; design a questionnaire or data collection sheet to provide relevant data; check data efficiently for errors; investigate relationships between variables; use software to represent data in simple graphs, charts or tables, justifying the choice of representation; derive new information from data, e.g. averages, probabilities; check whether conclusions are plausible; review and amend the structure and its data to answer further questions. 	<p>Analysing and automating processes</p> <ul style="list-style-type: none"> Use automated processes to increase efficiency (e.g. templates, master pages). Represent simple processes as diagrams, showing: <ul style="list-style-type: none"> how a task can be broken down into smaller ones; the sequence of operations, and any conditions or decisions that affect it; the initial information needed (e.g. room temperature, prices of items). <p>Models and modelling</p> <ul style="list-style-type: none"> Use software to investigate and amend a simple model by: <ul style="list-style-type: none"> formatting and labelling data appropriately (e.g. formatting cells to display currency); entering rules or formulae and checking their appropriateness and accurate working; explaining the rules governing a model; predicting the effects of changing variables or rules. Test whether a simple model operates satisfactorily. <p>Control and monitoring</p> <ul style="list-style-type: none"> Implement a system to carry out a simple control task, including some that involve sensed physical data, by: <ul style="list-style-type: none"> compiling sets of instructions, identifying those which can be grouped to form procedures or loops; testing and refining the instructions. 	<p>Fitness for purpose</p> <ul style="list-style-type: none"> Recognise common forms and conventions used in communications and how these address audience needs (e.g. columns of text in newspapers, graphics and enlarged print in posters, hyperlinks on websites). Apply understanding of common forms and conventions to own ICT work. Use given criteria to evaluate the effectiveness of own and others' publications and presentations. <p>Refining and presenting information</p> <ul style="list-style-type: none"> Plan and design the presentation of information in digital media, taking account of the purpose of the presentation and intended audience. Use ICT to draft and refine a presentation, including: <ul style="list-style-type: none"> capturing still and moving images and sound (e.g. using a scanner, digital camera, microphone); reorganising, developing and combining information, including text, images and sound, using the simple editing functions of common applications; importing and exporting data and information in appropriate formats. <p>Communicating</p> <ul style="list-style-type: none"> Use e-mail securely and efficiently for short messages and supporting material. Know how to protect personal details and why this is important.

NOTE: Objectives highlighted in colour are related to reviewing, modifying and evaluating work as it progresses.

Year 8 teaching objectives

Finding things out	Developing ideas and making things happen	Exchanging and sharing information
<p>Using data and information sources</p> <ul style="list-style-type: none"> Understand how the content and style of an information source affect its suitability for particular purposes, by considering: <ul style="list-style-type: none"> its mix of fact, opinion and material designed to advertise, publicise or entertain; the viewpoints it offers; the clarity, accessibility and plausibility of the material. Devise and apply criteria to evaluate how well various information sources will support a task. Justify the use of particular information sources to support an investigation or presentation. <p>Searching and selecting</p> <ul style="list-style-type: none"> Extend and refine search methods to be more efficient (e.g. using synonyms and AND, OR, NOT). Explain the advantages of the methods used by different search engines and programs to search for data in various formats. <p>Organising and investigating</p> <ul style="list-style-type: none"> In an investigation: <ul style="list-style-type: none"> use software options and formats to store, retrieve and present electronic material efficiently; explore and interpret collected data in order to draw conclusions; assess the consistency of conclusions with other evidence. Understand: <ul style="list-style-type: none"> how data collection and storage are automated in commerce and some public services; the impact of electronic databases on commercial practice and society; potential misuse of personal data. 	<p>Analysing and automating processes</p> <ul style="list-style-type: none"> Automate simple processes by: <ul style="list-style-type: none"> creating templates; creating simple software routines (e.g. style sheets, web queries, control techniques on web pages). Consider the benefits and drawbacks of using ICT to automate processes (e.g. using wizards, templates). Represent simple design specifications as diagrams. <p>Models and modelling</p> <ul style="list-style-type: none"> Develop ICT-based models and test predictions by changing variables and rules. Draw and explain conclusions (e.g. 'the best value for money is obtained when...'). Review and modify ICT models to improve their accuracy and extend their scope (e.g. by introducing different or new variables and producing further outcomes). <p>Control and monitoring</p> <ul style="list-style-type: none"> Develop and test a system to monitor and control events by: <ul style="list-style-type: none"> using sensors efficiently; developing, testing and refining efficient sequences of instructions and procedures; assessing the effects of sampling and transmission rates on the accuracy of data from sensors. Understand how control and monitoring has affected commercial and industrial processes (e.g. telecommunication, health and transport services). 	<p>Fitness for purpose</p> <ul style="list-style-type: none"> Recognise how different media and presentation techniques convey similar content in ways that have different impacts. Understand that an effective presentation or publication will address audience expectations and needs (e.g. the audience's levels of literacy, familiarity with a topic). Devise criteria to evaluate the effectiveness of own and others' publications and presentations, and use the criteria to make refinements. <p>Refining and presenting information</p> <ul style="list-style-type: none"> Plan and design presentations and publications, showing how account has been taken of: <ul style="list-style-type: none"> audience expectations and needs; the ICT and media facilities available. Use a range of ICT tools efficiently to combine, refine and present information by: <ul style="list-style-type: none"> extracting, combining and modifying relevant information for specific purposes; structuring a publication or presentation (e.g. using document styles, templates, time lines in sound and video editing, navigational structures in web media). <p>Communicating</p> <ul style="list-style-type: none"> Understand some of the technical issues involved in efficient electronic communications (e.g. speed and bandwidth, size and type of file, features of different browsers and mail software). Use ICT effectively to adapt material for publication to wider or remote audiences (e.g. as web articles or sites).

NOTE: Objectives highlighted in colour are related to reviewing, modifying and evaluating work as it progresses.

Year 9 teaching objectives

Finding things out	Developing ideas and making things happen	Exchanging and sharing information
<p>Using data and information sources</p> <ul style="list-style-type: none"> • Select information sources and data systematically for an identified purpose by: <ul style="list-style-type: none"> – judging the reliability of the information sources; – identifying possible bias due to sampling methods; – collecting valid, accurate data efficiently; – recognising potential misuse of collected data. <p>Searching and selecting</p> <ul style="list-style-type: none"> • As part of a study, analyse high-volume quantitative and qualitative data systematically by: <ul style="list-style-type: none"> – exploring the data to form and test hypotheses; – identifying correlations between variables; – drawing valid conclusions and making predictions; – reviewing the process of analysis and the plausibility of the predictions or conclusions. <p>Organising and investigating</p> <ul style="list-style-type: none"> • Construct, test and document the development of a database system which shows: <ul style="list-style-type: none"> – a design specification; – appropriate means of data input and validation; – systematic testing of processes and reports; – evaluation of the system's performance and suggested modifications. 	<p>Analysing and automating processes</p> <ul style="list-style-type: none"> • Automate ICT processes (e.g. use software to merge mail, create macros in an application program). • Represent a system in a diagram, identifying all its parts, including inputs, outputs and the processes used (e.g. to validate data). <p>Models and modelling</p> <ul style="list-style-type: none"> • Design and create ICT-based models, testing and refining rules or procedures. • Test hypotheses and predictions using models, comparing their behaviour with information from other sources. <p>Control and monitoring</p> <ul style="list-style-type: none"> • Use ICT to build and test an efficient system to monitor and control events, including: <ul style="list-style-type: none"> – testing all elements of the system using appropriate test data; – evaluating the system's performance; – annotating work to highlight processes and justify decisions. • Review and modify own or others' monitoring and control systems to improve efficiency (e.g. use more efficient procedures, reduce the number of instructions or procedures, add an element of feedback). 	<p>Fitness for purpose</p> <ul style="list-style-type: none"> • Produce high quality ICT-based presentations by: <ul style="list-style-type: none"> – creating clear presentations, sensitive to audience needs; – justifying the choice of form, style and content. • Use knowledge of publications and media forms to devise criteria to assess the quality and impact of multimedia communications and presentations, and apply the criteria to develop and refine own work. <p>Refining and presenting information</p> <ul style="list-style-type: none"> • Use a wide range of ICT independently and efficiently to combine, refine, interpret and present information by: <ul style="list-style-type: none"> – structuring, refining and synthesising information from a range of sources; – selecting and using software effectively, justifying the choices made. <p>Communicating</p> <ul style="list-style-type: none"> • Apply knowledge of the technical issues involved to communicate information efficiently (e.g. choose suitable file types to speed up transfer, use mail lists to speed up communication, use website tagging and hyperlinks to speed up searching). • Understand the advantages, dangers and moral issues in using ICT to manipulate and present information to large unknown audiences (e.g. issues of ownership, quality control, exclusion, impact on particular communities).

NOTE: Objectives highlighted in colour are related to reviewing, modifying and evaluating work as it progresses.

4

Planning

Reviewing your scheme of work

The National Curriculum programme of study can be regarded as a long-term plan, a scheme of work as a medium-term plan, and day-to-day lesson notes as short-term plans.

You should make a professional judgement about how you will review or customise your own scheme of work for ICT, once you have studied this Framework and the QCA scheme of work, reflected on the Key Stage 3 Strategy training, and evaluated your current practice. Any review should involve all staff, including technicians and assistants attached to the ICT department.

The time involved in planning is a worthwhile investment that ultimately reduces the demands of paperwork. Plans can be well constructed and informative without being written in full prose, though they need to be accessible to others. Their main purpose is to specify coverage and ensure good progression.

A scheme of work for ICT

A scheme of work illustrates how the programme of study can be:

- arranged into coherent teaching units;
- distributed across the years of the key stage in a sequence that provides continuity and progression in pupils' learning.

An effective scheme of work for ICT will:

- group topics in units of work throughout each term and over the year, sequencing the units so that they build on preceding work;
- reflect the progression in the teaching of ICT capability in and across years, as outlined in the yearly teaching objectives;
- describe the objectives that different groups of pupils might be expected to achieve in particular units;
- suggest activities and tasks to help pupils to achieve the objectives;
- identify how pupils will show that they have learned what was intended;
- refer to the contexts in which ICT is developed and used, and the impact at a personal, local and global level;
- incorporate literacy, numeracy and other key skills in ICT lessons;
- suggest the number of hours of teaching for each unit, including time for reviewing pupils' progress at the end of a unit;
- show how out-of-school activities can enhance learning in school.

