10 Primary Science ICT Tools and Techniques

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Introduction

ICT can enhance teaching and learning in the primary science lesson and while ICT capability is embedded in the Science learning area, you as a teacher can make the most of this opportunity and develop ICT capability within the context of science.

ICT can:

- Facilitate links with other places, subjects and other people.
- Facilitate the asking of questions and forming or modification of opinions
- Provide access to secondary sources of information with more breadth and depth.
- Support communication, thereby raising issues of audience and viewpoint
- Enable the gathering, storage and manipulation of data and other information
- Enable more effective analysis of data and information
- Enable simplification, simulation and modelling of scientific ideas
- Enable more effective communication of understanding of experimental results
- Support the asking of 'What if…?' questions through experimentation and testing
- Support teachers' professional development alongside students' learning.
  (Williams and Easingwood, 2003, p7)

However, if ICT is to make an impact on student science learning, then you as a teacher need to scaffold science ICT activities so that students can participate in the inquiry process.

Your aim as a science teacher should be to help children develop 'transparent' routines and techniques until it becomes part of their unconscious actions. This is your goal as a primary teacher to ensure that children are equipped with sufficient experience to enable them to use ICT without them having to stop and think.

In other words, enable them to reach the stage where the technology they are using becomes sufficiently 'transparent' that they are almost unaware of its existence.

The list that is present throughout this resource reflects the features of common software under each of the categories identified. As a teacher you must be aware of the capabilities and limitations of software packages of any program as this will influence your choice of software for any teaching and learning activity.

Researched and Developed by:
Michael Hilkemeijer
ICTE Solutions Australia

Spreadsheets

Spreadsheets are mainly used in primary science for data entry, tabulation and graph production. They are very useful and form an important element in determining fair testing results and seeking patterns.

Primary students are expected to use spreadsheets but are not expected to create them as this would detract their concentration from the science objectives.

When it comes time to explaining the equals sign in the spreadsheet formula you will need to ensure that the children know it doesn't balance the equation showing that one side is equal to the other, but provides a function, effectively instructing the software to perform the calculations that follow it.

In order for you to teach with and about spreadsheets effectively, you will need to know the following knowledge, skills and understanding about the program:

Selecting appropriate opportunities – in which data-handling can extend children's learning such as exploring number patterns of rules with a spreadsheet.
Selecting the appropriate resources – a search tool which enables the safe searching of a website.
Exploring the full range of activities – spreadsheets are not just about the storage and retrieval of information, they facilitate hypothesising, decision-making, organising, analysing and synthesising.
Make explicit links between knowledge, skills and understanding – knowledge, skills and understanding of spreadsheets have relevance across the primary curriculum.
Modelling appropriate use of ICT – for example, how the spreadsheet formulae can be replicated using the 'fill down' function.
Demonstrating and intervening - for example, demonstrating the effect of changing the price of sausages in a spreadsheet budget.

Databases

The use of databases in primary science teaching can reduce the demands on students in the manipulation of data. To ensure effective use, it is significant that you ensure that value is placed on interpretation and understanding rather than on the presentation of the graphics.

In order for you to teach with and about databases effectively, you will need to know the following knowledge, skills and understanding about the program:

Selecting appropriate opportunities – in which data-handling can facilitate, enhance or extend children's learning such as through a research project that involves interrogating a database.
Selecting the appropriate resources – a search tool which enables the safe searching of a website. Teachers and children will need to make an informed decision about whether it is worth setting up a database as opposed to the quicker option of a spreadsheet.
Preparing suitable resources – it is instructive for children to construct their own database by determining their own fields and records. As a teacher, you need to decide if it may be more appropriate to use prepared resources.
Exploring the full range of activities – databases are not just about the storage and retrieval of information, they facilitate hypothesising, decision-making, organising, analysing and synthesising.
Make explicit links between knowledge, skills and understanding – knowledge, skills and understanding of databases have relevance across the primary curriculum. Therefore, you have opportunities to make explicit and reinforce the links between children's previous experience and new learning across the range of contexts.
Modelling appropriate use of ICT – for example, how the spreadsheet formulae can be replicated using the 'fill down' function.
Demonstrating and intervening - for example, intervening to assist a child to identify the tallest child in a class by sorting height data in descending order.

