NATIONAL ASSOCIATION OF ADVISERS FOR COMPUTERS IN EDUCATION

British Educational Communications and Technology agency

Key characteristics of good quality teaching and learning with ICT: a discussion document

Introduction

This document has been produced jointly by NAACE and Becta. NAACE is the professional association for those who are involved in advancing education through the appropriate use of information and communications technology (ICT). Its members are advisers, inspectors, consultants and others who provide support for schools in their use of ICT in education. Becta is the government's lead agency for ICT in education.

In his speech at BETT in January 2001, Michael Wills MP, then Minister for Learning Technologies, concluded by inviting the education community to debate "what constitutes effective and good practice in ICT, both for the teacher and the learner". He suggested that there were five features of ICT in learning which could be used as starting points for the discussion – autonomy, capability, creativity, quality and scope. This document is structured around those five themes. Michael Wills raised three key questions:

- What is effective teaching practice with ICT?
- What can ICT do to assist the teacher?
- What might pupils be doing as a result of this good practice?

To move the debate forward, NAACE invited its members, most of whom observe classroom practice on a regular basis, to suggest the key characteristics of good quality teaching and learning with ICT. They were asked to consider those occasions on which they had observed ICT making a real difference to teaching and learning, either in the context of teaching about ICT itself or in support of learning in any subject across the curriculum. They were asked to identify the role that ICT was playing and the ways in which teachers and pupils were using the technology in a really effective manner.

This document is not a comprehensive exemplification of standards, nor does it set out to define progression in ICT experience; these are available from other sources. It records a range of good quality ICT classroom experiences which make a significant contribution to learning and the last section suggests characteristics of the enabling school. The examples are drawn from lessons observed across the age range and the curriculum, but there has been no intention to provide comprehensive coverage for each age group or subject area. The basis of the material is first hand observation of practice and judgements made by experienced professionals. While the material is not rooted in rigorous academic research, NAACE and Becta believe that the classroom observations made by colleagues are helpful in illustrating good practice with ICT.

This material may be used in a variety of ways:

a. as a stimulus for discussion by groups of teachers engaged in professional development activities designed to explore good classroom practice with ICT. To that end, some initial discussion points have been included at the end of each section.

b. as a support document for individual or groups of teachers engaged in self review of their teaching practices.

c. as support material for schools engaged in monitoring and reviewing their practice.

d. as a contributory source of exemplars which may assist inspectors of ICT to comment and make judgements upon observed practice.

This material is offered as a starting point for the debate, but it certainly is not the last word. Readers will undoubtedly have their own experiences to offer, their own questions to discuss, and their own views on what constitutes good practice in the use of ICT. You are invited to contribute to the debate with views, comments and questions by logging onto the Teachers Online Project discussion forum in both the Primary and Secondary lists (http://top.ngfl.gov.uk/forums.php3). If the response is significant, this material will be updated in the future.

To subscribe to the ICT in practice mailing lists, send a message to majordomo@ngfl.gov.uk and type [subscribe ictpractice-pri] or [subscribe ictpractice-sec] in the body of the e-mail message (leaving the subject blank) .

This list is open to all UK primary and secondary school teachers who have an interest in using ICT and are willing to share ideas and expertise relating to using ICT for teaching and learning. The list is free to join. If you have any problems e-mail top@becta.org.uk .

Finally, we know that as technology develops and new learning and teaching opportunities arise as a result, new examples of good practice will emerge. E-Learning will offer new ways of learning, teachers will play new roles in the process and new models of excellent classroom practice will become apparent. We expect the debate to continue and mature over time.

Five features of effective practice

1) Autonomy

Pupils develop autonomy through their use of ICT. They take control of their learning. They engage with the technology and work independently or with others, at the most effective pace and at the most appropriate level. They articulate reasons for their use of ICT.

Key words: analyse, learn by doing, make connections, make decisions.

Characteristics of autonomy

- Pupils make decisions or show initiative about which application or hardware is best suited to a task.
- Pupils develop their own ways of thinking about the task and develop their own strategies for overcoming problems. They seem confident, prepared to take risks and learn from their mistakes.
- Pupils use teacher intervention effectively to move them on to the next stage in their thinking.
- Pupils use peer intervention effectively to develop their thinking. They recognise the potential of feedback from others to improve their work.
- Pupils participate actively in formative assessment of their work. They know and understand how their work will be assessed and use these criteria to improve their work.
- Pupils are inspired to learn with ICT. They transfer knowledge to other contexts, for example, when using ICT at home. They recognise and value how knowledge gained outside the classroom contributes to their schoolwork.
- Pupils access independent, student-centred resources and use them to effect.