Objectives for a unit will usually be drawn from the objectives for the year group and from one or more of the ICT themes. If appropriate for the pupils, objectives can be drawn from those listed for older or younger age groups.

The QCA scheme of work is an example of a medium-term plan. It is published on the DfES Standards website: www.standards.dfes.gov.uk.

Short-term or lesson plans

Short-term plans are lesson plans or teaching notes for a block of lessons showing how a particular unit will unfold to achieve its intended objectives.

The main requirement of lesson plans is that they make clear how the objectives for the relevant unit will be taught and met. Aim for no more than two or three objectives in each lesson so that both you and your pupils can remember them. Lessons may have subsidiary objectives that do not need to be written down; the two or three that you list are the crucial ones.

Lesson plans should:

- indicate the teaching objectives for the block of lessons or individual lessons;
- stress the relevant key vocabulary;
- outline starter activities;
- show how work will develop in the main part of the lessons through teaching input, pupil activities and mid-lesson plenaries, with suggestions for differentiation where needed;
- identify key questions and teaching points;
- indicate how lessons will be rounded off in a concluding plenary;
- suggest what homework will be set;
- refer to relevant resources, such as textbooks and ICT applications, and, where relevant, indicate how they will be managed;
- indicate how any other staff, such as an ICT technician or a special needs assistant, will be deployed.

There is always the possibility in ICT lessons that, in spite of good preparation, something does not work properly. The best medium-term plans allow some flexibility so that any unfinished work can be completed at appropriate times.

Sample teaching units

Sample teaching units for ICT (see appendix 3, page 71, for details) show how a sequence of lessons based on the yearly objectives might be planned. Each unit focuses on a theme, such as using ICT as a modelling tool or creating high-quality ICT presentations. The lessons present pupils with tasks that are developed over the course of the unit. For example, an introductory lesson might be based on planning the solution to a problem, while a second lesson focuses on teaching and learning the new technical skills needed to reach a solution.

The sample lesson that follows is in the middle of a sequence of lessons for Year 7. Teachers' personal lesson plans would be much briefer and would probably refer to particular pupils or resources by name. It is not expected that all teachers produce lesson notes like this one, but a bank of lessons with this degree of detail, and accompanied by prepared teaching and learning resources, can be useful for supply teachers, newly qualified teachers and non-specialists.

ICT Framework objectives

- Identify what information is relevant to a task.
- Use ICT to draft and refine a presentation, including:
 - capturing still and moving images and sound;
 - reorganising, developing and combining information, including text, images and sound, using the simple editing functions of common applications.

Vocabulary

From Year 6: clip art, digital camera, graphic(s), image, photograph, scanner

From Year 7: acknowledgement, bitmapped graphic, copyright, crop, intended audience, multimedia presentation, vector graphic

Resources

Presentation package; graphics software; clip art; digital camera

Presentation A: a prepared short presentation on any topic but enhanced using graphics

Presentation B: a prepared demonstration with a series of slides each showing two different images of same thing (e.g. cartoon and photograph, sign or symbol and map, line drawing and logo, bar chart and table of the same set of data)

Starter

10 minutes

Introduce the objectives in simple language. Show presentation A. Ask the class to discuss in pairs what differences the use of images can make to a presentation. Invite feedback. Draw out positives such as adding interest, capturing attention, adding clarity, enhancing meaning, reducing the need for words, and negatives like adding length or distracting the viewer.

Main activity

40 minutes

The use of images in presentations

10 minutes

Show presentation B, slide by slide. Invite the whole class to say which image of each pair is more suitable for a given purpose. For example, which would be more suitable for a serious article, the cartoon or photograph? Would the bar chart or table be more suitable for an information leaflet for a doctor's surgery? Include options for a cookery book, travel brochure, advertisement, glossy magazine.

Discuss the variety of ways that images can be captured (by digital camera, scanner, CD-ROM, downloaded from the Internet). Remind pupils about copyright issues and the need to acknowledge sources of information.

Selecting and adding appropriate images to their work

30 minutes

Explain that pupils are to select images to use in their own presentations about themselves. They should consider which images best convey the impression of themselves they wish to give and what would be of most interest and value to the audience of their peers.

Demonstrate how to use the digital camera to take photographs of themselves. Show how being closer to the subject, or zooming in, can enhance the image.

Remind pupils how to access the files of clip art available, and how a clip art image can be added to their presentations. Pupils should now work in pairs adding clip art images to their presentations. Stress that in choosing an image better justification is needed than just liking it.

With more able pupils, distinguish between vector and bitmapped images. Vector images can be scaled and manipulated to any size, while a bitmapped image loses definition when its size on the page or screen is adjusted. Encourage these pupils to manipulate vector graphics they have chosen using simple drawing tools.

During this time organise a rota for some pairs of pupils to photograph each other using the digital camera. Once completed, demonstrate to the whole class how to add a photograph to a presentation. Show some simple manipulations, such as how to crop a photograph.

While pupils add their photographs to their presentations, circulate and ask:

- Why have you placed an image there?
- Why have you used this type of image? Would a photograph have been better?
- How does this image enhance or improve your presentation?
- Does this image reflect your view of yourself and what you wanted to convey? If not, why not?
- In what ways do you think this image will interest or inform your audience?
- Would you use the same or a different image if the audience were, say, your grandparents rather than your class-mates?

Plenary

10 minutes

Ask pupils in pairs to tell their partners briefly why they have chosen particular images, including photographs, for their presentations. Ask one or two pupils to share their discussion with the class, showing a couple of their presentation slides as a demonstration. Make sure that the discussion focuses on the fitness for purpose of the chosen image. Ask and encourage the class to ask questions similar to those in the main activity.

Sum up by stressing:

- images for a presentation should be chosen to fit the purpose of the presentation, and to interest and inform the audience;
- images are available in clip art files but can also be captured by digital camera or scanning, by downloading from the Internet or from CD-ROM;
- some changes to images can be made using the editing facilities of the presentation software but better results may require specialist graphics software;
- some images may be subject to copyright laws.

Homework

Pupils should list in their homework books six different images they could add to their presentation to enhance it. For each image, they should say why they have chosen the image and where they think they could obtain it.

5

Teaching and learning

The organisation of teaching

All schools need to provide for their Key Stage 3 pupils:

- sufficient regular teaching time for the teaching of ICT skills, knowledge and understanding and for direct access by pupils to ICT hardware and software;
- significant opportunities for pupils to use and apply their ICT capability across the curriculum as part of the teaching of other subjects;
- extra support for pupils who are less experienced or less able to help them to keep in step with the majority of their year group.

Interesting, non-trivial contexts for applying ICT often arise in other subjects. But any single application rarely requires a study in depth of all the relevant aspects of the ICT programme of study. For example, to obtain satisfactory scientific insights through applying ICT in a science lesson, the level of pupils' ICT capability may not need to be high.

To ensure rigour and progression in the Framework objectives, schools need to provide some time for specific ICT teaching by teachers trained to teach ICT.

Dedicated time allows:

- teachers to teach the objectives in sufficient breadth and depth, structuring them in a way that ensures good progression across the key stage;
- teachers to use contexts from or work started in other subjects to help pupils to appreciate the relevance of their ICT work;
- pupils to learn some transferable skills, knowledge and understanding in readiness for application in other subjects.

The use of ICT in other subjects can provide fruitful contexts for learning with, and about, ICT. These can enhance pupils' awareness of the application of ICT and give valuable practice in the use of some of the facilities. But it can be hard to address all the important aspects of a particular application (for example, good practice in sharing information through desktop publishing) when the focus of study is another subject in the curriculum with its own teaching objectives and assessment agenda.

Teaching time

In Key Stage 3, about one hour a week is typically given to ICT, approximately 4% of the teaching week. This needs to be supplemented by significant opportunities for pupils to apply and develop their ICT capability in all other subjects.

Duration of lessons can vary from school to school. Lessons one hour long provide sufficient time for effective teaching and for pupils to maintain and increase their knowledge, understanding and skills. Longer lessons can be useful for extended ICT work in an ICT room but, for lessons without practical work, 70 minutes can be too long for pupils to maintain concentration if the teaching is intensive and direct. On the other hand, a single 40- or 45-minute period offers too little time for key ideas to be developed and consolidated in the main part of the lesson.

Effective teaching and learning

The Key Stage 3 Strategy promotes these features of good teaching:

- **high expectations** and **clear objectives** conveyed to pupils in simple language: ‘What I am looking for is pupils who can ...’;
- **structured lessons**, often with an engaging starter, with new skills and ideas introduced in well-planned stages, and always with a summary at the end;
- **challenging and engaging tasks** to interest all pupils, coupled with appropriate interventions by teachers, including:
 - practical work to develop the technical skills of ICT capability;
 - oral work to develop pupils’ knowledge and understanding;
 - activities to plan, evaluate or document work;
 - problems to encourage pupils to think for themselves, including opportunities to carry out extended ICT development work;
 - research into the uses of ICT inside and outside school, so that pupils learn how practical applications of ICT are changing society and the economy;
- **manageable differentiation** based on work common to all pupils in a class, with targeted support to help those with less experience or ability, and real challenge for the more able;
- **interactive teaching** of whole classes, small groups and individuals, using a combination of exposition, demonstration, modelling, instruction and dialogue;
- **effective questioning**, giving pupils time to think, air views and hear others’ views, with an expectation that they explain and justify decisions and reasoning;
- **time for pupils to reflect** on their learning and progress, and to evaluate their own and other pupils’ work.

The Strategy also promotes pupils’ learning through helping them to:

- **acquire and use new learning and study skills**, building on those that they have acquired in Key Stage 2;
- **learn independently**;
- **integrate new learning** with prior learning;
- **solve problems** on their own and in groups;
- **reflect on their successes and failures**, and accept that learning can involve uncertainty and difficulties that can be overcome through perseverance.

The focus on interactive teaching and active learning

It is vital that pupils engage actively with their learning. This is the basis of developing ICT capability. Without it, learning is superficial and soon lost.

