

# Sharing good practice

**27/2/10** *This week we look at ICT in primary science, using as a focus the second of our 'blast-from-the-past' pieces. This is an article by Michael Negus, first published in 1981, which looks at the potential of the 'microcomputer' in the teaching and learning of primary science. As with Roger Keeling's article in SGP42 this piece shows remarkable foresight. Editorial margin notes make comparison between Michael's piece and the Becta science entitlement document. Finally we look at what Michael failed to foresee - the use of the internet for cooperation and collaboration.*

**SGP90 Science**

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## ICT in primary science: a pupil's entitlement

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Last year Becta published a series of entitlement documents written by subject and phase experts to guide teachers on making the most of ICT in these areas. They are available in a variety of formats at <http://schools.becta.org.uk> - follow Curriculum (left-hand menu) choose Science from the subject list and then the document 'ICT in primary science: a pupil's entitlement'. The document is introduced as follows:

*'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.*

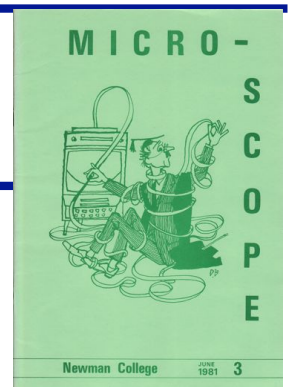
*Carefully planned activities involving the use of ICT will provide opportunities for pupils to predict, hypothesise, ask questions, evaluate evidence and communicate their findings. ICT is also an effective teaching tool as the presentation of teaching material on a large screen – graphs, microscopy,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

The document goes on to provide examples at both Key Stages of software and web-based applications to support nine different aspects of science teaching. The overlap between these suggestions and the ways in which leading edge teachers were using ICT in primary science almost twenty years ago is quite remarkable so we have based this issue of SGP on an article published in an early issue Microscope. This was the magazine of the organisation MAPE (Micros And Primary Education) of which most of the ictopus development team were active members.

We hope you enjoy the comparisons©

# Computers and Primary Science

Michael Negus - from *MicroScope* 3, June 1981



Remember this was written before the National Curriculum was even dreamed of!

Unfortunately we have been unable to contact Michael Negus. If any reader knows of him I would be grateful if you could ask him to get in touch with us at ictopus.

It may seem to many teachers rather premature to suggest a use for computers in primary science when in many schools no science is taught. Nationwide there is a concerted effort to encourage the incorporation of science into the primary curriculum.

The phrase 'computers and primary science' may suggest that primary science has need of sophisticated technology. The exact opposite is, in fact, the truth. Primary science, whether observational or experimental, requires only the most readily available equipment, much of which would normally find its way into the waste bin. Of course, specifically scientific equipment is not excluded from science: it is merely not essential.

The microprocessor in the primary school has found its immediate and most obvious use in the fields of mathematics and language, the emphasis in each case being on computer-aided learning, interaction between pupil and microprocessor. So far as science is concerned the micro should be used to assist, complement and extend practical investigations without in any way trying to supplant them. We will, however, at the end of this article suggest a possible future development in primary science, which will mean that the computer can play a role as equipment in first-hand, practical investigations. As well as enriching scientific investigation the micro can help with science by simulating events and situations that are impossible in school.

Because science is essentially the observation and manipulation of materials, direct contact with the physical and biological world, wherever possible, is a necessary pre-requisite for the use of a relevant computer program.

By way of illustration and example six areas of program development are described below, some of which are currently being developed by the author.

## Editor's Note

All the subsequent margin notes make comparisons between Michael's 1981 article and the Becta entitlement document. The latter identifies nine applications of ICT in the primary science curriculum:

1. providing information
2. supporting fieldwork
3. assisting observation
4. recording and measuring
5. sharing data with others
6. facilitating interpretation
7. simulating experiments
8. providing models or demonstrations
9. enhancing publishing and presentation.

Amongst the ictopus lessons2go there are also activities that typify Michael's six areas. These are indicated in red below. All these lessons can be found on the ictopus website under Resources> lessons2go> Materials by subject > Science.

However, we regret that Michael's own programs and the others that he mentions (mostly developed for RM 380Z computers) are not now available. If you know of any equivalents we would love to hear from you.

## DATA HANDLING

This is covered under item 6 of the Becta document – children use graphing software, databases and spreadsheets to record and analyse data.