In the classroom you might see or find…

Example 1

Year 2: Pupils in geography are using ICT to prepare a slide presentation on 'Our home town/environment'. They firstly carry out a survey and record their results in a tally chart for the item they are exploring. One group of pupils remembers using a digital camera in a PE lesson and wants to create an image to communicate the fact that in his family, they try to walk rather

than use the car. The pupils ask to use the equipment and articulate why they need it. They experiment with the camera and use each other's comments to achieve a positive result. The group shows their presentation to the class, including the newly created image of 'two feet'.

Teaching points: The teacher strategically groups the pupils and sets the time limit. She reminds them of font editing techniques and how to insert and re-size graphics. Pupils work in small groups to create a short presentation to the class. As they quickly begin to tackle the task, pupils discuss how to build a presentation that represents the results of the group. They select the appropriate images and enter their text. The teacher responds positively to the request to use the digital camera. The support teacher recaps how to use the camera and intervenes with questions to help them incorporate an appropriate image into the slide. Teaching supports the autonomy by ensuring there is not undue reliance on a 'recipe' from the teacher.

Example 2

Years 3 and 4: Pupils use a programmable robot in maths. They work in pairs to program the robot through a series of turns on a circuit. They begin by experimenting and enter in different degrees of turn until the robot makes the first turn on the circuit at the precise angle. They hypothesise on the degree required to turn the robot through the next turn. They question each other's hypothesis and use each other to develop their thinking. Through constructive talk, they move the robot through the series of turns with increasing precision. They record their thoughts on the relationship between the angle and the turn. They construct another circuit (providing the answer sheet in advance) and challenge other pairs to a race.

Teaching points: The teacher chooses ability pairs and sets the time expectation. She reminds them of how to programme the robot and sets out the problem. She challenges more able pupils with a more complex series of turns. Less able pupils have access to a help sheet that sets out the necessary angles needed to make the turn in a visual format. She encourages them to make mistakes and draws the group back together if there is a common misconception. The teacher intervenes with questions as they solve the problem. She encourages them to apply what they have learnt to the series of turns. She matches pairs of pupils as they finish the task, encouraging them to extend what they have learnt by creating another circuit for others to tackle or by racing another pair around a circuit.

Example 3

Year 6: Pupils in history are learning about children in the Victorian period. Pupils have access to paintings, postcards and artefacts from the period and discuss how children are depicted. Through class work, they begin to articulate characteristic features of Victorian children's life. The autonomous learner decides to look for further sources at home, using ICT independently to find out more about children's games, for example. The pupil begins by accessing the history activities on Channel4 Learning Homework High web site from a favourites list. They also recall the teacher's reference to paintings at the National Portrait Gallery. They use a search engine to locate the site. Once within the site, they use the main menu and a key word search to locate paintings showing Victorian children at play. They print out a thumbnail view of a particularly apt image and spend time analysing it. They bring their new findings to the next lesson and share with others.

Teaching points: The teacher appreciates that some pupils will work independently to find out more about how children lived in the Victorian period. Parents at home are offered a favourites list of suitable sites to support the history scheme of work for each year group. She also refers parents to the DfES Parents web site history section. She builds in opportunities for pupils to incorporate their own findings and ideas throughout the series of lessons. She creates an atmosphere where contributions from pupils' independent learning are positively encouraged. Pupils feel confident to present their findings. They are encouraged to talk about how they selected the sources, how they found the information and they interpret what they have found.

Example 4

Year 7: Pupils use an integrated assessment tool in maths. They work with a partner on a
specific activity to develop and extend their understanding of a mathematical concept. They use constructive talk to make decisions throughout the learning stages in the activity. They pose 'what if' questions to each other and begin to predict outcomes. They use teacher intervention to help them think around the task. They use understanding gained during the whole class teaching part of the lesson and apply it to the task on screen. They use the onscreen assessment tool to pinpoint weaknesses in their understanding and are confident to retackle the activity. They are able to articulate the reason for their misunderstanding of the problem and gain confidence through successful completion of the task.

Teaching points: The teacher chooses partners and sets the time expectation. She ensures pupils locate the task quickly and settle to work with minimal fuss. She intervenes when appropriate and reiterates teaching points to support pupils as they apply their understanding of the concept to the onscreen task. She encourages pupils to talk, analysing their contributions and monitoring individual learning gains. She uses individual pupil scores to set appropriate consolidation or extension work.

Example 5

Years 10 and 11: Pupils are using ICT in a languages lesson to help them prepare for a structured mini- group debate on the theme of the environment. They use a video recorder autonomously to capture the discussion at formative stages. They prepare their various interactions, knowing the point they want to make during the discussion. They record their discussion for the first time, without the intervention of the teacher, who will take the role of chair in the debate. They watch the replay and review the group performance, concentrating on improving the language used and the opinions expressed. They isolate contributions from individuals and discuss as a group how the accuracy and quality could be improved. They use ICT to modify their contributions accordingly. In the 'performance' they are confident and contribute at a high level. They refer to notes to support them with key phrases and vocabulary whilst attempting to contribute much from memory. They deal effectively with unexpected interjections from the teacher and are able to produce some spontaneous responses.