Aim to spend a proportion of each lesson in leading interactive activities that involve all pupils in an active way. Organising pupils as a ‘whole class’ helps to maximise their contact with you so that every pupil benefits from direct teaching for sustained periods in each phase of the lesson. But direct teaching, intervention and

interaction are as crucial during individual, paired and group work as they are in whole-class sessions, whether they be practical work or other activities.

High quality interactive teaching is oral, collaborative and lively. It is not achieved by lecturing the class, or by expecting pupils to teach themselves indirectly during practical work or from books. It is a two-way process in which pupils are expected to play an active part by answering questions, working together collaboratively at appropriate times, contributing points to discussions, and explaining and demonstrating their methods, conclusions and solutions to others in the class.

You can achieve good interactive teaching and active learning by balancing different approaches:

- **Directing and telling:** sharing your teaching objectives with the class, ensuring that pupils know what to do, and drawing attention to points over which they should take particular care, such as keeping in mind the needs of an audience for a presentation, acknowledging websites that they use, choosing appropriate data types when setting up fields, matching images to text appropriately, saving their work at regular intervals ...
- **Demonstrating:** giving clear, well-structured demonstrations using appropriate resources and visual displays: for example, showing a certain technique or method for a practical activity based on a particular application, such as how to import data from a website, create a computer-generated graph, scale up and crop an image or rearrange a sound file using cut and paste ...
- **Explaining and illustrating:** giving accurate, well-paced explanations, and referring to previous work or methods: for example, giving the meaning of a technical term; using models and analogies to assist understanding; explaining how collected evidence leads to an acceptable conclusion; illustrating how poor information leads to unreliable results; showing how a presentation takes account of the intended audience; explaining the purpose of different file types ...
- **Questioning and discussing:** questioning in ways which match the direction and pace of the lesson to ensure that all pupils take part; using open and closed questions, skilfully framed, adjusted and targeted to make sure that equal numbers of girls and boys, and pupils of all abilities, are involved and contribute to discussions; asking for explanations; giving time for pupils to think before inviting an answer and deciding when it is apt to have a 'no hands up' approach; listening carefully to pupils' responses and responding constructively to take forward their learning; challenging their assumptions and making them think ...
- **Exploring and investigating:** asking pupils to pose problems, suggest a line of enquiry to investigate for themselves, or identify anomalous results; equipping pupils with the skills required to plan and carry out tasks, including opportunities to extend the range of hardware and software they can use successfully in their work ...
- **Consolidating and embedding:** providing varied opportunities to practise and develop newly learned skills, through a variety of activities in class and well-focused homework; asking pupils either with a partner or as a group to reflect on and talk through a process; inviting them to expand their ideas and reasoning, or to compare and then refine their methods and ways of recording

their work; encouraging them to use and apply their ICT capability to solve problems or complete tasks in work across the curriculum ...

- **Reflecting and evaluating:** discussing pupils' justifications of the methods or resources they have chosen; evaluating presentations of their work to the class; giving them oral feedback on their documentation; identifying pupils' errors, using them as positive teaching points by talking about them and any misconceptions that led to them ...
- **Summarising and reminding:** reviewing during and towards the end of a lesson the ICT that has been taught and what pupils have learned; identifying and correcting misunderstandings; inviting pupils to present their work and picking out key points and ideas; making links to other work in ICT and other subjects; giving pupils an insight into the next stage of their learning ...

Structured lessons

A typical ICT lesson can vary depending on the type of work you want pupils to do but will usually involve a mix of practical ICT work and work away from computers.

A typical 50- to 60-minute lesson is likely to include a starter activity, the main part of the lesson and a concluding plenary.

Starter activity (about 5 to 10 minutes)

Each new lesson can begin with setting the scene and a short activity to help pupils to tune in, interest them and engage their attention.

Setting the scene involves clarifying the objectives in simple language and explaining the purpose of the lesson. You might want to look back, discuss homework and, when the main activity spans more than one lesson, consider how a lesson develops from the previous one. You might outline the sequence of the lesson so that pupils know what to expect, say why a certain activity is to be done, and indicate where the lesson fits in with others. All this helps pupils to understand why they are learning these new ideas and to make connections.

A short, stimulating starter activity, either before or after the scene setting, helps to get the lesson off to a brisk start and prepare pupils for the main activity. It can also allow for pupils arriving late to join the lesson before the main part is under way. For example:

- present a short problem, such as improving a poor presentation, completing a questionnaire, creating a flow chart to show the steps to take and decisions to be made in carrying out a simple task;
- carry out short data handling activities, displaying a graph, chart or table and asking questions such as: 'What event or "story" could the graph illustrate?', 'What questions could this chart help to answer?', 'What do the data in the table show you?', 'What conclusion would you write if this graph represented your results?';
- try a 'What if...?' question to find out what pupils think and elicit their ideas;
- focus on key words through a card game;
- present and discuss some 'facts' about ICT appearing in the press.

The main part (about 25 to 40 minutes)

Building on the starter, the main part of the lesson is characterised by high levels of direct, interactive teaching and probing questioning, regardless of whether pupils are working as a whole class, in groups or individually, or whether the lesson consists of practical work, an extended investigation or written work.

The main part of the lesson will depend on the objectives but might include:

- whole-class discussion led by the teacher, or discussion by pupils in small groups, so that they can air views, suggest ideas and hear the ideas of others;
- software demonstrations or video illustrations;
- teaching specific new skills or knowledge;
- practising particular technical skills or techniques;
- collecting and analysing information for use in a task;
- planning, reviewing and deciding how to improve work;
- developing or modifying work in progress ...

Organise the class so that you can interact with as many pupils as possible. Match the particular activities that pupils will do to their previous attainment and your objectives for the lesson. You may want to allow some choice here.

Effective ICT lessons might have several cycles of main activity and plenary; mini-plenaries during the main part of a lesson allow errors or misconceptions to be identified and dealt with quickly. Throughout the main activity, encourage pupils to make predictions before any demonstrations, especially those that give unexpected outcomes. Look for gains in understanding, misconceptions, inappropriate use of ICT... Use opportunities for both you and the pupils to report back, clarify, model and review.

Concluding plenary (about 5 to 10 minutes)

Short plenaries may take place during the main activity, while the concluding plenary rounds off the lesson. It is far more than 'logging off' after a practical session and should be just as dynamic as the starter. Help the pupils to reflect on the lesson, say what was important about it and consider the progress they have made. Draw out from them and highlight the key learning points, such as facts, ideas and vocabulary. Get them to think about how they might apply the new ideas, by showing how the ideas can be used and where they fit in.

The final plenary can also look forward to the next stage of learning. It should make pupils think and anticipate what the next steps might be. The homework you set should help pupils to consolidate or apply what they have learned, or prepare for the next lesson.

Effective ICT lessons and flexibility

Secondary schools work to different time constraints so the structure and timing of ICT lessons will differ. The outline structure of a three-part lesson described above is recommended since it can be adapted to different circumstances. It provides a beginning, a middle and an end in which you prepare pupils for what they are to

learn, teach it to them, then help them to recognise what they have achieved. It allows a variety of patterns of teaching methodology and organisation, depending on a lesson's objectives and its position in a series of lessons.

The outline structure is not a mechanistic recipe to be followed. Use your professional judgement to determine the activities, timing and organisation of the beginning, middle and end of the lesson to suit its objectives.

In the main part of the lesson there is scope for considerable variety and creativity, with a different interplay of work with the whole class, groups, pairs and individuals in different lessons, although each lesson should include direct teaching and interaction with the pupils, and activities or exercises for pupils to do. For example, at the start of a new unit of work you might need more time for demonstration, explanation and discussion with the whole class, interspersed with very short exercises for pupils; the plenary may be very short. On the other hand, when you have identified general errors or misunderstandings in the main part of a lesson, you may need several mini-plenaries during the lesson to sort them out, as well as a final summing-up. Later in a unit of work, pupils might start the main part of a lesson by continuing to work in pairs on a previous problem. Once they have refocused on it, you might hold a mini-plenary with the whole class to share ideas, highlight important results and structure work from there on. At the end of a unit of work, it can be helpful to use the plenary to review a number of lessons to draw together what has been learned and to identify key points and methods that you want pupils to remember and use in the future. For this kind of plenary, you may need a much longer time than usual.

Classroom management in an ICT suite

The design and arrangement of furniture and equipment in an ICT suite make whole-class and group teaching more complex without careful management. Room layout can vary considerably. Sometimes pupils need to move their chairs away from computer screens or to turn their monitors off if they are to concentrate on the main display in the classroom and engage with whole-class work. They should learn that not all ICT lessons involve working with computers and that many will include a mix of activities, some at keyboards and some away from them. If the ICT suite does not have space and suitable furniture for collaborative work, consider grouping pupils round one machine. An alternative is to move to a classroom with a single computer and display and use it for demonstration and modelling, with interaction from groups of pupils.

There will be times when you want to group pupils for particular purposes (for example, for differentiated activities) to allow experienced computer users to assist the less experienced, to create single-sex groups or to separate unruly pupils. Pupils should not always expect to sit at the same machine but to work in a different part of the room and on a different computer as appropriate. You will need to make sure that the network allows for this.

Wherever possible, arrange equipment and furniture so that pupils have space for their notes, writing frames, drafted work that needs editing, software prompts, and so on. The impact of good teaching can be diminished by pupils not having sufficient space around the computer to place their reference notes.

6

Using ICT across the curriculum

Effective use of ICT in other subjects often builds on discrete ICT lessons by providing fresh contexts for applying newly learned skills and understanding. This example of a lesson with a higher attaining English set is described in *ICT in schools*, published by Ofsted in April 2002.

Example

The pupils were working on a genre study of horror fiction. In the previous lesson they had begun to write text and sketch design ideas for a horror fiction website home page. They had started learning about web-page design in their ICT lessons and in the previous English unit. They were now working in the ICT suite, designing their home page with hypertext links to other pages. They referred to a worksheet, which contained clear instructions for setting up hypertext links. The teacher stressed primacy of purpose and audience rather than design for its own sake. Pupils worked quickly and effectively in pairs, constructing their home pages and incorporating images and text from the Internet as required. Motivation was very high and the task forced pupils to summarise in a very accessible form what they had learned about the horror genre, which they did very well.