The computer is probably most "at home" when employed as a tool for the rapid analysis of data. Data collection and sorting are important components of graph construction in the junior school (e.g. foot length, eye colour, height etc.) Programs to extend this area of education need to be sufficiently flexible to enable almost any kind and quantity of data to be input.

Such programs make it possible for the results of analysis, rather than the method of analysis, to be given the focus of attention. Large numbers of measurements can be stored, sorted and output in tabular or graphical form. Thus, for example, the analysis of sizes of children in virtually a whole school, rather than just a class, becomes a real possibility. Such sorted data would be invaluable in the context of a topic such as Growth. There are obvious applications of such programs in other areas such as environmental studies.

See I2g *Characteristics of materials* for ages 7-8, *Friction* for ages 8-9, *Measuring heartbeats* for ages 9-10 and *Dissolving* for ages 10-11.

## SIMULATIONS

This is covered under item 7 in the Becta document. There are a large number of simulations available from the BBC (although none specifically addresses the sounds experiment that Michael describes).  
<http://www.bbc.co.uk/schools/scienceclips/>

The science of sound is a commonly chosen area for investigation in both infant and junior classes. Observations result in the description and classification of sounds with regard to their pitch, loudness and quality; investigations include trying to change pitch, discover resonance and achieve amplification. The speed of sound through air is measured by the echo method - measuring the time taken for a sound (two bricks banged together) to travel across a playground and echo back to the observer off a high wall. Such measurements are essentially practical exercises but may be extended and made more accurate by computer simulations of travelling sound waves. The program ECHO, by the author ... enables the pupil to find the time taken for sound to travel through chosen distances in air, water and metal and so eventually enables the pupil to calculate for himself the speed of sound in these different materials.

See I2g *Sorting and using materials* and *Growing Plants* for ages 5-6, *Rocks and soils* for ages 7-8, *Friction* for ages 8-9, *Changing sounds* for ages 9-10 and *Forces in action* for ages 10-11.

## INTERACTION

This is covered under item 8 in the Becta document. Virtual oraries, which demonstrate the movements of the sun, moon and planets, are available from many websites.

Certain areas of primary science lend themselves naturally to very interactive programs. One example is astronomy, with obvious use of graphics. Another is the topic of magnetism and electricity. Concepts and information derived from experiments with magnets and circuits can be thoroughly tested, verified and assessed by suitable question/answer programs. Circuit diagrams in particular, because of their simple 'rectangular' nature, readily lend themselves to a modular graphics display. Jones (1980) mentions such a program, called 'Circuits 8-12' for Apple II.

See I2g *Electrical circuits* for ages 6-7, *Phases of the moon* for ages 9-10 and *Changing circuits* for ages 10-11

## KEYS

This is covered under item 6 of the Becta document – children use a branching database to create a key to identify a set of minibeasts.

Classification is an important aspect of primary mathematics. It is also of cardinal importance in the interpretation of scientific information as well as in the construction and use of keys for the identification of unknown plants and animals. ITMA (The College of St Mark and St John, Plymouth) has recently produced an ingenious package of programs developed from the well-known ANIMAL key program. Two master programs THINK and SEEK make it possible to use the files SLUGS, TWIG, POWDER and ANIMALS. These offer interactive binary tree systems for the identification of slugs, twigs, powders and animals. The files grow

Most computers at that time had less than 48K RAM!!!

with use; mistakes, which inevitably will be added to the files by children, can be replaced by the teacher. New files can be created by a program called INTREE. Programs of this kind do have a few problems. The teacher must regularly monitor the files for mistakes; also, the micro needs a 48K RAM.

See I2g *Sorting and classifying* for ages 6-7 and *Pond life* for ages 8-9.

## CONCEPT DEVELOPMENT

This gets close to item 1 in the Becta document – see Editor's note on page 5 below.

The author has a particular interest in the correct development of such concepts as mass, force, weight and pressure in primary science together with an understanding of the standard units involved. The computer can offer considerable help in the development of such concepts by means of programs that combine graphical illustrations with interactive question/answer components. One such program, called MASS is currently being developed by the author. Another program, to be called CHAIN, will assist the development of concepts associated with ecological food chains.

See I2g *Living or non-living* for ages 5-6, *Seasonal Changes and Plants and animals* for ages 6-7, *Moving and growing* for ages 8-9, *Pollen Park* for ages 9-10 and *Interdependence and adaptation* for ages 10-11.