Teaching points: The teacher groups the pupils accordingly and sets the time expectation. She reminds them of video operating techniques. The teacher supports at the preparation and replay stage, intervening to give feedback, suggest improvements in language and pronunciation, and to point out errors. The teacher models difficult phrases on camera so pupils can refer to it if appropriate when preparing. When chairing, during the debate, she uses the knowledge she has gained during the formative process to apply an appropriate amount of linguistic challenge to both groups and individual pupils. Pupils know how they will be assessed and have access to assessment criteria.

Example 6

Years 10 and 11: Pupils in business studies lessons are using ICT to prepare a presentation to the class. The mini-group presentation includes slides and handouts in a shared task. The autonomous learner decides to use available tools to improve the quality of the work during drafting stages. He accesses tools like spellchecker and thesaurus during drafting. He uses track changes to redraft text produced by others in the group. He uses a version containing track changes to generate discussion in the group about particular sentences or phrases in the piece of text. Pupils use feedback effectively to improve the quality of their work, discussing the most effective way of communicating meaning and making changes together on screen. They save different versions of the piece of work, naming files appropriately and keeping a record of how they improved the work.

Teaching points: The teacher reminds pupils of the need to draft and redraft work and to check for accuracy. Through effective intervention, she poses questions that challenge pupils to think about the quality of the work. She encourages pupils to access on-line help and praises this when she sees it used to effect. When pupils discuss the version containing track changes, she listens and intervenes sensitively to seek contributions from each member of the group. She allows pupils to make decisions as they learn from and with each other.

Discussion points

- Some pupils work best in pairs or small groups, others make maximum learning gains when working alone in an intensive session. How can teaching support different learning styles to encourage pupils to become autonomous learners?

- Effective teacher intervention requires pupils to analyse and make decisions based on careful questioning. How do you set out a problem without giving the solution? What types of questions make pupils think?

- Many pupils are using ICT out of lessons and at home on a daily basis. How do we find out what they already know, understand and can do? How do we build effectively on such prior learning?

2) Capability

Pupils develop the knowledge and skills that enable them to use new technologies efficiently and effectively.

Key words: confident, competent, skills, transfer, apply, critical judgement.

Characteristics of capability

- Pupils are developing good ICT skills that they deploy appropriately to the task in hand, with increasing confidence and competence.
- Pupils transfer and apply their skills using ICT effectively to support learning in other subjects.
- Pupils experiment purposefully, problem solving through extrapolating from previous experience.
- Pupils develop the ability to make critical judgements about the contribution of ICT to their work and understand the value of using ICT.

In the classroom you might see or find…

Example 1

Years 1 and 2: Pupils are reordering the mixed-up story of Goldilocks and the Three Bears into the correct sequence as part of its retelling, using a word processor. This helps 'scaffold' pupils' understanding of sequencing. They are able to select a sentence, cut and paste it, and use the enter key to start a new line. Once finished they change font size and style without spending too much time over this, and are learning how to check their work to end up with a good result. They can print and save their work.

Teaching points: The file has been prepared in advance. Using another well-known text, the teacher first models how to cut and paste and start a new line to the whole class, focusing on these key tool skills. She also has visual reminders on the walls that reinforce 'how to do…'. Pupils are grouped strategically to support the task. The teacher gives instructions and monitors that they share the hands-on part of the task. An extension task is ready for the most able which requires them to respond to some questions and insert some additional text to add detail to the story, check it, and save as version two.

Example 2

Year 3: Pupils are using a program to combine text and graphics in order to create a greetings card for a friend or family member. Pupils are confident in their use of the software and use of key functions such as undo when they make a mistake. When questioned it is clear that pupils recognise commonalties between software such as the word-processing and painting packages they have used. They are able to copy and paste, highlight and change items, and save the file as they go, applying their knowledge of the items they expect to find under edit, format and file menus. Pupils are able to comment on how the computer helps them produce a more professional looking result.

Teaching points: The activity needs to be broken down into the key ICT tool skills the pupils need to know in order to undertake the task, such as undo, cut/copy and paste, selecting items, save/save as, etc. Well planned questioning helps pupils apply earlier knowledge such as how to repeat elements. Pupils need to develop 'a sense of audience' in their work from an early age. Therefore, having examples of commercial cards and focusing on the use of images and text helps pupils develop their visual literacy and highlights the non-trivial nature of the task. To prompt pupils' evaluation, a range of statements are provided to help them comment on the role and value of ICT in supporting their work. The lesson has not just focused on skill acquisition and there are other important learning gains.

Example 3

Year 6*:* Pupils are using a control kit to simulate controlling a buggy. They work in small groups of three or four, and following a period of trial and error, build a procedure to automate and repeat the process, so that the buggy moves in a

particular way, but also reverses when it hits an object. Some pupils are able to tidy up and refine their procedure. They can also talk about how control technology is used in some everyday situations.