There is a statutory requirement to use ICT to support pupils' learning in every Key Stage 3 subject. The main purpose of using ICT in a lesson in another subject may be to develop pupils' skills and understanding in that subject. If so, the ICT objectives may be at a relatively low level (although they may provide some useful practice). On the other hand, the main purpose of the use of ICT in another subject may be to enhance pupils' ICT capability in a different context. In this case, the subsidiary objectives for the other subject must be challenging enough to meet pupils' needs in that subject without distracting from the ICT objectives.

ICT resources are not a panacea for all eventualities. In some situations they will be the best way to convey or consolidate a new concept, but not always. ICT needs to be planned carefully into departmental schemes of work so that pupils make good progress. Teachers can check whether the use of ICT is appropriate by asking whether it will:

- allow pupils to investigate or be creative in ways not possible otherwise;
- give them access to information not otherwise readily available;
- engage them in the selection and interpretation of information;
- help them to think through and understand important ideas;
- enable them to see patterns or behaviours more clearly;
- add reliability or accuracy to measurements;
- enhance the quality of their presentations;
- save time, for example, spent on measuring, recording or writing.

Across the curriculum, ICT can be used to **enhance individual learning**: for example, individuals or pairs of pupils can use a simulation to model changes under different conditions. Pupils need clear directions before they start, otherwise

teachers might spend too much time trouble-shooting. Structured tasks and activities should allow pupils to focus on the ideas underpinning the model, not the ICT skills needed to manage the software.

ICT can also be used to **enhance the learning of a whole class**, if a large screen or data projector is available so that the whole class can see. For example, a science teacher working with a whole class could use:

- an oxygen probe to measure the levels of oxygen in various samples of pond water to help explain why different habitats support different plants and animals;
- a datalogger to collect and analyse changes of pH during neutralisation reactions, or changes of mass when an acid reacts with carbonate salts;
- a microscope connected to a computer monitor to display close observations;
- a spreadsheet to complete calculations and plot graphs, and to show how changing the data alters the graphs;
- a simulation to explore toxic materials in food chains, or investigate circuits;
- a video or CD-ROM to observe a dangerous chemical reaction;
- an Internet link to find up-to-date information, for example, on environmental issues.

Various ICT applications support the teaching and learning of Key Stage 3 subjects.

- **Information resources** allow pupils to find information to develop their knowledge and understanding of the subject. For example, CD-ROMs, data files and access to the Internet can supplement textbooks by providing extensive sources of information and illustration; selected pages on websites can be downloaded for further study offline. Video snippets allow pupils to see things that cannot be brought into school.
- **Publishing and presentation software**, such as wordprocessors, desktop-publishing packages and web-page creation software, allow pupils to present their findings to others. Slide presentations used for this purpose can increase pupils' motivation and enthusiasm. Time can sometimes be saved by dividing tasks among groups and getting the group as a whole to report back.
- **Creative software tools** encourage the use of imagination and creativity, for example, in music composition, in graphic design or textiles, and in computer-aided design (CAD).
- **Simulations and modelling** help pupils to understand ideas that they could not otherwise experience in school, or that may be too slow, too fast, too dangerous or too expensive. Simulations allow pupils to investigate the effects of changing variables and to consolidate and reinforce their conceptual understanding of the ideas that underpin the model, for example, of coastal erosion in geography, of battle strategy in history, of molecular structure in science, of geometric relationships in mathematics.
- **Programming and control applications** help pupils to understand how many functions are controlled by ICT and how this ability to control has changed the way that people work. For example, in design and technology, ICT can be used to control manufacturing processes; in mathematics, programming languages

such as Logo or Basic, and the programming capabilities of graphical calculators, can be used to explore numerical, algebraic and geometrical relationships more quickly and exhaustively than can be done manually.

- **Datalogging** helps pupils to record, present and analyse results. For example, sensors can be used to detect physical data and experimental results can be displayed as a graph on an interactive whiteboard. Through datalogging, pupils can capture data involving very fast or very slow changes. Electronic measuring equipment removes the tedium of manual measuring and recording and frees up time for discussion of the underlying concepts.
- **Databases, spreadsheets, graph plotters and graphical calculators** allow pupils to organise, search, sort and display information, explore relationships, look for patterns and test hypotheses.
- **Programs that support pupils' learning in a specific context**, for example, word or number games, or ILS (integrated learning systems), can provide and manage practice in particular techniques tailored to individual pupils' needs.

The key to success in all these applications is the quality of the whole-class discussion that accompanies the use of ICT. Teachers should encourage their classes to:

- ask questions, predict and hypothesise;
- find, organise and use information that is fit-for-purpose;
- work and think creatively and analytically;
- seek patterns and relationships;
- interpret results and evaluate evidence;
- present and communicate their findings in a variety of ways;
- review their work with ICT critically with a view to improving it.

The Year 7 history lessons described below are from Ofsted's *ICT in schools*. They show how successful teaching involves interventions to ensure that lesson objectives are met and pupils are not distracted by the technology.

Example

In two parallel history lessons, pupils used presentational software. One lesson was far more productive because the teacher intervened to deepen the pupils' thinking by sharing historical ideas and persuading them to go back to sources to probe a hypothesis more closely. In the other lesson, time was lost by searching for clip art and experimenting with fonts. There was less depth of explanation, and the teacher drew on pupils' existing knowledge rather than using new sources of evidence. Some pupils copied from exercise books. The lack of intervention allowed the lesson to drift and far less was achieved.

Assessment and target setting

Effective assessment

It is important to assess regularly what pupils know, understand and can do, not merely record what they have been taught. The Key Stage 3 Strategy promotes these features of assessment:

- pupils understand and take part in the assessment of their work and progress;
- teachers and pupils jointly assess pupils' strengths and difficulties in their learning, where they have reached, what they need to aim for next and how to take the next steps;
- assessments include informal observations, oral questioning and occasional tests or special activities designed to judge progress;
- teachers make use of the assessments and information passed on by previous teachers, particularly when pupils transfer from another school, so that work is planned to build on what pupils have already achieved;
- recording systems give teachers the information that they need to plan and report successfully, but are not too time-consuming to maintain.

Assessment, recording and reporting are important elements of teaching but they have to be manageable if the information they yield is to be useful. The best assessment has an immediate impact on both teaching and learning:

- it alerts you to the needs of pupils who are either out of step or exceeding expectations;
- it helps you to maintain the pace of learning for all pupils by informing teaching plans, in a continuous cycle of planning, teaching and assessment;
- the immediate feedback you give to pupils, and the self-assessments that they make, are crucial in helping them to see how to improve their work.

It is useful to consider assessment at three connected levels: short-term, medium-term and long-term.

Short-term assessments

Short-term assessments are focused on short-term learning objectives and are an informal part of every lesson. Their purposes are to:

- check that pupils can use a particular skill or technique and explain their work using ICT technical terms;
- check that pupils have grasped the main teaching points in a particular lesson or unit of work, whether they have any misunderstandings or misconceptions that you need to put right, and whether they are ready to move on;
- ensure that pupils understand the objectives of the teaching and take part in the assessment of their progress;
- provide information which will help you to give pupils feedback, adjust day-to-day lesson plans, and brief any support staff about which pupils to assist.

Short-term assessments help you to judge the degree to which your short-term teaching objectives have been met. There are several ways to make them:

- **During every lesson** you absorb and react to pupils' responses, see whether they are confident with new work, decide whether they need extension work or more help, and offer immediate support. Where you notice difficulties, misunderstandings or misconceptions, you can adjust your lesson and address them straight away, if necessary continuing in the next lesson or two. In this way, pupils can keep up with the pace of work and do not fall behind.

Where pupils customarily work in pairs because resources only allow one computer to two pupils, it is especially important to make sure that you are able to judge the developing knowledge, skills and understanding of every pupil. Occasionally you may need to contrive opportunities so that this can happen.

In plenaries throughout and at the end of lessons, you can involve pupils in assessing their own and others' ICT work, acknowledge class and individual achievement and effort, and remind pupils about their targets. Plenaries are also a good time to firm up short-term assessments by asking probing questions to judge how well individual pupils have understood new work and to check again for any misunderstanding or misconceptions.

- **At intervals** you can supplement your day-to-day observations. For example, a homework task or an occasional short informal test can give you useful information on who has learned what and who needs extra support.
- **Marking of pupils' classwork and homework** helps you and them to judge their progress. By doing it together with pupils, or following it immediately by discussion with the whole class and individuals, you can give them feedback on their performance and what they need to do to improve. Constructive written comments or questions are often more helpful than grades and ticks and crosses. At the same time you will probably want to ask pupils to correct any errors and to discuss with them the merits of their different methods or approaches. Self-evaluation, marking, feedback and corrections are best done immediately after a piece of work so that pupils can still remember how they approached the task and so that you can modify your teaching plans if you need to. Some teachers focus their marking and feedback on particular groups in a particular week, using detailed marking to inform their discussion with that group. Marking of the work of other groups is less detailed in that week but is sufficient to help pupils to keep on track with their work.
- **Informal discussion with teachers of other subjects** helps you and them to judge pupils' progress and ability to apply their ICT knowledge, skills and understanding in different contexts.

Short-term assessments do not need to be recorded, since they are for immediate action and attention. Some teachers note briefly when a pupil surprises them, perhaps with his or her knowledge or degree of success with something difficult. Informal, personal recordings can help to clarify patterns in performance over time or responses to specific teaching or support. Any recording needs to be manageable and determined by individual teachers; some like to make detailed notes while others prefer brief annotations in mark books or planners.

Medium-term assessments

Medium-term assessments should gather new information, not just confirm what you already know. They are mainly to:

- review pupils' progress over a particular unit of work or the previous half-term in relation to the yearly teaching objectives, that is:
 - what they know and can do;
 - whether they can apply their knowledge, understanding and skills in a new context;
 - whether they still have any difficulties;
- identify pupils' progress against specific individual targets so you can give pupils feedback and formulate new targets;
- help you to plan work over the next half-term or so;
- give you information to feed into end-of-term or end-of-year assessments.

