

Primary Science with ICT: Pupil's entitlement to ICT in primary science

Becta in association with



ICT has fundamentally changed the ways in which scientists measure, handle data and access information. It also offers opportunities to extend work in the classroom and affords insights, possibilities and efficiencies that are difficult to achieve in other ways.

ICT can make a distinctive contribution to teaching and learning science at Key Stages 1 and 2 by helping pupils to observe, record, measure, manipulate and interpret results. It can also extend pupils' ability to exercise choice, work independently and make connections between their studies and the wider world.

Carefully planned activities involving the use of ICT will provide opportunities for pupils to predict, hypothesise, ask questions, evaluate evidence and communicate their findings. ICT is also an effective teaching tool as the presentation of teaching material on a large screen – graphs, microscopy, simulations and observations, for example – enhances whole-class interaction and supports understanding.

The main applications of ICT in science are for:

- providing information
- supporting fieldwork
- assisting observation
- recording and measuring
- sharing data with others
- facilitating interpretation
- simulating experiments
- providing models or demonstrations
- enhancing publishing and presentation.

Providing information

There are many videos, CD-ROMs and websites containing information and interactive activities for use in primary science teaching. These provide an alternative to traditional learning media and help children to appreciate the role of science in everyday life.

Key Stage 1

Active science

A Year 1 teacher used a quiz about animal appearances as a stimulus to class discussion about the external parts of animals. Although the questions and answers are spoken aloud on the site, she turned off the sound function and read out the questions and written feedback to the class, so she could add extra questions and explanations where necessary.



The quiz is in the Humans and Animals section of Active Science.
<http://www.activescience-gsk.com/home.html>

This website contains science activities and information for Key Stages 1 to 4, related to the National Curriculum. The yellow activities are for Key Stage 1.

National Curriculum Science KS1 Sc2 2a:

QCA Schemes of Work Science Unit 1A: Ourselves

Key Stage 2

The BBC Learning Zone



This Year 3 teacher used two short film clips which demonstrated plant growth using time-lapse photography. She showed the clips on a large display, pausing them at appropriate stages to point out what was happening and discuss this with the children.

This website provides rich audio-visual material for use in primary science teaching (as well as other subjects). The videos can be used in many ways, to stimulate and engage pupils or to deliver specific learning points.

You can find the video clips on the Learning Zone.
<http://www.bbc.co.uk/learningzone/clips/>

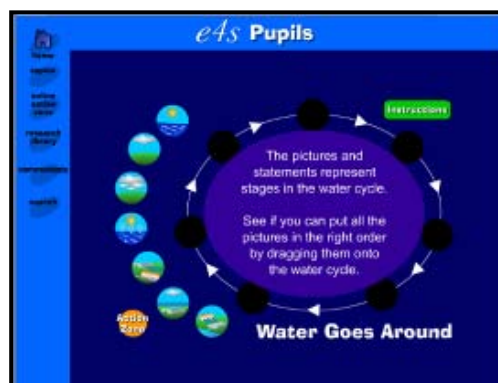
National Curriculum Science KS2 Sc2 3 a, b, c:

QCA Schemes of Work Science Unit 3B: Helping plants grow well

Progression idea

Education for sustainability – e4s

One Year 5 teacher had been working with her children on practical work to demonstrate the properties of condensation and evaporation. She asked individual children to explain what happens when water is heated and cooled and then showed the class the Water Goes Around activity, demonstrating how to hover the mouse to see the explanation that accompanies each diagram. The children then worked in pairs to decide the order of the



pictures that make up the water cycle and complete the diagram online.

The internet is the ideal medium for primary teachers who wish to explore ethical and topical issues in their science teaching. There are also many websites devoted to issues such as wild-life protection and sustainability. Education for Sustainability – (e4s) <http://www.e4s.org.uk/> is a rich source of support materials and pupil activities.

For older pupils, online press cuttings covering a science topic that is currently in the news are also a good stimulus. The Science/Nature section is updated daily on BBC News. <http://news.bbc.co.uk/1/hi/sci/tech/default.stm>

National Curriculum Science KS2 Sc3 2e:

National Curriculum Science KS2 Sc2 5a:

QCA Schemes of Work Science Unit 5/6H: Enquiry in environmental and technological contexts

Supporting fieldwork

ICT can enable children to make virtual visits to distant locations to study different habitats, or to prepare for, and follow up real visits. Many field centres and museums have websites and provide resources for schools.