Teaching points: To support pupils' understanding that control programs need to be broken down into logical steps, she gives the pupils some cards to sort a typical process, such as the traffic lights sequence, possibly as a homework task. The teacher then demonstrates the key commands, such as turn on/turn off/wait. So that time is not wasted on low-level tasks, the buggies have already been assembled and the equipment set-up. An extension task is planned for the most able, adding a flashing light when the buggy meets an object, with the additional commands required. In order to help pupils review their work and look for efficiency, the teacher brings the class together and shows them a procedure that is accurate, but has too many commands and can be made more efficient. They discuss it as a whole class before looking again at their own.

Example 4

Year 7: Pupils are using the Internet to underpin some work they are doing in geography. They are learning how to enter a search and narrow down that search. The aim is to find information about the effects of a recent earthquake in order to write up an account using evidence from the Internet. Working in pairs, some are to consider the impact from a human interest viewpoint, others are to give a scientific factual report about the quake, and others are reflecting on the global distribution of earthquakes and likely danger areas on population from a geographers' viewpoint. Pupils can highlight relevant items and copy and paste into a prepared template. Each group presents their findings to the rest of the class.

Teaching points: The teacher has previously checked to ensure the pupils will find relevant sites. As a whole class they discuss what key words might work and try them out to see how many hits they get and how to narrow this down to as small a number as possible. The teacher has explained how the URL indicates the likely source of the information. She reinforces this as a whole-class activity, so pupils develop their ability to select information that will be relevant and plausible and do not surf aimlessly on the web. Pupils are asked to look at some pages, pre-selected by the teacher, and have to answer some questions to find some key information relevant to their audience/viewpoint. This is done as a quick fire test to encourage the pupils to skim and scan for key information. They are reminded how to highlight relevant items and copy and paste into the presentation software. Once in the geography lesson, the pupils use some agreed bookmarked sites so they get straight on with the information retrieval and presentation task.

Example 5

Year 9: Pupils are to design and make a co-ordinated range of promotional products based around the promotion of a charity record as might happen in real life. Following on from some research they have undertaken using a range of resources, including the Internet, some groups are working on the CD cover design. They are using some parts of images scanned from other sources. The pupils can readily switch between appropriate software packages to achieve better results. For example, they can work with the scanned image to erase unwanted parts, adjust scale or add effect before copying and pasting it to a CAD program, where the image is manipulated to fit onto the net and add some text. They can discuss the likely audience the CD cover wishes to attract and the reasons for their choice of image and text. Some are able to use on-line help effectively, of their own volition, to double-check how to do something, transferring and applying their previous skills. When questioned, the pupils can talk about why a particular use of ICT is not appropriate and differentiate when one application is more appropriate than another, for instance, when to use the CAD program instead of the image manipulation or paint program.

Teaching points: To prevent pupils wasting too much time over their choice of image, this has been set as a homework task and pupils have been given the opportunity to scan their images in the computer club. The task is time-constrained with pupils knowing they only have a limited number of lessons to complete. A 'net' has been prepared to support the less able. All these factors ensure trivial elements do not sidetrack pupils. The class has previously considered the need to consider the audience, which the teacher reinforces at the start of the project as a whole class. She does this by displaying some previous work and asks some evaluative questions in order to help pupils to develop critical awareness skills. The pupils' images have been saved in a readily accessible sub-directory, so that they don't waste time trying to locate images.

Example 6

Years 10 and 11: Pupils have to look for the possible relationships between some development data in geography. This involves ranking data and graphing data in order to look for patterns and highlight oddities. For example, when questioned,

pupils are able to differentiate the reasons for using a spreadsheet to explore the data rather than the database software they have. They are able to apply previously taught skills showing a competent knowledge of how to sort data and generate and label scatter graphs in order to look for possible causal factors. Pupils are able to think critically about the reliability of the data set.

Teaching points: The geography and ICT departments liaise to ensure that data handling and manipulation activities for the geography course build on previous work and to ensure that pupils transfer and apply their skills. The teacher goes through the use and interpretation of scatter graphs and has a crib sheet to support the pupils. The teacher reminds the pupils how to change the scale of graphs in order to see how this impacts on possible interpretation. Previously, pupils have undertaken an activity to look for errors in data and have discussed the validity of data. The teacher reinforces this earlier work, going further to provide discuss what can be learnt from the data and what requires additional information. This supports pupils in considering the plausibility of data.

Discussion points

- With pressure on access to computers and the need for pupils to develop 'good' ICT skills, how can schools ensure that pupils are taught the skills of using software within contexts that are not trivial and yet do not place unacceptable demands on subject time ?
- What strategies can teachers employ to help pupils make critical judgements about their work at different stages?
- Pupils with home computers can often be more confident using computers than those without, and this helps them develop their competence. What can schools do to ensure any digital divide is not exacerbated?