Most pupils should be living up to expectations for their class and you will be familiar with their progress and learning from your short-term assessments. Assessment of pupils' progress in the medium term (e.g. at the end of a unit of work) should be made against the relevant yearly teaching objectives for the unit of work, not against the level descriptions. These assessments will help to set their future targets and will influence your medium-term planning.

Medium-term assessment tasks can be chosen so that pupils tackle them independently, leaving you to concentrate on the pupils you are unsure about. They need not be elaborate if the units of work have gone well. The purpose may be just a matter of identifying which pupils need extra feedback or consolidation, and setting new targets for the whole group or particular groups and individuals. The key principle is to mobilise medium-term assessments quickly into the setting of relevant and realistic targets.

When you judge pupils' attainment and progress by assessing an ICT-based process or product, you need to look at successive versions of the work. Involve pupils in making self-assessments and encourage them to seek evaluations from their peers or adults. Ask pupils to explain the choices they have made by annotating their work – including any choice not to use ICT for particular tasks – and to identify any improvements that might be appropriate and feasible. Their responses help to give insights into their ability to review their work. Looking at subsequent versions and pupils' annotations of their work can reveal whether they have learned from and used the feedback they were given.

As pupils progress, an increasingly important feature of their ICT attainment is the fitness for purpose of their ICT communications, models and systems, and the extent to which these take account of the context, intended users or audience and desired outcomes. When you are assessing you will need to give increasing weight to evaluations by the users. You should also consider what teachers of other subjects regard as good practice, for example, in art and design, in the use of language, sound and images, or in the use of graphs, charts and tables.

Assessing ICT-based work in other subjects

Activities with outcomes that are worth assessing can occur in ICT lessons or in other subjects. In the latter case, the work will need to be assessed from different perspectives. The example below illustrates how an application of ICT in pupils' study of science was assessed against different criteria for ICT and science.

Example

As part of a Key Stage 3 science investigation, pupils created individual presentations on the dangers of smoking. The ICT teacher had already introduced the pupils to the presentation package during a science lesson that was 'ring-fenced' for teaching ICT capability. Pupils had seen videos on the effects of smoking habits and listened to speakers who described the consequences of smoking by family members. They had obtained ideas and images from websites associated with the tobacco industry and with various health organisations.

Pupils knew what was to be assessed, both in ICT and in science. Each pupil prepared an oral presentation and question-and-answer session to accompany their ICT presentation. This was observed by two teachers. The science teacher looked out for:

- the pupil's understanding of the scientific principles involved in the study;
- mature reflection about the principles and the ability to explain them and respond to questions about them.

The ICT teacher focused on:

- how well pupils had used the ICT facilities to interest their audience of peers, and the appropriateness of the choices made about the items to be included in the computer-based presentation and its style;
- the range of data, images and effects used;
- the appropriateness of the oral commentary and other audio-visual aids, such as a newspaper article to support the computer presentation.

Both teachers agreed that the technical complexity of the ICT presentation by itself did not show high achievement in either subject. But several pupils who had made links to online information, tested the material on friends in a parallel class or evidently engaged their peer audience gained higher credits for their ICT capability than for the scientific accuracy and insights they provided at the time. Conversely, some pupils who had used basic ICT facilities and approaches, and who did not impress their audience, but who displayed good scientific knowledge and reasoning, showed higher achievement in science than in ICT.

When pupils' practical work is assessed from different viewpoints, it is understandable if there are differences between levels awarded for ICT and for the other subject. In the above example, a well-executed, persuasive ICT presentation but with little science in it would yield two very different assessments.

Recording pupils' progress

It is helpful if pupils' progress towards yearly teaching objectives is recorded but, of course, this is not a statutory requirement. Since there are relatively few yearly objectives, records are not too onerous to maintain, and updating them every half-term is sufficient. The easiest system is a class record of progress against the relevant objectives. Teachers need only note:

- any pupils who have struggled to meet the objectives and who will need extra support when the class revisits the objectives;
- any pupils who coped quickly with the work, were taken further and who will need to be given more challenging work when they revisit the objectives.

This record should be used to inform planning by current and future teachers, so should be passed on to subsequent teachers. A class record of this kind can be a useful aide-mémoire for parents' evenings or when you are writing annual reports.

Targets for individual pupils

A discussion with pupils during the course of each half-term to formulate and involve them in setting their personal targets helps them to achieve the yearly objectives over the medium term. You may want to arrange your discussion with some pupils on an individual basis – for example, pupils with special needs or pupils who would benefit from a degree of privacy – but for most of them you can organise the discussion in small groups as part of an ordinary ICT lesson. Ask pupils to suggest two or three improvements to work on over the next term. You could also offer pupils some practical advice on the steps they might take to achieve their targets, and give them an occasional opportunity to work on the targets as part of one or more homework tasks. It is helpful if some monitoring of progress towards individual pupils' ICT targets can take place in tutor-group time as part of a whole-school approach to target setting.

Individual targets will usually be linked to your teaching objectives for the next few weeks, or to extracts from level descriptions, formulated in words that pupils understand. A target may be very specific: for example, 'to find information using simple search methods'. For some pupils a target may need to be broken down into stages: for example, 'to find information using a contents list'. For others, it may be appropriate to choose a target linked to the yearly teaching objectives for the year group below or above. Whatever the targets, they need to be straightforward and not too many at one time, so that pupils understand them. One way of keeping track of pupils' individual targets is to highlight a class record of objectives. Exceptionally, there may be some pupils with special needs whose personal targets need to be recorded in supplementary notes.

Long-term assessments

Long-term assessments are summative. They are made against the level descriptions on a 'best-fit' basis at the end of a key stage and, if schools wish, annually. Their purposes are to:

- assess individual pupils' work against the level descriptions;

- help to review pupils' overall progress and attainment against school, local and national targets for Key Stage 3;
- give supplementary information about individual pupils' attainment and progress for reporting to parents and, if appropriate, the next teacher.

Long-term assessments include end-of-year tests or examinations, and teacher assessments.

There is not enough space in this document to include examples of pupils' assessed work but the National Curriculum in Action website www.ncaction.org.uk has some very useful illustrations of pupils' work at different levels that teachers can use for comparison purposes.

Teacher assessments at the end of the key stage

At the end of Key Stage 3, teachers are required to give a level for each pupil for the ICT attainment target. It can be helpful to study the pitch of the yearly teaching objectives against the level descriptions for each year group. For example, a Year 9 pupil who has successfully met the vast majority of objectives in ICT lessons over the year can be regarded as being between levels 5 and 6.

End of Year	Expected attainment		
	Pupils who make slower progress	Most pupils	Pupils who make faster progress
7	level 3/4	level 4/5	level 5/6
8	level 4	level 5	level 6
9	level 4/5	level 5/6	level 6/7

Pupils' attainment in ICT often shows characteristics of several different levels. A pupil's understanding does not develop in a series of even steps but often as quite sudden leaps interspersed with plateaux and even sometimes slipping back.

The level descriptions are designed to be used as a 'best-fit' model at the end of a key stage to encompass this variation in performance. You will need to decide if a pupil has broadly achieved a particular level or whether the level above (or the level below) is a better fit. This judgement should be relatively quick and easy to make for the great majority of pupils if you have assessed their medium-term progress against the yearly teaching objectives.

Before assessments are made, it is helpful if all staff teaching ICT in Key Stage 3 examine together and 'level' a sample of pupils' work. This helps to make sure that judgements against the National Curriculum level descriptions are consistent throughout the department. The portfolio can also be useful to show new teachers joining the school.

Wherever possible, teachers of other subjects who have been making extensive use of ICT applications in their lessons should be involved in this moderation. You may also want to take account of pupils' own assessments of their progress.

8

Responsibilities for ICT

The management of ICT presents a special challenge to school senior managers. On the one hand, ICT is a National Curriculum subject with its programme of study and associated requirements for resources and time. On the other hand, ICT tools have the potential to affect teaching and learning in other subjects. Pupils need opportunities to apply their ICT skills and knowledge to wider aspects of learning, and to gain further ICT skills and understanding from these applications.

Given the rapid changes in technology and the impact not only on schooling but also on homes and leisure, school leaders face a huge challenge. They need to respond to the opportunities presented by ICT in learning throughout the curriculum, the legal requirements of ICT as a subject, and pupils' and teachers' growing but variable interest and expertise in ICT. They need to provide a cohesive curricular vision of where the school should go with ICT, allocate resources and support staff development. There is extensive advice on these matters on BECTa's website www.ictadvice.org.uk.

In many secondary schools, responsibilities for ICT in the curriculum are split between several groups or individuals. For example:

- **The governing body, with the headteacher and senior leadership team**, will provide an overall vision and set priorities for the future development of ICT. They will balance the needs of various departments for facilities and for professional and technical support. They will agree Key Stage 3 and Key Stage 4 ICT targets, and monitor and review progress regularly.
- **The ICT coordinator**, usually a member of the senior leadership team, will be responsible for coordinating the cross-curricular use of ICT to support learning in all subjects, and for allocating equipment, accommodation and professional support for ICT throughout the school.
- **The subject leader for ICT**, the head of the ICT department, will have responsibility for the teaching and assessment of the programme of study for ICT.
- **All subject leaders** will be responsible for ensuring that ICT is used productively to promote pupils' learning in their subject and will agree with the ICT coordinator the facilities needed to make this possible. They may also contribute to the assessment of pupils' performance at the end of Key Stage 3 by passing on a record of the level reached to the ICT subject leader.

In some secondary schools, the ICT coordinator and the ICT subject leader will be the same person. This makes for a significant workload for the individual concerned. A strategic management decision needs to be made about what is reasonable for the individual in the overall context of the school's resources.