Key Stage 1

Sebastian Swan

As preparation for a pond-dipping activity in the school grounds, a Year 2 teacher used the online big book Pond Web with the whole class. He focused on the different creatures found in the pond and asked the class to suggest answers to questions such as 'Who ate the?' testing their knowledge of pond animals. He also copied some of the images from the site and created worksheets with pictures of the different creatures. Each worksheet had spaces for children to write the name of the creatures – as well as one creature missing, so children could draw their own picture.

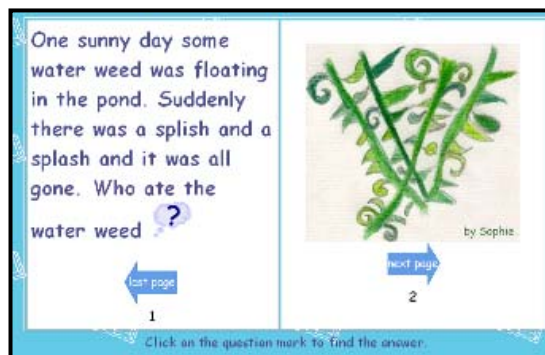
Pond Web is available from Sebastian Swan.

<http://www.sebastianswan.org.uk/index.htm>

l which is part of Naturegrid

<http://www.naturegrid.org.uk> from

Canterbury Environmental Education Centre. This site has many pupil and teacher resources to support classes preparing to visit the centre.



National Curriculum Science KS1 Sc2 5a:

QCA Schemes of Work Science Unit 2B: Plants and animals in the local environment

Key Stage 2

Teachers' TV



A class of children visited the Natural History Museum in London. They went with a specific objective – to investigate how animals move so that they could improve and develop dances based on these movements. They looked in particular at the Creepy Crawlies exhibition and staff from the museum provided support. The teacher had used the Natural History Museum website <http://www.nhm.ac.uk/> in planning the visit and also liaised with the museum staff so pupils could make the most of their trip.

A clip which explains how a visit to the museum can be planned and what activities are provided, is available on Teachers' TV <http://www.teachers.tv/video/2832>.

The Science Museum also has its own website with lots of information and resources for teachers. <http://www.sciencemuseum.org.uk/>

National Curriculum Science KS2 Sc2 2e:

QCA Schemes of Work Science Unit 4a: Moving and Growing

Assisting observation

Digital photography enables children to capture images and view them almost immediately. A collection of such images facilitates discussion and can form the foundation of work in many science contexts.

Key Stage 1

Sources of light

To explore sources of light, this teacher took her Year 1 class on a tour of the school. She began with a whole-class discussion based around photos of different sources of light, asking questions such as: 'Where do you think this is? How is it switched on? When is it needed?'.

The children then went on a walk to explore the school in small groups with adult support. Each group was provided with a digital camera for children to take photographs of light sources.

Back in the classroom, the pictures were viewed and discussed and later used by the teacher to create a multimedia representation of sources of light in the environment.

You can find a lesson plan for this activity in the Direct2U collection on NAACE <http://archive.naace.co.uk/direct2u/> (search for Science Year 1 Sources of Light).

National Curriculum Science KS1 Sc4 3a:

QCA Schemes of Work Science Unit 1D: Light and dark

Key Stage 2

Digital microscope

This Year 5 class were learning how to use a digital microscope. Their teacher explained about various magnifications, how to take a snapshot and how to save a picture. The class then used the microscope to examine a number of minibeasts.



The teacher began by demonstrating to two pupils how to:

- change the light from above to below
- begin the magnification at its lowest level and then work upwards
- take a snapshot of the creature and save the snapshot
- put the creatures safely back into plastic cases without damaging them.

The first pair of pupils then showed the next group how to use the microscope, and so on. The pupils enjoyed watching the minibeasts enlarged on the screen. They could clearly see their movements and interesting features, and were able to describe them well.

There is a case study of a similar activity on NC in Action.