## COMPUTER GAMES

The Becta document does not make a distinction between simulations and games – this is covered under item 7.

Some computer games can be useful from a scientific point of view. Programs like LUNAR LANDER or ROCKET (Digital Computer Games, 1975) can easily be adapted for 380Z with graphics. These programs together with others that involve missiles, bombs and so on require the pupil to estimate speeds, distances, forces etc. The programs have obvious educational uses: missile programs teach 'intuitively' the resultant of vectors; ROCKET, the landing of an Apollo capsule on the moon, teaches the relationships between fuel consumption, thrust and the controlled rate of descent against lunar gravity.

The use of computers in primary schools is in its infancy. The use of computers in the context of primary science has hardly begun. Undoubtedly many mistakes will be made, but mistakes are part of an ongoing learning process. Primary science programs will become increasingly available as computers become the normal possession of primary schools.

This is covered under items 3 and 4 in the Becta document. Technological developments, which Michael speculates about, have included digital cameras, computer microscopes, sensors and data logging equipment in addition to control systems.

To conclude, mention should perhaps be made of a relatively new development in primary science. This is primary technology or applied primary science, the design and construction of equipment to perform a specific task or make a desired measurement. Those interested should read Evans (1977, 1980). At the same time we can expect that microelectronics will gradually be incorporated into the electricity sector of primary and middle school science. The 'black box' aspect of integrated circuits probably makes them more suitable for this age range than microelectronics. It is quite possible to suppose that once primary schools have computers cheap interfaces will become more available (one is already being sold by Oundle School). Then the computer could be used to analyse inputs from peripheral equipment (made in the primary school) or even to act as a simple control system.

See I2g *Exploring sounds* or *Exploring sources of light* for ages 5-6, *Shadows* for ages 7-8 and *Using a computer microscope* for ages 8-9.

## References

- Digital Equipment Corporation (1975): 101 Computer Games.
- Evans, P. (1977): Technology in the Primary School. ASE booklet
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- Jones, R. (1980): Microcomputers: their uses in Primary Schools. Council for Educational Technology.



## Editor's note

So what did Michael fail to foresee?

Answer: **the Internet!**

Back in 1981 none of us dreamed that so much information would be available so readily and so accessibly through the use of the Internet and powerful search engines. Item 1 in the Becta list is about using CD-ROMs and the Internet to find out about science and item 2 is about using the Internet to plan and prepare field trips. However, Michael's CONCEPT DEVELOPMENT section gets close when he speaks of 'programs that combine graphical illustrations with interactive question/answer components'.

The power of the Internet for sharing was also unforeseen. Item 5 in the Becta list involves using ICT to collaborate with peers and participate in national and international projects and item 9 is all about using word-processors, publishing and presentation software to communicate their findings to a wider audience. To compensate for this gap in Michael's document our next article provides a roundup of some of the ways in which ICT can be used to cooperate and collaborate in primary science.

## Using ICT in 2010 to cooperate and collaborate

Heather Govier

Perhaps the most well known collaborations are the Springwatch/Autumnwatch series from the BBC - see [www.bbc.co.uk/springwatch](http://www.bbc.co.uk/springwatch). These are seasonal projects, which involve studying and supporting the natural environment and many include collaborative data collection exercises.



During the January snows, for example, Snow Watch was launched. A blog was set up inviting people to write in with observations on how the natural world in their area was coping and to submit photographs to a Flickr group. There was no specific schools section for this but children did contribute and ask questions and there would be nothing to stop schools getting involved in this type of project.

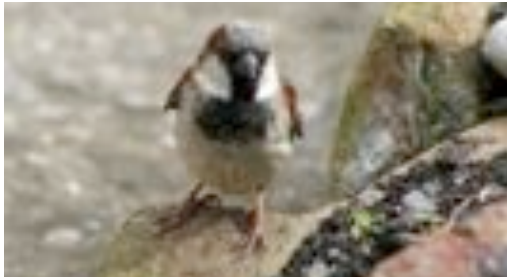
Breathing Places, also from the BBC does have a specific schools section [www.bbc.co.uk/breathingplaces/schools](http://www.bbc.co.uk/breathingplaces/schools), which offers many ideas for projects and activities - some involving data sharing activities.