3) Creativity

Pupils' creativity is inspired by their use of ICT. They will find opportunities to be creative using ICT, and to use ICT creatively, in a wide range of subjects and contexts, throughout their school life.

Key words: create, design, explore, play.

Characteristics of creativity

- Pupils are inspired to be creative with ICT.
- Pupils release their creative ability through a range of ICT tools.
- Pupils use ICT to explore styles of communication and expression.
- Pupils are innovative / creative in their use of ICT.
- Pupils explore the possibilities of multimedia tools, enabling them to create in the styles readily available to them in games, CDs and television.

In the classroom you may see or find…

Example 1

Year 2: Pupils work with the simple tools of an art package, to explore the use of shape, colour and pattern to create a picture based on observations of a vase of flowers. They use the circular brush tool, and select colours from a restricted palette. Using a rainbow brush they are able to use colours in a way which would be otherwise impossible. They use the mouse to select a shape tool and are able to draw regular circles and oblongs, which they fill with colour.

Teaching points: The teacher has ensured that the painting package is set up so that a small and easily managed set of tools is available. Pupils are shown how the simple tools are used, and are given time to experiment using the mouse to

select tools and colours. The teacher encourages the children to talk about their pictures after they have been printed. She may display the pictures with descriptive text added.

Example 2

Year 3: Pupils use a music package to create a tune relating to their topic based on the ancient Egyptians. They select appropriate musical phrases, represented by graphical images, and arrange them to create their composition. The pupils work in pairs and review the available musical phrases, deciding which would be best suited to open, continue and end their compositions. They experiment with the repetition of certain phrases and alter tempo to achieve a pleasing result. Files are saved, and then played for the whole class to appreciate. With their teacher's help, the class select two tunes which will be played in loops before and after an assembly, during which they are to share their project work with the whole school.

Teaching points: The teacher reminds the pupils about the basic operation of the software, and provides a simple help-sheet to facilitate independent working. The pupils are encouraged by their teacher to draft and redraft their compositions considering the provisionality that ICT offers, until they are satisfied with their creation. The teacher groups the children and requires them to work to a given deadline.

Example 3

Year 4: Pupils create designs for textiles based upon the work of William Morris. They create a motif, and then cut and paste to create a repeating pattern. They make use of the facilities provided by the software to further experiment with pattern making, including ready-made stamps, symmetry, sizing and rotation tools. Using a fill tool to flood-fill backgrounds, they experiment with colour ways, and present a portfolio of their printed designs.

Teaching points: The teacher demonstrates the tools which select areas of the screen and produce repeating patterns. A help sheet illustrating the layout and functions of the software tools is made available. Pupils are encouraged to compare other methods of producing repeating patterns, including cut and paste, as well as traditional methods away from the computer. The teacher facilitates discussion based on the perceived advantages/disadvantages of using ICT to produce patterns.

Example 4

Year 6: Pupils work in groups with a professional presentation graphics/animation tool to create animated multimedia presentations linked to Design and Technology projects. As part of a project on the environment, the pupils make a visit to the Thames Barrier, collecting information and digital images, which they then incorporate into an animated presentation. Pupils work in pairs to create their own section of the presentation. Other pupils work on a presentation based on a visit to an outdoor education centre, producing amongst other things an animated diagram showing how waterfalls are formed.

Teaching points: The school makes use of the skills of an expert working with the pupils to encourage their creativity and response to challenge. They have been taught the basic operation of the software. They are challenged to work creatively, within the structure commonly found in design and technology projects; investigation, analysis, planning, problem solving, production and evaluation. When projects are complete, the presentations are loaded on to the school web site and shared with pupils and parents.

Example 5

Year 7: As part of an art project on self-image, pupils use a digital camera to capture self-portraits. They transfer the images to a computer, and using a photo-editing software package, replicate and recolour the images. As part of their study of the ideas, methods and approaches used by other artists, they then incorporate the images into a photographic collage, in the style of Andy Warhol.
Teaching points: Pupils have been taught the operation of the digital camera, and how to transfer the images from camera to computer. They are encouraged to experiment with the photo-editing software, using techniques and skills they have developed using other art packages. Pupils are given opportunity to combine traditional and digital media.

Example 6

Year 8: Pupils use a sophisticated object-oriented graphics software package with animation facilities to create objects and images to be incorporated into pages which will be published on the Internet or the school's Intranet. As part of designing and building interactive web pages, on a subject of their choice, they create graphic objects that are then programmed to interact with the positioning and clicking of the mouse. Before beginning their own pages, pupils investigate a variety of web site designs, judging which are the most effective for their respective audiences.

Teaching points: Pupils are given access to appropriate software tools. The teacher selects a dedicated graphics package, which provides an appropriate facility for the teaching and learning of animation. Pupils are taught the operation of the software, and also share the expertise of fellow pupils who have developed high order skills outside school. Pupils are encouraged to research into web site designs as part of a homework task, paying particular attention to the interactive nature of graphic content.