<http://curriculum.qca.org.uk/key-stages-1-and-2/assessment/nc-in-action/items/science/4/1434.aspx?return=/search/index.aspx%3FfldSiteSearch%3Ddigital+microscope%26btnGoSearch.x%3D0%26btnGoSearch.y%3D0%26btnGoSearch%3DGo>.

Digital microscopes can support a wide range of investigations. Direct2U

<http://archive.naace.co.uk/direct2u/> has a lesson plan on Shadows, describing how Year 3 children used a digital microscope to investigate what happens when objects are lit from the back and the front. There is an extensive guide to the use of digital

cameras and microscopes in the classroom on the ASE site.
<http://syacd.co.uk/primary/ict/cameras-and-microscopes.htm>.

National Curriculum Science KS2 Sc2 5b: pupils should be taught about the different plants and animals found in different habitats

QCA Schemes of Work Science Unit 4B: Habitats

A digital microscope is a versatile tool for science teaching. It can be used in all areas of the science curriculum: in Sc2 to study minibeasts, in Sc3 to examine materials and in Sc4 to explore light and shadow.

Among the Direct2U science activities at <http://archive.naace.co.uk/direct2u/> are:

Shadows

Year 3 children used a computer microscope to investigate what happens when object are lit from the back and the front.

National Curriculum Science KS2 Sc4 3b:

QCA Schemes of Work Science Unit 3F: Light and shadows

Using the Computer Microscope to Explore Fabrics

Year 4 children use a microscope to examine fabrics and support investigations into suitable uses.

National Curriculum Science KS2 Sc3 1a, b:

QCA Schemes of Work Science Unit 4C: Keeping warm

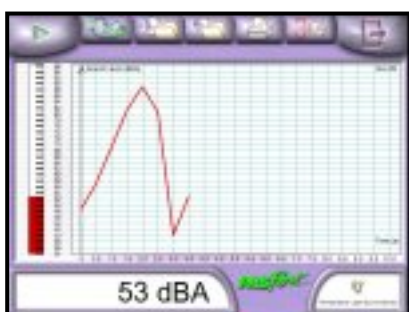
There is an extensive guide to the use of digital cameras and microscopes in the classroom at: <http://syacd.co.uk/primary/ict/cameras-and-microscopes.htm>.

Recording and measuring

Sensors and data loggers can be used in the classroom to record results, plot graphs and analyse data. Automating this routine aspect of information gathering allows teachers to focus on discussion and the use of higher-order information handling skills like analysing and making predictions. ICT can be used to measure changes that take place too rapidly to record by traditional methods, or that take place over an extended period of time. When events are plotted immediately and continuously on screen, children are better able to appreciate what is happening and develop their investigative skills.

Key Stage 1

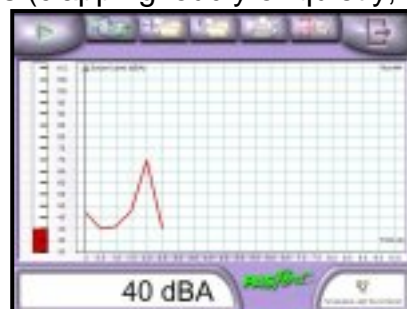
Exploring sounds



A Year 1 class explored sounds using data-logging equipment. The teacher set up the sound sensor using the form of display that best showed the differences between loud and quiet sounds.

She made various noises (clapping loudly or quietly, using a variety of musical instruments, whispering and shouting) and asked children to describe the differences in the display.

How does the display show a loud sound? How does it show a quiet sound?



The children then set up experiments to investigate whether sounds get fainter as they travel away from the source and whether louder sounds can be heard from a greater distance than quiet sounds.

A lesson plan for this activity can be found in on Direct2U <http://archive.naace.co.uk/direct2u/> (search for Science Year 1 Exploring Sounds).

National Curriculum Science KS1 Sc4 3cd:

QCA Schemes of Work Science Unit 1F: Sound and hearing

Key Stage 2

Blackout curtains

This Year 3 teacher worked with the children to help them develop an experiment to answer the question, 'Which fabrics are best for cutting out the light?' They spent a long time considering how they could set up a fair test and deciding what light source should be used, where they should place the light meter relative to the fabric and the light source and how the results could be recorded? They then used a light meter to carry out their experiments, which produced accurate data and graphs which helped them to understand the results.