Factors that promote higher standards

Those with responsibilities for ICT will be familiar with the factors identified by Ofsted and in research findings that promote higher standards. For example, where the **leadership, management and planning** of ICT is concerned, better standards occur when:

- there is sufficient timetabled teaching time for ICT (see page 37), reinforced by the significant use of relevant ICT applications across the curriculum, and extended by regular homework and extra-curricular activities;
- a desire to secure high standards through effective teaching and learning pervades the whole school;
- an ICT scheme of work, based on clear teaching objectives, promotes high expectations, consistent approaches and sustained progression;
- the subject leader for ICT (the head of the ICT department):
 - provides strong leadership and sets high expectations for what can be achieved by staff and pupils;
 - is well informed about applications of ICT in the curriculum, and is able to plan and teach the ICT curriculum to dovetail with work in other subjects;
- the professional skills of ICT teachers are developed through opportunities out of school and in school: for example, they occasionally observe each other teaching, and meet regularly to discuss and develop common understanding of the ICT curriculum;
- senior staff, including the ICT coordinator, with the subject leader for ICT, monitor teaching and standards systematically;
- evidence from this monitoring and from an annual review is used to set targets and identify action points for incorporation into departmental and school improvement plans;
- senior staff monitor the use of timetabled time, accommodation and resources for ICT, and the levels of technical support for the subject.

The ICT coordinator's responsibilities

Where the responsibilities of ICT coordinator and ICT subject leader are held by two teachers, the ICT coordinator's role is usually one of strategic leadership and management across subjects to promote the use of ICT in teaching and learning. Through liaison with others who have ICT responsibilities, the coordinator's role typically includes:

- ascertaining that every department, including special needs and the library, identifies its requirements for ICT provision;
- coordinating the effective use of ICT across the whole curriculum and encouraging aspects of cross-curricular planning;
- with the ICT subject leader, helping other departments to consider how ICT can support the teaching and learning of other subjects and what those subjects can contribute to the teaching and learning of ICT capability;
- monitoring on behalf of the senior leadership team the use of accommodation, the acquisition, maintenance and replacement of equipment and software, and its storage, access and use by pupils and staff;
- ensuring that sensible, transparent decisions are made where there are competing demands for resources, and that the school improvement plan includes plans for ICT;

- encouraging and supporting the professional development of all staff in the use of ICT in their subjects, in line with whole-school policy and practice;
- liaising with partner primary schools, any local city learning centre, the local education authority and the wider community;
- managing the school's ICT technician and network manager.

The ICT subject leader's responsibilities

The subject leader for ICT, in particular, has a crucial role to play in implementing the Key Stage 3 Strategy by leading the team of staff who teach ICT. Some of these teachers may not be ICT specialists and may need extra support; others may contribute no more than one or two periods per week to the teaching of the subject. Leading and supporting them all is a challenging task.

Although some tasks may be delegated, and others shared with the ICT coordinator, the subject leader for ICT is generally responsible for:

- inspiring ICT teachers, supporting their professional development, and leading discussion and debate about the teaching of the subject;
- auditing standards, teaching and learning in ICT, setting annual targets for the subject and producing an annual improvement or development plan outlining the actions needed to achieve the targets;
- reviewing and updating the ICT scheme of work and teaching resources, and ensuring that it takes account of literacy and numeracy across the curriculum;
- organising ICT teaching groups and allocating staff to teach them;
- monitoring and evaluating teachers' planning and teaching of ICT and the assessment of pupils' work and progress;
- liaising with the school's network manager and ICT technician to ensure that the resources needed for teaching the ICT curriculum are available;
- liaising with staff who support particular groups of pupils, e.g. the SENCO, the coordinator for gifted and talented pupils;
- keeping the school's senior leadership team informed about the ICT department's plans and progress.

Specific responsibilities in the context of the Key Stage 3 Strategy

In the context of the Key Stage 3 Strategy, the ICT subject leader's main responsibilities are:

- 1 To identify strengths and areas for development** in the subject through:
 - leading an audit to evaluate standards and the quality of teaching of ICT;
 - identifying ICT targets to be achieved and action points for achieving them; and
 - working with staff in the ICT department to identify their professional development needs in relation to the Strategy.

The audit of standards and the quality of teaching can be based on the Strategy's audit guide and the advice on teaching and learning in this ICT

Framework. The purpose of the audit is to identify for the school's senior leadership team and for the department:

- what changes are needed to the ICT department's work to raise standards;
- which ICT teachers could benefit most from the training and school-based consultancy offered through the Strategy.

The action points should ensure that the identified changes are tackled in order of priority, at a pace that is manageable for the department with the resources available to it, and in a way that ensures that the changes can be sustained.

2 To lead improvements and support implementation of the Key Stage 3 Strategy by:

- offering curriculum leadership;
- leading and disseminating Strategy training;
- monitoring implementation.

A major responsibility of the ICT subject leader is to offer curriculum leadership so that all staff teaching ICT regularly discuss how to teach certain topics or particular groups of pupils. Such discussions help to develop teamwork and consistent approaches and to disseminate ideas learned in training. They can lead to refinements of a scheme of work and the preparation of teaching materials that all ICT teachers can use. A particular issue to be addressed is how teachers can cater for the great variety of backgrounds and expertise that pupils have in ICT. At times, these discussions can be extended to other departments to consider how ICT can support the teaching and learning of other subjects and what those subjects can contribute to ICT.

A vital part of the implementation of the Key Stage 3 Strategy is the subject leader's monitoring role. A subject leader has to be aware of the quality of teaching among staff in the department and the teaching styles and methods they are using, and advise and support teachers accordingly. In a thriving department, the subject leader will from time to time observe ICT lessons taught by other members of staff. In turn, they will be given an opportunity to observe the subject leader teaching and to see each other at work.

The subject leader also reviews regularly with ICT teachers the written work and investigations, systems or presentations of pupils in different classes in order to monitor the progress of each class and to check that marking and other assessments are being carried out satisfactorily. These observations are best when followed by feedback and collective discussion, and can be of particular help to newly qualified and non-specialist teachers of ICT.

The ICT network manager and technician(s) have a key role to play in freeing the ICT subject leader to carry out these responsibilities, for example, by incorporating agreed refinements into the scheme of work or into online resources and teaching materials.

A separate Key Stage 3 Strategy booklet, *Securing improvement: the role of subject leaders*, is available (see appendix 3, page 71). The booklet helps to identify strengths and areas for professional development and complements publications from the National College for School Leadership.

Inclusion and differentiation

ICT has the potential to engage and inspire all pupils. Try to ensure that, as far as possible, pupils work together through the planned programme for their class so that all of them are included in each unit of work, take part fully in lessons, and benefit from the discussion and interaction with their teacher and their peers.

There are several ways of meeting the needs of classes with a spread of attainment. The first step is to establish a classroom climate where all pupils feel that they can contribute and which secures their motivation and concentration. The next step is to adopt teaching and organisational strategies to keep all pupils involved and suitably challenged, while giving them maximum opportunity to interact with you as their teacher. This includes providing appropriate support, aids or interventions to give particular pupils access to the curriculum and to keep any who have limited access to ICT outside school in step with the rest of their class.

Differentiation in whole-class oral work

In starter activities with the whole class, you could begin with some questions that all pupils can manage to get them involved and interested. If possible, use open questions that allow more pupils to respond and some pupils to give a more extended response. At times, target an individual or group with particular challenges suited to their abilities or needs, such as pupils at the early stages of learning English, very able pupils, or pupils with special educational needs. Particular pupils may need some discreet help, for example, with technical terms. When questions are directed to the whole class, the trick is to maintain pace but also to build in enough wait time for pupils to think or discuss with a partner before answering.

Differentiation in written work and homework

Differentiated practical work is another way of catering for a range of attainment in mixed-ability classes. Planning of a unit of work might take account of three levels: expectations for most pupils, expectations for pupils who have not made as much progress and expectations for pupils who have progressed further. Practical activities can be designed to give some pupils extra support using prompt cards, templates or pre-selected websites, while others are given greater challenge through the technical facilities of the software.

Written tasks and homework can be adapted to suit particular needs without varying either the task or the level of difficulty – for example, by presenting them in enlarged print or on audio tape. Some pupils may need tasks broken down into structured steps. For others, you may need to identify and explain key words, or use extra diagrams or illustrations for particular points.

Some pupils work faster than others, perhaps because they use shortcuts or are generally more confident and more able, or have had considerable ICT experience outside school. They may be ready to move on to extension or enrichment tasks linked to the theme of the lesson so that they use and apply their skills in more challenging contexts. Others may require longer to practise and consolidate what they have been learning and to do exercises at each level of difficulty.

Some pupils take longer to record or present their work. You need to allow for this and to be aware that it can be a gender issue. Some pupils, often boys, rush through planning tasks so that they can move on quickly to the practical use of ICT. Where this happens, you may need to explain that their planning will contribute to their ultimate success in the subject.

Able and gifted pupils

The yearly teaching objectives in the ICT Framework are targets for the majority of pupils in a year group (see the links to National Curriculum levels, page 29) but for able and gifted pupils you can draw on the objectives for older age groups if it is appropriate to do so. Able pupils, who progress more quickly, will need a blend of increased pace, breadth and depth in their ICT activities to extend the range of their ICT capability and the quality of their thinking. They can be stretched by being given extra challenges while other pupils are consolidating their skills and refining their work. Homework also provides opportunities to set suitably demanding tasks. This challenging work should involve a wider range of contexts and applications, including work that draws on other subjects, and require able pupils to demonstrate not just more advanced technical skills and knowledge, but also higher level cognitive skills and understanding.

All pupils, but especially the gifted, need opportunities to carry out sustained investigations and ICT enrichment work in school and, where appropriate, continued at home. The National Curriculum guidance on gifted and talented pupils defines the gifted as the most able 5% to 10% in every school, including the most able 5% nationally (see www.nc.uk.net/gt); this guidance includes a specific section on ICT.

Pupils who are gifted in ICT may also enjoy the challenge of the World Class Tests on problem solving for 13-year-olds (see www.worldclassarena.org). There are many good publications to support problem solving, including materials from problem-solving websites. The DfES Standards website www.standards.dfes.gov.uk/excellence has more information.