Discussion points

- Pupils can be inspired to be creative with ICT. How can we encourage this creativity?
- How might creativity using ICT be encouraged in subjects other than the arts?
- To what extent does creativity reflect the capability of software, rather than that of its user?

4) Quality

Pupils use ICT to develop their ideas and improve the quality of their work. They use ICT to enrich their learning, making use of the wide range of source material available to them. Where appropriate, they also use ICT to improve the presentation of their work.

Key words: purposeful, efficient, appropriate, high standards, value, redraft, improve.

Characteristics of quality

- Pupils use ICT to present and communicate their ideas to a high standard, redrafting as necessary to produce better quality outcomes.
- Pupils have clear ideas of how they use ICT to improve the quality of their work.
- Pupils readily engage in thinking about the task in hand. They explain what they have done and why. They justify their use of ICT in terms of the quality of the outcomes.
- Pupils display evident pride and satisfaction. They value the outcomes of their endeavours. They develop a personal commitment to good quality work and aspire to the highest standards.
- Pupils have high expectations and demonstrate concentration, persistence and determination to develop work of a high standard.
- Pupils are engaged in high quality thinking and analysis through decision-making, predicting, hypothesising and testing.

In the classroom you might see or find…

Example 1

Year 1: Pupils have been grouping objects according to their colours. They use a simple screen display package such as My World, to sort shapes into sets of different colours and they associate the colour as a text item with the correct set. Some pupils add their own titles and text to their screens. The outcomes are presented as a wall display for parents. Pupils are proud of their work and take care to design screens which are arranged neatly and are easy to understand.

Teaching points: Pupils have been taught how to work with a My World screen, selecting pictures from menus and typing simple text. They know that their sentences must begin with a capital letter and end with a full stop. They know that they may have to correct their spelling and are able to rearrange their images as necessary.

Example 2

Year 5: Pupils produce a book of stories and poems for Key Stage 1 pupils. They know that their work will be used in the infant classroom alongside professionally published material, and that it will therefore need to be of good quality. They draft and redraft the work, improving the language and structure of the work. They talk with other pupils about how to improve the material. They consider aspects of page layout, readability, and the needs of young children. They research published works and identify what makes for an appealing page of material for a young child. They research the content, produce the pages and consider how they can be illustrated.

Teaching points: Pupils have been taught how to use a word processor to edit and manipulate their text and add graphics. The teacher emphasises the quality of content in addition to good presentation. Pupils have been taught how to lay out a poem on the page, and are given an opportunity to experiment with different layouts and make judgements about suitability. The teacher encourages enthusiasm for the quality of the finished product, and encourages self-criticism by organising the class to appraise each other's work using a prepared checklist. This helps the pupils consider and value ideas from their teacher and other pupils.

Example 3

Year 9: Pupils use ICT to monitor the results of a scientific experiment. They have been taught how to use data logging equipment and have some experience of how to make sensible use of data collected automatically with ICT. Pupils design their experiment, collect the data, consider issues of accuracy and equipment reliability, and check the plausibility of their results. They interpret the data, possibly using ICT to help, for example, by representing the data graphically. They use the data to predict outcomes of further experiments and test their predictions. They hypothesise a general rule and carry out further tests. Pupils understand how the use of ICT has improved the quality of their experimental work.

Teaching points: Pupils are taught how to set up the equipment and how to use data logging equipment to record results. They have been taught how to use appropriate software packages to analyse and represent the data. They have been taught to evaluate their results and to check for plausibility.

Example 4

Year 10: Pupils use the graphing facilities in an industry standard spreadsheet package to produce a range of graphs from a set of experimental data. They discuss the appropriateness of different graphs and understand when one particular form of graph is more appropriate than another. They are able to print their graph and explain to others what it shows. They can interpret the graph in terms of the original data source or experiment. They consider how to customise the graph so that it provides all the necessary information for the reader. Pupils can remove default jargon and replace it with their own text. The outcome is a graph which is fit for the purpose and which appears to have been designed for the reader. Pupils are able to import their graphs into other text to produce work of high quality.

Teaching points: Pupils are taught how to make effective use of the graphing facilities and to choose the most appropriate graph for the task in hand, through discussion and exemplification. They are shown how to title and customise the graph appropriately and copy it into other text. Later, when a geography teacher wants the class to produce graphical representation of data, she is aware that the pupils will be able to use the spreadsheet to do this. There is an expectation in the geography class that pupils will use ICT.

Example 5

Year 11: Pupils are engaged in an art project to design a full colour magazine page involving editorial text, illustrations and advertisements. They have studied commercial examples and explored design and layout issues. They have considered fitness for purpose, the audience and how the message is conveyed. They have discussed the characteristics of good quality page design. They have been taught how to use suitable page design, graphics and artwork software. Through the use of appropriate software, they are able to produce work of a quality similar to that published in magazines they have surveyed. They evaluate their own work, and that of their peers. They seek to produce work of the highest quality and are committed to improving their work in the light of the views and feedback of others.