Details of the activity can be found on Direct2U <http://archive.naace.co.uk/direct2u/> (search for Science Year 3 Blackout curtains).

National Curriculum Science KS2 Sc1 2f:

National Curriculum Science KS2 Sc1 2j:

National Curriculum Science KS2 Sc4 3b:

QCA Schemes of Work Science Unit 3F: Light and Shadows and Unit 3C: Characteristics of Materials

Sharing data with others

Key Stage 1

Big Schools Birdwatch

This class of Year 2 children participated in the RSPB's Big Schools' Birdwatch.

The school caretaker set up a bird table and feeder in the school grounds outside the classroom window. The teacher chose a date for the watch and arranged a rota of children to observe the feeding station for an hour in total. The children kept a tally of all of the birds seen and their results were sent to the national survey.



The Big Schools' Birdwatch is a free activity for schools throughout the UK, which is run every year by the Royal Society for the Protection of Birds in January and February. By observing the birds that visit their school grounds, children and teachers help monitor UK bird numbers. Schools can also create their own database year on year.

A free teacher's activity pack is available and there are lots of resources to help schools carry out the activity in school grounds or a local park, from the RSPB. <http://www.rspb.org.uk/schoolswatch/>

National Curriculum Science KS1/2 Breadth of Study Sc1 1c:

Key Stage 2

The Globe at Night



These Year 5 pupils had to wait until dark to participate in the Globe at Night campaign. This involved observing and recording the magnitude of visible stars as a means of measuring light pollution in a given location. The teacher prepared a worksheet for children to take home to use with their parents. It explained how to locate the Orion constellation and observe what they could see of it on a particular night. The teacher then

entered the data into the Globe at Night online database and showed the children how their results compared with others from around the world.

You can find out more from the US-based Globe Program. <http://www.globe.gov/>

National Curriculum Science KS2 Breadth of Study Sc1 1a, b:

Progression idea

Children could use data from previous Birdwatch surveys to learn more about British birds, including a comparison of their findings with national data. Birdwatch surveys have taken place every year since 1979 and much can be learned by exploring the data gathered in earlier surveys. For example, some of our most familiar birds are in decline: since 1979, the number of house sparrows counted has fallen by 56 per cent, the number of starlings by 76 per cent and blackbird numbers are down by 44 per cent. This data is summarised by the RSPB. <http://www.rspb.org.uk/birdwatch/about/index.asp>

2007 rank	Species	Average per garden
1	Chaffinch	5.17
2	House sparrow	5.09
3	Starling	3.83
4	Blue tit	2.87
5	Blackbird	2.56
6	Greenfinch	1.55
7	Great tit	1.53
8	Robin	1.31
9	Duncock	1.10
10	Goldfinch	1.08

Other national surveys provide more complex data which is suitable for children at the upper end of Key Stage 2, such as the survey of woodlice conducted between 2001 and 2004 by the Natural History Museum. <http://www.nhm.ac.uk/nature-online/life/other-invertebrates/walking-with-woodlice/results.html>.

National Curriculum Science KS2 Sc1 2I, m:

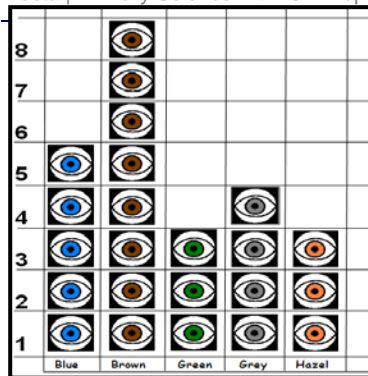
Facilitating interpretation

Prepared databases or spreadsheets provide sources of useful information and allow data to be interrogated and analysed. Information can be sorted, grouped and displayed in various formats (including graphs) to allow relationships to be explored and conclusions drawn. Children will also learn how to record their own data using ICT, structuring it in such a way as to aid investigation.

Key Stage 1

A survey of eye-colour

A Year 1 teacher used pictogram software to gather, record, display and discuss information about the eye colours of children in the class. She began with a discussion about eye colours and the words used to describe them. She then worked with the whole class using a data projector and demonstrating how to set up a graph of eye colour. With the help of a teaching assistant, the class were then organised into groups of similar eye colour, and the numbers in each group counted so this data could be added to the chart.



