USING ICT TO ENHANCE TEACHING AND LEARNING

Today's scientists model, measure and report on their experiments and they do this using a variety of ICT software. Children developing their scientific understanding also need to do these things. As they work they need to record their ideas, assemble data, perform measurements and communicate their thoughts and findings to others. In a modern world 'content free' ICT tools, ie word processing/spreadsheet packages etc, are crucial to this process. The use of such software allows the young scientist to focus on the science involved and not on elaborate drawing or time-consuming colouring-in of graphs.

To this end, this book has pointers, in the margins, towards opportunities for the use of ICT. The icons next to the activities are indications of the opportunities to use generic software to enhance teaching and learning in the contexts indicated. There are many different types of 'content free' pieces of software available that allow users to communicate and handle information to support work in primary science. It is important to be able to distinguish between the types so that decisions can be made about their suitability for specific purposes.

COMMUNICATION

The software tools used for communicating fit into the categories below. All have different functions but most will allow for the communication of information in text, graphics and sound.

- Word processors
- Graphics packages
- Presentation tools
- Multi-media authoring packages

Word processors can store both text and images and allow these formats to be reviewed. They are simple to use, can be accessed quickly and the data in them amended. Modern word processors are also good at handling text, graphics and sound making them useful multi-media tools. Tables built in a word processor are exceptionally useful for clarity of collation of information. It is possible to use a conventional word processor with a 'find' option to do some careful 'key word' sorting of collected data.

Graphics packages allow the creation and storage of images. Each child drawing a picture from observation and then saving it so that the images can be reviewed and re-ordered would be a good KS1 model.

Presentation packages such as MS PowerPoint allow for the input of text and images and these can be easily ordered and displayed. Sound and video can also be added here. It is important to remember that data is not just text and numbers but can be sound, still image, moving image and animation.

Multi-media authoring packages allow for many different kinds of information to be combined together to make a sensory experience out of searching and accessing information. The World Wide Web and the CD-ROM are manifestations of this idea.

DATA HANDLING

The software tools used for data handling fit into the following categories:

- A 'free text' or 'card file' database
- A branching database
- A graph maker
- A flat file or single file database
- A spreadsheet

Each does a specific job but there are overlaps and some versions of each are more suited to younger than older children.

A 'Free text' database

These databases allow users to type in information about things or collect sets of pictures of things in their own way. The database itself is unstructured so can be used by very young children. There are proprietary versions of this type of software, often called 'card files'.

A Branching database

Branching databases (or sometimes called binary trees) are those which work by the users supplying 'yes' or 'no' answers to a series of questions. There are two main types in use at present but the principle of each is based on the idea of unique identification. The usual way of building such a database is to select a number of items and proceed to write questions which divide the items up based on the 'yes' or 'no' answers to carefully written questions. The most general questions are asked first and the more specific ones later. The process of doing this eventually identifies each individual item in the database. The valuable thing, in terms of science in the primary school, about using this type of database, is in getting the children to build the trees themselves. The technology is a way then of displaying their thinking and allows them to refine it.

A Graph maker

This is a software programme which simply allows data collected to be presented in a graphical format. Some programs present the data as pictograms, as ticks (as in a tally chart), as blocks (as in the manual version – unifix or multi-link) or as standard bar, line and pie charts.

A Flat file or single file database

This type of database stores information in records which have a common format, being divided into a number of pre-determined fields. Before data can be entered into the database it must be 'set up' to receive it. The decision to use a flat file data base usually begins because there is a question to answer that needs the collection of some data eg do all the materials we have tested stretch? The information can then be viewed graphically. Flat file databases are good with words and numbers but are better for words.

A Spreadsheet

A spreadsheet is like a flat file database in many ways. Data is stored under similar field headings but can be manipulated in many different ways. Spreadsheets are excellent at handling numerical data, they are also good for mathematical modelling and doing calculations. Information in them is arranged in cells, and any information – numbers, words, formulae etc. can be entered into an active cell. The cells can be selected and the information in them displayed graphically *in* any of the usual ways (block, bar, pie, line etc.) including correlations with scattergrams.

SENSING PHYSICAL DATA (DATALOGGING)

With a sensor connected to a computer via an interface box or connected directly through one of the available ports (this depends on the sensors), physical data such as changes of temperature, light or sound can be collected and displayed. The simplest sensors display the data in spreadsheets or in software written to optimise visually the information, which has been collected. In science at a primary level probably the most useful of these is a sensor which can record temperature change over a period of time or as 'snapshots'.