Pupils who make less than expected progress

It is likely that a significant minority of pupils will still be working at level 3 or below in ICT at the end of Key Stage 2. Some of this group of underachieving pupils may not have been taught the whole programme of study, perhaps due to a lack of resources or teacher expertise in Key Stage 2. Some may face relatively minor difficulties in learning resulting from misconceptions in an earlier aspect of ICT work. Often the pupils will be in English or mathematics catch-up groups because weaker literacy and numeracy skills have impeded their progress. Some may have been disadvantaged by circumstances at home or lack of access to ICT outside school. Some may have been moved to a number of different schools, or have gaps in learning resulting from missed or interrupted schooling. For all these pupils, Key Stage 3 gives them an opportunity to catch up in ICT.

Early targeted support will help the pupils most, as it is much easier to catch problems early on than to struggle with a backlog. You will need to focus on the gaps, misconceptions or weaknesses the pupils have had with earlier work and build in some extra consolidation. At regular intervals, assess and review their

progress and make sure that their learning of the yearly teaching objectives, in particular, is secure. Some mentoring sessions may be needed for pupils who are disaffected or whose behaviour causes concern to prepare them for whole-class work. You may also be able to encourage parents to help their children in specific ways, especially if they have access to ICT at home, in a local library or at a learning centre.

Extra support for the pupils is of great benefit, perhaps before or after school and during breaks. Teachers, other adults and older peers can help particular pupils to prepare for or to consolidate their learning. For example, the pupils could be introduced to new technical terms or unfamiliar software in advance of a lesson.

Any extra opportunities that the school provides for pupils to access ICT need to be monitored to ensure that both girls and boys take these up. Some schools provide separate 'girls only' and 'boys only' sessions to ensure that this happens.

Pupils who need help with English, including EAL learners

Reading or writing difficulties can slow some pupils' progress dramatically in particular ICT applications. Many of the strategies for helping pupils with literacy difficulties apply also to pupils learning English as an additional language (EAL).

Introduce new vocabulary carefully, breaking down pronunciation into syllables where appropriate. Teach the pupils to articulate new words clearly, followed by writing them. This is a particularly effective way to encourage pupils' use and understanding of technical terminology. Specifying the vocabulary for a unit of work gives pupils opportunities to refer back to vocabulary in their exercise books and ICT work, on charts, diagrams and wall displays as well as in oral questioning. While pupils must be familiar with essential vocabulary and instructions, it helps if you minimise written explanations in electronic media, worksheets and exercises. Wherever possible, read through written tasks or questions and discuss them with pupils. Provide a range of directed activities related to text to help pupils to develop their reading skills. Choose websites with effective images and text written in accessible language.

Remember that ICT has a strong visual element and capitalise on this wherever you can, since pupils with less familiarity with the English language can often learn by watching. Make use of visual aids such as diagrams, graphs or physical models, and games where the rules are picked up quickly by watching a demonstration.

It is easy to underestimate what pupils can achieve in ICT, simply because they are new learners of the English language. The expectation should be that they progress in their learning at the same rate as other pupils of their age. Whole-class work can provide helpful adult models of spoken English, and time for careful listening, oral exchange and supportive, shared repetition. Group work allows intensive, focused teaching input. You may need to speak more slowly to some EAL pupils, stressing key words, particularly when describing tasks that they are to do independently. In oral work, it may help to use extra visual clues or gestures, or translation. Use picture cues on written materials and simplify the words, but not the ICT (except where an EAL pupil also has special educational needs that warrant this).

Peer-group talk helps pupils to make sense of and apply ideas. It helps if English-language beginners can converse with other pupils or adults who speak the same home language when they are working with ICT. Aim not to ask individual pupils at the early stages of learning English to present their work orally before they are ready. Allow them time to watch and listen to those fluent in English explaining and demonstrating their work to the class. Invite them also to show their work – they will often show capabilities that are as good as if not better than those of their peers – but without any pressure to accompany their demonstration with an oral explanation in English before they are ready.

Pupils with special educational needs (SEN)

Some pupils with special educational needs may have problems accessing ICT because of difficulties of varying complexity. It is not possible within the scope of this document to give detailed advice covering every type of special educational need. As a general guide:

- aim to include all pupils fully in ICT lessons so that they benefit from oral work, take part in watching and listening to other pupils demonstrating and explaining their methods and solutions and, at times, contribute themselves;
- identify relevant objectives from the teaching programmes, use suitable teaching strategies to take account of the pupils' different learning needs and give support so that the pupils can access lessons;
- consider the particular ways in which ICT itself can help to improve pupils' access to the curriculum, including to ICT as a subject, and therefore help to raise standards for this diverse group of pupils.

For example, you can simplify or modify tasks and ask any support staff to help consolidate key points. Where appropriate, you could develop a 'group education plan' with common learning targets for a group of pupils who have similar difficulties.

In many cases, pupils' needs will be met through differentiation of tasks and materials. A smaller number of pupils may need access to specialist equipment and approaches, or to alternative or adapted activities. For example, there may be pupils in a class who need support to take part in whole-class work, such as:

- specific help to prompt the recall of technical terms, or specific techniques of handling software, to compensate for difficulties with long- or short-term memory;
- help with the interpretation of data represented in graphs, tables or charts, and other visual images, to compensate for difficulties with visual discrimination and information processing;
- access to tactile and other specialist equipment for making observations and measurements, to overcome difficulties in managing visual information;
- help in interpreting or responding to oral directions, or information in sound files, to compensate for difficulties in hearing or with auditory discrimination.

This support may be augmented by advice from external specialists as described in the SEN Code of Practice or, exceptionally, with a statement of special educational need.

Using teaching assistants, including support for SEN and EAL

Support staff, where they are available, can help to make sure that particular pupils take part in their ICT lessons as independently as possible. The aim is inclusion – support is not a substitute for careful thinking about how each individual can be involved in the lesson. Planning for effective deployment of assistants and other adults at each stage of the lesson is essential, whether the support is by a parent, teaching assistant or learning support staff. ICT technicians, because of their particular expertise and experience, can provide invaluable help to pupils, especially with practical work. The success of any support will depend on good communication and working relationships between the ICT department, the SENCO and other staff managing individual pupil support, and suitable training for support staff.

Give the SENCO and support staff copies of this Framework and, if possible, involve them in planning and departmental meetings. Brief them thoroughly about each lesson and their particular role in it. Make sure that they know not only what pupils are to do but also what they are to learn. Draw their attention to the key vocabulary to focus on in each lesson.

During any whole-class oral work – both the starter and the teaching input in the main part of the lesson – ask support staff to position themselves close to any pupils who need special help and provide this discreetly. They should also observe carefully the responses of pupils they are working with to inform the support they will provide. While pupils are working more independently on practical activities and written tasks, support staff should work with identified pupils. For example, support staff might:

- prompt reticent or less confident pupils;
- ensure that pupils interpret instructions correctly, concentrate and behave responsibly;
- remind pupils of teaching points made earlier in the lesson;
- question pupils and encourage their participation, using questions and prompts that you have suggested;
- help pupils to use equipment, personal learning resources such as calculators, or visual or practical aids, and to operate individualised ICT resources as specified in a pupil's statement;
- provide symbols, or sign or translate key vocabulary or phrases;
- look for and note any difficulties that pupils have, or mistakes that they make, so that you can address these in the plenary and in future lessons.

Using the ICT Framework in special schools

In special schools, all or nearly all of the pupils in a class may have learning difficulties that extend to ICT. For these pupils, the routines of the ICT lesson are best built up over a period of weeks. Many of the Framework's principles are applicable to special schools, such as planning from clear teaching objectives, providing interactive teaching, motivating tasks and visual interest, and keeping

pupils working together as far as possible. Special schools are encouraged to adopt this Framework but should also adapt their schemes of work to suit their particular circumstances. For example, there may be times when all the pupils are taught together for their ICT lesson, just as in a mainstream school. At other times two 'whole-class lessons' may be taking place in the same room, with the class teacher teaching one half of the class, and an assistant working with the other half.

There are four wider areas of need adopted in the SEN Code of Practice:

- communication and interaction;
- cognition and learning;
- behaviour, emotional and social development; and
- sensory or physical difficulties.

Communication and interaction

Pupils who have difficulty in communicating or interacting face particular challenges in ICT. They need clear, effective teaching, which steadily builds their confidence and participation. Use a structured approach to develop the technical language you expect them to use. Some pupils with speech and language impairments have no other developmental difficulties and ICT lessons provide the opportunity to work alongside peers, practising and discovering strategies to overcome their difficulties. However, pupils who have autistic spectrum disorders require well-structured lessons with clear routines and predictable parts. They respond best when the language used is concise, teaching is explicit, and challenges are direct and well focused. They may also need longer to record or present their work. Your expectations for what these pupils will learn and do, both in the lesson overall and in each separate part or activity, need to be defined very clearly.

Cognition and learning

The attainment of pupils with significant cognition and learning difficulties is likely to be well below age-related expectations. For them, a much greater degree of differentiation will be necessary. You may need to refer to the programmes of study for Key Stages 1 and 2, modifying the ideas to set them in a context suited to 11- to 14-year-old pupils. Extra 'small steps' can be inserted, and contexts for practical work and problem solving adapted. There will then be time for consolidation without sacrificing the breadth of the teaching programmes or the principle of planning from clearly defined objectives.

Some pupils may be working at pre-level 1 for much of their secondary education. QCA has published general guidelines, and some specific to ICT, for planning, teaching and assessing the curriculum for pupils with learning difficulties. The guidelines relate particularly to pupils whose attainment by the age of 16 is expected to remain in the range from pre-level 1 to level 2 (see appendix 3, page 71).

Behaviour, emotional and social development

Pupils with emotional and behavioural difficulties can present their problems in a number of ways: they may be withdrawn, isolated or anxious, or show immaturity. They sometimes present challenging behaviours because of other needs, including sensory and physical impairments or learning difficulties. For all these pupils, poor literacy and numeracy skills often result from their inability to maintain concentration and persevere with tasks. As a result, they may need to be supported with some aspects of the ICT curriculum. Yet if the work they are given is pitched at too low a level, they become even more demotivated and disaffected.

The Key Stage 3 Strategy can benefit these pupils in several ways. For example, the ICT Framework helps to ensure high expectations for their learning. Like most pupils, they respond well to structured ICT lessons where expectations and routines are well established, and to the interaction provided by the software. However, their concentration span may be shorter and their frustration greater when problems occur. In the main part of the lesson, break down independent activities and written work into 'chunks' that are more manageable for them, and invest time in establishing routines for the transition between one activity and another, so that they can learn independently of support staff.