When the survey was complete, the class discussed the display addressing questions such as: What can we find out from the graph? Can we tell how many children have blue eyes? Which eye colour is the most common? Which is the least common?

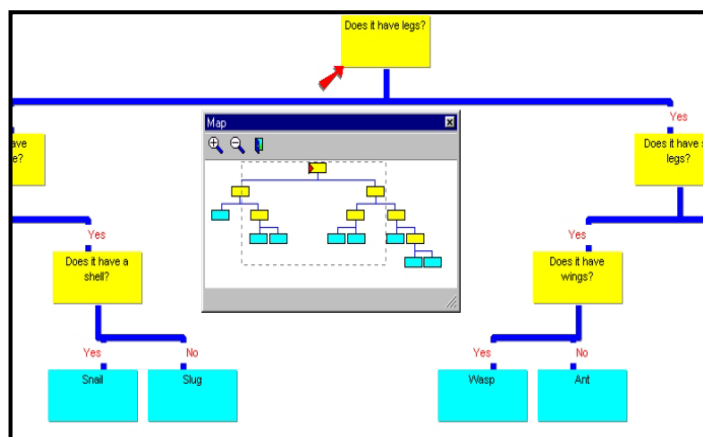
You can find a lesson plan for this activity on Direct2U <http://archive.naace.co.uk/direct2u/> (search for Science Year 1, A survey of eye colour).

National Curriculum Science KS1 Sc2 4a:

QCA Scheme of Work Unit 1A: Ourselves

Key Stage 2

Branching databases: Minibeasts



A mixed class of Year 4 and Year 5 children used a branching database to create a key to identify a set of minibeasts. In a previous lesson the pupils had conducted a minibeast (insect) hunt and had successfully collected and observed a range of minibeasts. There had been a group discussion to name all the different minibeasts. The teacher introduced the idea of a scientific key (a list of specifications to describe a species) and explained that the pupils had to identify the correct minibeast by asking questions that gave yes/no answers. She set each group the task of creating their own key using computer software (a branching database) that would help them to do this. When all of the groups had completed their diagrams, the teacher demonstrated some finished keys to the class.

For details of this activity see Minibeast tree diagrams on NC in Action <http://www.ncaction.org.uk/search/index.htm> (search on Science, KS2, using ICT, find all examples where pupils used ICT).

National Curriculum Science KS2 Sc2 4a:

National Curriculum Science KS2 Sc2 5b:

National Curriculum Science KS2 Sc1 2h:

QCA Schemes of Work Science: Unit 4B: Habitats

Progression idea

Elastic forces

A Year 3 class of children made predictions and set up an experiment to investigate the force exerted by a stretched elastic band. They recorded their results in a spreadsheet table and viewed them as a bar chart to discover whether their predictions were correct.

You can a lesson plan for this activity on Direct2U

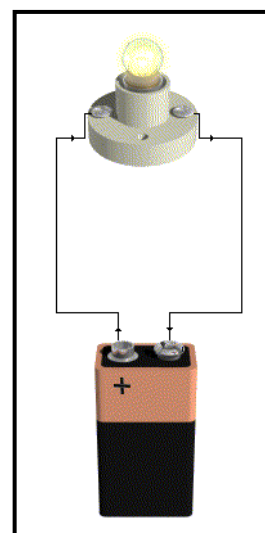
<http://archive.naace.co.uk/direct2u/> (search for Science Year 3, Elastic Forces).

National Curriculum Science KS2 Sc1 Scientific enquiry; Sc4 2e:

QCA Schemes of Work Science Unit 3E: Magnets and springs

Simulating experiments

Simulations can never be a substitute for hands-on practical science, but they can enable children to experiment with phenomena that may be too slow, too fast, too dangerous or too expensive to experience in school. They can also be used as introductory or follow-up work to practical science, providing ideas for experimental design or consolidating understanding. Within simulations children are able to investigate the effect of changing variables and deepen their understanding of scientific ideas by asking 'What if...?' type questions without the diversions of faulty equipment or messy practicalities that frequently accompany scientific experimentation.