There are sensors available that can be used independently of a computer, and then connected for data analysis.

CONTENT SPECIFIC SOFTWARE TO SUPPORT WORK ON MATERIALS AND THEIR PROPERTIES

There are numerous CD-ROMs and programs that could be used by teachers to capture the interest and imagination of their pupils. The use of these powerful tools as motivators and catalysts for discussion is the responsibility of individual teachers. It is they who must do a little research to ensure that the materials presented to children do not harbour the potential to bring about misconceptions, nor does the excitement of ICT detract from the learning of science.

Reviews of software available for primary science education can be found at

http://www.chemsoc.org/networks/LearnNet/thats-chemistry.htm

Below is a very short list of content specific software which teachers might find useful for enhancing the work on materials and their properties.

Science Explorer	Granada
Science Explorer II	Granada
Becoming a Science Explorer	Dorling Kindersley
Mad About Science 3 Matter	Dorling Kindersley

USEFUL WEBSITES

This is not intended to be an all-inclusive list. Some of these sites are for children with information at that level and some are for teachers to improve their subject knowledge and to support ideas. Most will have some content for both purposes. Teachers will need to visit these sites and spend time deciding whether the information/simulation/activity displayed enhances their teaching and the children's learning. (Sites accessed November 2000)

chem4kids
http://www.chem4kids.com/

e4S have some animations
http://www.e4s.org.uk/

QUEST
http://www.nhm.ac.uk/education/quest2/english/index.html

Scienceweb
http://www.scienceweb.org.uk/index.htm

Virtual Teachers Centre
http://www.vtc.ngfl.gov.uk/vtc/curriculum

Volcano world
http://volcano.und.nodak.edu/vw.html

Science Museum
http://www.nmsi.ac.uk

Roger Frost's site
http://www.rogerfrost.com

TOOLKITS

Many software companies put together generic toolkits. Sets of software which integrate together to provide users with the ability to communicate in text, graphics, charts and tables.

It is worth contacting RM, Granada Learning, BlackCat Educational Software, Softease and Edu Tech, amongst others, for details of these integrated packages. Contact details for these companies can be found at
http://www.chemsoc.org/networks/LearnNet/thats-chemistry.htm

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GROUPING AND CLASSIFYING MATERIALS
on the basis of their simple properties

Science background for teachers

VOCABULARY

Names of a variety of materials; wood, metal, plastic, paper, rock, sand, chalk, fabric, leather, cotton, oil, wax, natural, man-made

Words to describe materials using the senses; shiny, dull, transparent, soft, hard, rough, smooth, including 'smelling' and listening words such as smells 'peppery', sounds loud

Words to describe properties; solid, liquid, strong, tough, magnetic, bendy, squashy, elastic, waterproof, floater, sinker

For children, 'materials' often mean fabrics or textiles when in fact we can use it to mean any substance. Materials exist as solids, liquids or gases and as mixtures of these and when introducing their classification it is worth beginning with this grouping especially with young children, since, for example, many of them think of liquids as being only water. Materials are also natural or man-made. Confusion often arises for children because man-made materials can be divided into two groups; those that are derived from natural products but are refined or altered by man for his use, and synthetic products originally derived from substances from the Earth and then changed chemically into new products. A further complication comes from the fact that some things originally made from the natural material like candles from beeswax, are now more commonly man-made, in this case from paraffin wax. At this stage it is also worthwhile discussing the term man-made where the word man is used generically and not specifically.

Natural materials include wool, cotton, linen, leather, wood, cork, stone, gravel, sand, salt, coal, gypsum, talc, some metals eg gold and silver, silk, oil, gemstones, beeswax.

Converted raw materials include pottery, china, earthenware, most metals eg steel and aluminium, coke, charcoal, rubber, paints, some medicines and drugs, paper and viscose.

Synthetics include plastics, polyester, acrylic, PVC, nylon, polythene, glass, some other medicines and drugs.

Materials are used for different jobs on the basis of their properties, so young children need to begin to identify such properties before they can consider the suitability of materials for different uses. They can group materials on the basis of the simple properties that they can experience with their senses, beginning with simple ideas such as texture, and building up to more complex concepts, such as elasticity. A large amount of descriptive vocabulary can be introduced in this context.

Most towns and villages have areas where glass, paper and metals can be taken, sorted and put into the appropriate bins for recycling. This science topic is an ideal opportunity to raise the children's awareness of this idea.