There are links from the BBC sites to many other collaborative projects. The UK Ladybird survey, for example - [www.ladybird-survey.org](http://www.ladybird-survey.org) - provides information about the various ladybird species and online forms to record observations. Part of that site is specifically aimed at children and includes access to a Little Ladybird Spotter Pack. There is similar site where sightings of painted lady butterflies can be reported and which shows the collected data in the form of maps. In January

two butterflies had been reported one just south of Edinburgh and another near Huntingdon.

The British Trust for Ornithology website hosts many surveys of bird populations and the Royal Society for the Protection of Birds (RSPB) runs annual projects aimed specifically at schools. This year's Big Schools' Birdwatch, which ran from 18<sup>th</sup> January to 1<sup>st</sup> February involved a simple bird survey to be carried out within school grounds or in a local park - [www.rspb.org.uk/schoolswatch/index.aspx](http://www.rspb.org.uk/schoolswatch/index.aspx) - and the parallel Little Schools' Birdwatch was aimed specifically at the Early Years sector [www.rspb.org.uk/schoolswatch/little/index.aspx](http://www.rspb.org.uk/schoolswatch/little/index.aspx). A free teacher's activity pack was available and there were themed videos from Teachers TV to help schools get the most from the projects.

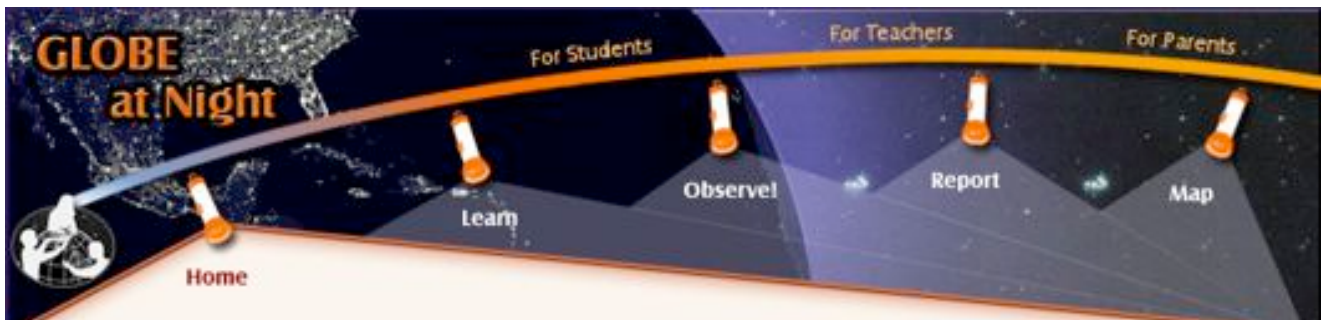


Birdwatch surveys have taken place every year since 1979 and much can be learned by exploring the data gathered in earlier surveys. For example, the survey has recorded the huge declines in some of our most familiar birds. Since 1979, the number of house sparrows counted has fallen by 56%, the number of starlings by 76% and blackbird numbers are down by 44%. This data is summarised on-line at <http://www.rspb.org.uk/birdwatch/about/index.asp>

Other national surveys provide more complex data, which is suitable for children at the upper end of KS2, for example, the survey of woodlice conducted by the Natural History Museum between 2001 and 2004:

<http://www.nhm.ac.uk/nature-online/life/other-invertebrates/walking-with-woodlice/results.html>

Science Across the World (see SGP87) is a network of schools from 147 countries collaborating on science topics and Planet Science [www.planet-science.com/home.html](http://www.planet-science.com/home.html) supplies weekly newsletters, which include numerous collaborative projects.



The GLOBE (Global Learning and Observations to Benefit the Environment) Program - a US based project - hence the spelling - is a worldwide hands-on, school-based science and education programme which encourages students, teachers and scientists to collaborate on inquiry-based investigations of the environment. While many of the projects are aimed at the secondary sector there is much for upper primary including for example Globe at Night - [www.globeatnight.org](http://www.globeatnight.org) - an annual project which runs this year from 3-16<sup>th</sup> March. The project involves observing and recording the magnitude of visible stars (Orion) as a means of measuring light pollution in a given location. Children are shown how to locate the Orion constellation and observe what they can see of it on a particular night. Data can then be entered into the Globe at Night on-line database and results compared with others from around the world.

By using ICT to collaborate with schools and scientists across the world children are participating in 'real' science - a perfect context and stimulus for learning.