Key Stage 1

Crocodile clips

A Year 2 teacher used this program as an extension to practical work as the class had already carried out activities building simple circuits using real bulbs and batteries. She demonstrated how the program worked using a computer and projector and then children worked in pairs to recreate the circuits they had made with real equipment. The program also enabled the more able children to go further, constructing circuits which required more components than they had available in the classroom.

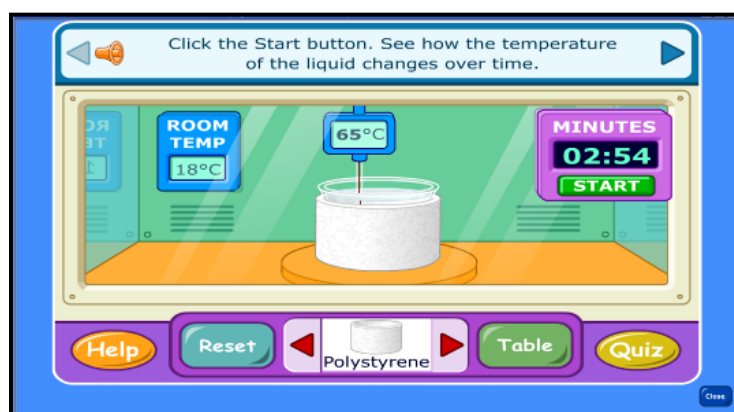
You can download Crocodile Clips http://www.crocodile-clips.com/en/Yenka_Basic_Circuits/ for free once you register online. The program provides on-screen tools which allow pupils to select basic pieces of virtual electrical equipment and connect these together in a circuit. Connections are made by clicking and dragging virtual wires between the terminals. Switches can be included, and when a switch is thrown (it rocks when clicked) the virtual bulb, virtually lights or the virtual buzzer actually buzzes. The free software covers everything that primary school pupils are likely to need and is useful at Key Stages 1 and 2.

National Curriculum Science KS1 Sc4 1b.c:

QCA Schemes of Work Science Unit 2F: Using electricity

Key Stage 2

Which materials provide the best insulation?



Children from this Year 3 class used an activity from the BBC Schools Bitesize website to investigate the use of different materials for insulation. The teacher demonstrated the software to the class and then allowed children to work through the experiment in pairs.

This is a neat little virtual experiment on the insulating properties of various materials. The resource is well supported with online and off-line lesson plans, a worksheet and a quiz. The activity provides a container full of a virtual liquid, which is initially at 70°C while the room temperature is 18. The thermometer indicates the change in temperature over a period of 60 minutes (speeded up – not in real time). The simulation may be paused at any time and clicking on the Table button brings up a table where it is possible to enter the temperature readings. The beaker can be virtually wrapped with polystyrene, cardboard or metal foil and the experiment repeated to see how the cooling times are changed. You can find it on Bitesize. http://www.bbc.co.uk/schools/ks2bitesize/science/activities/keeping_warm.shtml

National Curriculum Science KS1 Sc3 1b.2c:

QCA Schemes of Work Science Unit 4C: Keeping warm

Progression idea

BBC Bitesize



A Year 6 teacher encouraged her class to use the BBC Bitesize website for homework activities in the half-term before their SATs tests.

The Science section of the BBC Bitesize site has many more virtual experiments covering topics in all areas of primary science.

<http://www.bbc.co.uk/schools/ks2bitesize/>

National Curriculum Science KS2 Sc1 1b:

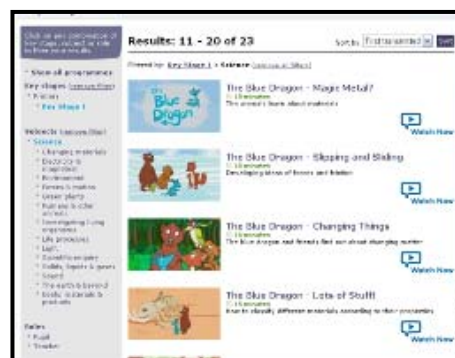
Providing models or demonstrations

Animations and virtual models on video, CD-ROM or the internet allow children to see things that cannot be directly observed and thus develop understanding. Such models are often best explored through direct teaching using a large screen display.