Learning to work independently with increasing self-confidence is important for these pupils. This has to be introduced slowly, cultivated deliberately and rewarded as the level of support is reduced and eventually withdrawn. Tasks and timings are critical.

Sensory or physical difficulties

Some pupils with physical or sensory difficulties may need to develop proficiency with particular aids. These pupils will work on the same ICT objectives as their peer group. Expectations for them should remain high, with the focus on giving them maximum access and independence.

For example, support to overcome pupils' difficulties with mobility or manipulative skills should have been identified and provided in ICT and other lessons to enable them to take part safely and as fully as possible. Modifications to ICT teaching and learning resources, equipment and furniture, and the provision and use of specialist ICT items, will also help to meet the pupils' needs.

Where pupils with sensory impairments need signing support, Braille or materials written in signs or symbols it is likely that provision will be through a statement of special educational needs. The pupils will also need to be appropriately positioned in the room and may need extra time to manage visual or auditory information. Provision of specialist equipment and materials and adult support for them will apply to all subjects. Where necessary, text should be adapted to a larger print size, or translated into Braille or symbols and sounds amplified. Pupils with hearing impairments may be helped by visual demonstrations.

Appendix 1

From Key Stage 2 to Key Stage 3

This appendix describes what most pupils should have learned in ICT by the end of Key Stage 2, particularly those aspects that relate to the yearly objectives in Key Stage 3.

Finding things out

By the end of Year 6, most pupils should be able to:

- identify the information they need to complete a simple task or solve a simple problem;
- use simple search techniques, including indexes and lists of contents, to find information;
- prepare information for use in a task by downloading relevant pieces or collecting them from various sources;
- classify information for use in a database and understand how a suitable structure is created;
- recognise different types of information such as text, numbers, graphics;
- enter data into a database, search it and present data in simple tables and graphs;
- check that information is accurate and reasonable;
- discuss what might happen if information is entered into the computer incorrectly or not downloaded completely.

Developing ideas and making things happen

By the end of Year 6, most pupils should be able to:

- combine text, graphics and sound to develop and present their ideas;
- reorganise information for a particular task or problem;
- create, test and refine a simple sequence of instructions to control events or make things happen;
- use datalogging equipment to monitor changes, for example, in light, temperature or sound;
- use simple spreadsheet models to explore the effect of changing variables and answer straightforward questions;
- identify patterns revealed by simple models or simulations.

Exchanging and sharing information

By the end of Year 6, most pupils should be able to:

- use e-mail;
- use software to create stories, animations, presentations, displays and posters;
- consider the needs of different audiences, such as parents, peer groups, younger or older pupils;
- recognise the need for quality and accuracy in their presentations of work and ideas;
- work in groups to solve problems and complete tasks.

Reviewing, modifying and evaluating work as it progresses

By the end of Year 6, most pupils should be able to:

- review what they have done and consider how they might improve their work;
- evaluate other people's work and get ideas for their own;
- describe their use of ICT and how they might have completed a task using other methods;
- compare their use of ICT with other people's;
- recognise the benefits of using ICT for particular tasks;
- describe some uses of ICT outside school and the impact it might have on people at work and at home.

Appendix 2

ICT key vocabulary

This appendix lists the key terms and technical language used in the yearly teaching objectives and in the Strategy's sample teaching units designed to support the teaching of ICT. The lists are not exhaustive but contain the terms that are most important and used most frequently. The lists do not include subject-specific terms that appear in the vocabulary lists in other subject Frameworks, for example, 'line of best fit', 'correlation'. Nor do they include vocabulary specific to particular software. Words in the lists appear only once although pupils may meet them in other units and later years.

Pupils should be able to use all these words accurately in a range of contexts.

Key Stage 2

By the end of Year 6 most pupils will have used these terms in their ICT work.

Finding things out

accuracy/accurate, average, bar chart, browse, chart, classify, compact disc (CD) read-only memory (CD-ROM), computer, data, data collection sheet, data handling, desktop computer, disk drive, download, experiment, file, file name, find, floppy disk, folder, frequency, graph, hardware, home page, identify, index, information, Internet, key word, keyboard, laptop, load, log on/log off, network, pie chart, questionnaire, range, report, represent, save, search, software, sort, survey, table, tally, web page, website, World Wide Web (WWW)

Developing ideas and making things happen

calculate/calculation, cell, column, control, digital, enter, formula, input, label, Logo, model, output, pattern, predict, procedure, process, relationship, repeat, robot, row, sequence of instructions, simulate/simulation, spreadsheet, store, switch

Exchanging and sharing information

animate, audience, audio cassette recorder, bold, bullet points, capital letters, capture, clip art, colour scheme, copy, cursor, cut, delete, desktop publishing (DTP), digital camera, display, drag, drop-down menu, e-mail, earphone, effect, font, font size, footer, format, graphic(s), header, heading, illustration, image, italic, label, link, microphone, mouse, moving image, object(s), paint and draw software, paste, photograph, presentation software, print/printer, scanner, screen, scroll/scroll bar, slide show, sound, speaker, style, teletext, television (TV), text, transfer, underline, video cassette recorder (VCR), video clip, wordprocessor

Reviewing, modifying and evaluating work as it progresses

adapt, assess/assessment, check, draft, edit, evaluate/evaluation, judge, organise, plan, produce, purpose, refine, review, spell-check, test

Year 7

Finding things out

AND, archives, comparative, conclusion, content, contents list, copyright, data structure, data type, database, dial up, enquiry, field, file extension, hypothesis, information source, intranet, locate/location, numeric, opinion/opinion poll, OR, origin/originator, password, query, record, reliable/unreliable, representation, search engine, search method, server, uniform resource locator (URL), verify, viewpoint, web browser

Developing ideas and making things happen

analogue, automate/automatic, cell reference, control loop, flow chart, formulae, gridlines, if ... then, input device, output device, prediction, print area, probe, program, random number, repeated process, replicate/replication, rule, sensor, subtask, system, template, variable

Exchanging and sharing information

acknowledgement, address book/list, atmosphere, attribute, bitmapped graphic/image, body text, copyright, corporate image, crop, design brief, digital video disk (DVD), digital video software, document, duplicate, export, hypertext, import, intended audience, landscape, layer objects, layout, logo, manipulate, multimedia authoring, multimedia presentation, onscreen viewing, points, portrait, projector/projection, readability, resize, scale, serif/sans serif, shared area, slide view, still image, storyboard/storyboarding, structure, subheading, typeface, upper/lower case, vector graphic/image, voiceover, web publishing, white space

Reviewing, modifying and evaluating work as it progresses

annotate, backup, clarity, criterion/criteria, criticise, develop, effective, efficient/efficiency, enhance, expected outcome, feature, fitness for purpose, improve, revise, value

Year 8

Finding things out

assumption, authentic/authenticity, bandwidth, bar code, bias, Boolean connector, continuous data, discrete data, distribution, file size, gateway, hierarchical, hits, hyperlink, hypertext mark-up language (HTML), Internet service provider (ISP), interpolate, interrogate, misrepresentation, misuse, navigate, NOT, operator, point of sale (POS), primary source, qualitative data, quantitative data, representative, sample, sample size/composition, satellite, search technique, secondary source, tags

Developing ideas and making things happen

absolute cell referencing, automated process, control technique, counter, datalogging, feedback, forecast, goal seek, live data, monitor, physical data, port, random number generator, relative cell referencing, remote datalogging, remote sensor/sensing, rescale, synthesise, system life cycle

Exchanging and sharing information

document formatting, dots per inch (dpi), dynamic link, length delimited file, local area network (LAN), permissions, pixellated, public information system, resolution, style sheet, style template, teleconferencing, transmission speed, video conferencing, wide area network (WAN)

Reviewing, modifying and evaluating work as it progresses

appraise, critical audience, Data Protection Act, documentation, functional, hacking, personal information, planning frame, plausible, virus

Year 9

Finding things out

data retrieval, electronic funds transfer at point of sale (EFTPOS), European article number (EAN), extrapolate, international services digital network (ISDN), meta-tags, raw data, universal product code (UPC), validate/validation, verification

Developing ideas and making things happen

audit trail, computer-aided design (CAD), computer-aided manufacture (CAM), optical character recognition (OCR), state table, verification

Exchanging and sharing information

archive, e-commerce, protocol

Reviewing, modifying and evaluating work as it progresses

project management, system design

Appendix 3

Related publications and websites

A number of other publications complement this Framework. Those marked DfES are available from DfES Publications (tel: 0845 6022260), and are on the Standards website at www.standards.dfes.gov.uk. Those marked QCA can be obtained from QCA Publications, PO Box 99, Sudbury, Suffolk CO10 2SN (tel: 01787 884444, fax: 01787 312950).

DfES *Auditing a subject in Key Stage 3*

DfES ref: 0756/2001

www.standards.dfes.gov.uk/keystage3/publications

DfES/QCA *ICT: a scheme of work for Key Stage 3*

ISBN 1 85838 383 8; QCA ref: QCA/00/446

www.standards.dfes.gov.uk/schemes

DfES *Key Stage 3 National Strategy Sample teaching units for ICT*
from autumn 2002

www.standards.dfes.gov.uk

QCA *Planning, teaching and assessing the curriculum for pupils with learning difficulties: information and communication technology*

QCA ref: QCA/01/745 (March 2001)

www.nc.uk.net/ld

Ofsted *ICT in schools*

Ofsted ref: HMI 423

www.ofsted.gov.uk

DfES *Securing improvement: the role of subject leaders*

DfES ref: 0102/2002

www.standards.dfes.gov.uk/keystage3/publications

Websites

General advice on ICT is available on BECTa's website:

www.ictadvice.org.uk

QCA's National Curriculum in Action website offers advice on understanding standards and making accurate summative assessments:

www.ncaction.org.uk

'Gifted and talented' websites:

www.standards.dfes.gov.uk/excellence

www.nc.uk.net/gt

www.worldclassarena.org (World Class Tests)

www.xcalibre.ac.uk