Teaching points: Pupils have access to appropriate software packages and have been taught how to use them (for example MS Publisher, Photoshop, and Illustrator). Help booklets are available for those who have forgotten earlier work. Appropriate hardware is available, including scanners, digitisers, digital cameras, colour printers, etc. and pupils are given an opportunity to use these facilities out of lessons. Pupils have been taught how to handle criticism and comment from their peers and adults.

Example 6

Year 9: Pupils study a period in history. They access information on the Internet from sites already identified by their teacher. They also use search engines to see if they can identify useful new material. The teacher has identified a university lecturer who will be prepared to answer a few questions from the class. Following class discussions, suitable questions are written and emailed to the university. Copies of the replies are given to the class as additional source material for their project. The teacher has also identified a school where students are working on the same topic. There is an exchange of e-mails between the classes, each sharing key findings about the topic and making comment. Pupils understand how they can make effective use of material researched from a variety of sources to improve the quality of their work. They can skim and scan material to identify and record key points. They assemble such material into well-organised prose and incorporate this into their work.

Teaching points: Pupils learn to make sensible and efficient use of the Internet. They are taught how to locate relevant sites, identify and select relevant material, copy material to their notes, and to acknowledge sources and assess veracity. They learn to use source material to illustrate and contribute to their own material and ideas. The teacher bookmarks a range of relevant sites to ensure pupils do not waste time in fruitless searches. Pupils learn how to write polite, well-constructed e-mails asking for information or advice. They know how to send appreciative thank you emails. Pupils have been taught how to handle criticism and comment from their peers and adults.

Discussion points

- When discussing the quality of presentation, how can pupils be helped to distinguish between concepts of 'perfection', which they will never achieve, and 'fitness for purpose' or 'good enough' which they might strive for?
- What teaching approaches will help pupils to distinguish between using the Internet to increase the volume of their work (indiscriminate cut and paste) and using the Internet to improve the scope and depth of their work?
- How can the teacher use assessment criteria, shared with the pupils, to encourage work of good quality?

5) Scope

Pupils use ICT to make practicable learning activities that would otherwise be too onerous, difficult, time-consuming or impossible to achieve. Pupils use ICT to add intrinsic value to a process.

Key words: extend, enhance, explore, question, hypothesise, predict.

Characteristics of scope

- Pupils employ ICT to gain access to experiences, information or resources in ways that are not possible with other media. This extends opportunities and brings a new dimension to teaching and learning.

- Pupils' learning is enhanced by reaching beyond the classroom, via e-mail, Internet use etc, expanding their knowledge and understanding of the world.

- Pupils use ICT to think in new ways. Pupils use ICT to explore and question, hypothesise and predict. They find different ways to do things.

In the classroom you might see or find…

Example 1

Year 1: Pupils control the replay facility on a CD-ROM enabling them to listen and read several times to reinforce the meaning. This facility enables them to double-check their understanding and adjust the pace to their own needs, thereby providing more individualised learning.

Teaching points: The teacher ensures the pupil is tackling activities matched to their individual needs and with an appropriate time expectation. She monitors the pupil's progress, intervening with appropriate questions. The choice of CD-ROM extends and enhances the literacy work being covered by the class.

Example 2

Years 3 and 4: Pupils are communicating via e-mail with another school in this country or abroad. They are comparing aspects of the local environment, the weather, shops, how they travel to school and the sorts of work family members do. Following a series of class interchanges, the two schools set up a video conferencing or simple NetMeeting opportunity, so that pupils can see each other. This generates significant interest and awareness of each other's communities that would not have been otherwise possible. Motivation to communicate with this real external audience is very high and the technology makes a significant contribution to extending and enhancing the pupils' outcomes.

Teaching points: The two teachers use e-mail to keep in regular contact to ensure the project is well planned, and learning objectives remain at the fore. The e-mails are constructed as a whole class and replies are posted onto a board for the whole class to read. In order to practice speaking to a video conferencing camera before they go live, pupils are grouped into threes so that they all have an opportunity to say who they are. Four pupils are selected to represent the class for the main part of the video conferencing session. The class has prepared questions and answers beforehand to aid the live session.

Example 3

Year 5*:* Pupils undertake a data logging experiment to record different insulating properties of various materials. The probes enable the class to measure and record temperature changes that would not be otherwise possible and explore a variety of scenarios. The graphs are automatically generated which enables pupils to quickly analyse what is happening. Discussion can be of a higher quality, as they are able to discuss aspects of the shape of the graph and the rate of cooling.

Teaching points: The experiment is set up and then left to cool while the class work on another aspect of the lesson, in which they have to predict which will retain its heat longest and give a reason why. Pupils are organised into small groups and asked to print and annotate the graphs in order to enable them to focus on the message of the graph. More able pupils are given extension questions that require them to hypothesise and predict how the graph might appear under different conditions. To aid pupils' writing up of the task, they are given an appropriate writing frame. The results are then reinforced as a whole class. The technology has extended the scope of the exercise, enabling pupils to achieve higher quality thinking through more active experiments than might otherwise have been possible.