Key Stage 1

The Blue Dragon

A Year 1 teacher used a series of videos from Teachers' TV to introduce a number of concepts from the science curriculum. In the first film the Blue Dragon introduces the main characters (cartoon animals) who find an egg which hatches into a blue dragon. The teacher used the animation as a stimulus to discuss with the children:



- the differences between something that is alive and something that is not
- the stages of animal life cycles from babies to adult
- what animals need to stay alive.

The Blue Dragon is the generic title for a series of 15-minute animated films which cover: sounds, light, shadows and reflections, circuits, materials, forces and friction, changing and classifying materials, recycling, plants, living healthily. All can be

downloaded and used off-line. You can see them on Teachers' TV.
<http://www.teachers.tv/video/1773>

National Curriculum Science KS1 Sc2 2f:

QCA Schemes of Work Science Unit 1A: Ourselves

Key Stage 2

Phases of the moon



A teacher used an online simulation of the orbit of the moon to demonstrate the pattern and time scale of changes in the moon's appearance over a 28-day cycle.

Using an electronic whiteboard, she took the class through the activity, ensuring that the children appreciated that the model is not to scale and that the Sun is off screen far to the right.

She asked the class questions such as:

- What is the source of light at night?
- How does this light reach the Earth?
- What does the moon do to the sunlight?'

There are many online orreries which demonstrate the movements of the sun and moon. The one featured is freely available online from Liverpool John Moore's University's National Schools' Observatory.

<http://www.schoolsobservatory.org.uk/astro/textb/solsys/moonphs.htm>

You can find a lesson plan for this work by visiting Direct2U

<http://archive.naace.co.uk/direct2u/> (search for Science Year 5, Phases of the moon).

National Curriculum Science KS2 Sc4 4c:

National Curriculum Science KS2 Sc4 4d:

QCA Schemes of Work Science: Unit 5E: Earth, Sun and Moon

Communicating

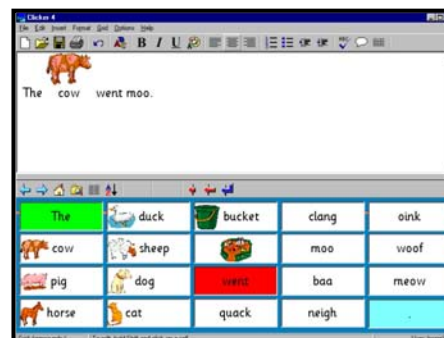
ICT allows children to prepare work which is neater and more accurate and present their findings to others clearly and confidently. They are able to refine their work by developing a draft into final copy and to write for real audiences as they prepare

leaflets, posters, web pages and slide shows to present scientific ideas using text, graphs, pictures, sound and video.

Key Stage 1

Farm sounds

After a farm visit one teacher introduced the children to online grid software (a clickable grid combining pictures of objects and animals from the activity, sound effects and word-bank software) so they could further explore the farm and the noises found there. The teacher asked the pupils to imitate the sounds. The pupils then voted for the best impersonator for each sound and that pupil recorded their version of the sound into the software, using a microphone. The sound was stored in the cell showing the word for the sound name (for example 'moo') so that it would play when that cell was right-clicked.



Once the grid was complete, the pupils worked in small groups at the computer to create a sentence about each of the sounds by clicking on words from a word bank. The activities developed the pupils' ICT skills and demonstrated how ICT could be used to record and display information in a variety of ways. They were able to produce a number of resources; for example, worksheets and print-outs for the classroom display.

See Farm sounds on NC in Action: <http://www.ncaction.org.uk/search/index.htm> (search on KS1 science).

National Curriculum Science, Sc4 3c:

QCA Schemes of Work Science 1F: Sound and hearing

Key Stage 2

School safari

A group of Year 3 children suggested making a video about wildlife around the school. All of them enjoyed watching wildlife films and they wanted to find out more about the minibeasts and other creatures in the school environment. The children searched the school grounds for minibeasts and other wildlife and discussed with the teacher the kind of animals that could be filmed. They filmed in situ and using a computer microscope.



You can read a full case study of this work in Sharing Good Practice Issue 5 – available from the ictopus website www.ictopus.org.uk where you can also see the video: http://www.ictopus.org.uk/video_clips/SchoolSafari.htm made by the children.

National Curriculum Science KS2 Sc2 5b:

National Curriculum Science KS2 Sc1 2h:

QCA Schemes of Work Science: Unit 4B: Habitats