Example 4

Year 7: Pupils undertake a modelling task using a spreadsheet representing a business plan for making and selling badges at a school open day. The model has rules and assumptions, for example, about the level of sales, cost of materials, number that can be produced in a day, likely maximum that can be sold, and makes a profit and loss statement. Pupils have to alter the assumptions to assess how well the plan works in different situations, making predictions and testing them out. Some will look at the validity of the rules and adjust or change as necessary.

Teaching points: The model has been set-up in advance and has been produced to look simple and attractive. First the pupils are given a range of scenarios to explore what happens and ask a range of 'what if…?' type questions in order to try and find the break even price. Next, they are shown how the rules work and given some questions that help them question the validity of the rules, for example, that there is a maximum number that can be produced in a day. They are then shown how to change the formulae in order to adjust the model and see how it impacts on the previous findings. Pupils are given a sheet to complete at points during the lesson, to get them to enter predictions, record results and consider possible reasons for differences. The activity enables higher quality predicting and hypothesising than might otherwise have been possible.

Example 5

Year 8: Pupils are working on elements of play writing in an English class. The teacher uses an interactive whiteboard to model how some text can be improved and developed. All members can see the display and contribute to the evaluation task in hand. This adds value to the exercise and provides a more effective whole class interaction. Pupils then work individually on their text, reworking their ideas using a word processor.

Teaching points: To encourage the pupils to look critically at the text and redraft it, pupils are given a reading partner to look at the text. The teacher reminds them how to use a table to aid in the layout of the text.

Example 6

Year 10: Pupils have access to a range of up-to-date electronic resource material on an Intranet or the Internet, which supports their study of a modern foreign language. Working with authentic, target-language materials adds value and scope to the activity. The activities become more topical and relevant. Pupils are introduced to authentic sources and apply their knowledge in new contexts. They read to glean information or for gist, dependent on the task in hand. They read for pleasure by accessing articles from web sites of relevant newspapers or teenage magazines.

Teaching points: The relevant source materials have been previously bookmarked to ensure pupils do not waste time in the language lesson looking for relevant sources, and that the language is not too complex. They are encouraged to look at new material and read beyond the task.

Discussion points

- Select a specific age group of pupils. How can ICT add scope and intrinsic value to activities that require pupils to 'find things out' and to 'develop ideas and make things happen'?

- Using a model or simulation *per se* will not necessarily raise the quality of pupils' thinking. Consider your phase or subject. What strategies can be employed by teachers to help pupils to predict and hypothesise, for example, asking 'what if…?' type questions?

- The Internet, CD-ROMs and DVD resources offer access to a huge range of materials. How can pupils be supported to find, select and use effectively and what skills do they need?

And finally … the ICT enabling school

The ICT enabling school values the use of ICT in many learning contexts and pupils are provided with the opportunity to develop high standards in and with ICT. The school has a clear vision of what pupils will experience through taught lessons

and beyond. This vision is apparent throughout the work of the school, from developmental planning through to work on display. The senior management team, subject departments and individual teachers use a rigorous cycle of annual planning to support continuous improvement. Monitoring of teaching and learning ensures that pupils develop higher-level thinking skills through exploiting the full potential of ICT.

Training for ICT is promoted and taken up by all of the senior management team and both teachers and support staff take full advantage of the professional development opportunities on offer. The continuous professional development programme is supported with access to relevant files or teaching ideas, and teachers share lesson plans and resources by using the curriculum network. Management Information Systems (MIS) aid the tracking, target setting, assessment, recording and reporting of pupils' achievements and progress.

The ICT development plan links the budget plan to the drive to raise standards. Funding is set aside to purchase key tools, equipment, peripherals and Internet connections that extend the scope of teaching and learning. There is appropriate software and access to relevant content from a variety of sources that meets the needs of core ICT lessons and also supports subjects' use of ICT. Technical support is of high quality and availability, ensuring that technology issues do not impede teaching and learning.

Accommodation and deployment of resources are set out in the development plan and there is a rationale to support deployment and use of ICT facilities. The development plan includes how access will be further improved to support learning in all subjects. In classrooms, ICT resources are organised to facilitate various learning styles, including individual and collaborative working and there is sufficient space to work away from computers. The school is effectively exploiting the growing resource of home computers and there are schemes in place for working with pupils and members of the local community during out-of-school hours.

The ICT enabling school develops pupils who are:

autonomous in their use of ICT;

capable with ICT;

creative in their use if ICT;

using ICT to produce work of **quality**;

adding value to their learning through the **scope** of ICT in use.

As a result, teaching is more effective, learning is more dynamic and demanding and standards are rising.

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