Word Processors

Throughout the entire primary curriculum from Foundation to Year 6 students can use word processors such as MS Word to assist with sequencing and sorting information in primary science. As children develop the degree of structuring and preparation may vary.

Students in the early years can begin to use this ICT tool as an on screen word bank that features images with text labels. An example might be to sort the materials into hard and soft.

Word processors are very useful for helping students to seek information from databases. They can make their own notes about what they have found and then supplement them with images or text copied from electronic sources.

In order for you to teach with and about word processing effectively, you will need to know the following knowledge, skills and understanding about the program:

Selecting appropriate opportunities - in which word processing can facilitate, enhance or extend children's learning such as in the importance of presentation in communication.
Make explicit links between knowledge, skills and understanding – word processing is closely linked to literacy and language development in all year levels and as a consequence has a contribution to make across the primary curriculum.
Modelling appropriate use of ICT – for example, scribing and amending shared writing with the whole class or a group using the IWB.
Demonstrating or intervening - for example, inserting an image into a word processing document. Word processing requires explicit teaching of knowledge, skills and understanding in science curricula as with any other curriculum topic. By the time children enter your classroom, they will already have developed word processing skills themselves, however, without your guidance and direction the acquisition of such capability will be haphazard.

Graphics Software

Science work in all year levels requires illustration to aid communication and graphics programs such as painting and drawing software can enable this to occur. Images can be created, imported and modified by the students with considerable easy these days given the various levels of software sophistication available for primary students.

Students can also use these programs to create labels to aid in the identification and explanation of images. An idea would be to have the students create a poster which is designed to illustrate scientific understanding.

Other ideas would be to use painting software to produce images which illustrate the effects of light sources such as street light at night time.

In order for you to teach with and about graphics software effectively, you will need to know the following knowledge, skills and understanding about the program:

Preparing resources – such as illustrations to support a wall display.
Selecting appropriate opportunities – in which painting and drawing software can enhance, extend and facilitate students' learning.
Make explicit links between knowledge, skills and understanding – painting and drawing programs have applications across the entire primary curriculum and as a consequence has the opportunity to make explicit links between knowledge, skills and understanding in science, mathematics and art for example.
Modelling appropriate use of ICT – like cropping an image to insert into a word processing document for example.
Demonstrating or intervening – demonstrating a new skill for instance or intervening to provide guidance for a student when they are struggling with the concept involved such as assisting a student to delete multiple copies of an image.

Data Logging

Graphing programs offers a range of opportunities to record and represent experimental data. Programs these days allow text to entered and displayed alongside graphs and these can typically be copied and pasted into other applications such as word processors.

Activities at times may involve the collection, entry and representation of data while others are to do with prepared data for students to look for patterns.

Data-logging can be used by students to facilitate the development of scientific experimental techniques such as enabling the realistic repetition of experiments to achieve consistency in results and enabling the testing of variables over greater range of values.

In order for you to teach with and about graphing software effectively, you will need to know the following knowledge, skills and understanding about the program:

Selecting appropriate opportunities - in which graphing software can enhance, extend and facilitate students' learning such as exploring the impact of graphically representing one set of data using a range of scales.
Exploring the full range of data-handling activities – it is important to remember that the data-handling does not end with the production of the graph. You must focus students on being able to interpret and analyse the graph.
Making explicit links between knowledge, skills and understanding – data-handling has many applications across the primary curriculum. This provides you with opportunities to make explicit links between new experiences and learning across the range of context.
Modelling appropriate use of ICT – an example of this might be the joining of individual dots of data on a line graph to assist in the analysis of the pattern or trend.
Demonstrating or intervening – intervene to assist a student to export a graph to an appropriate place.

Digital Cameras

Digital cameras in primary science are primarily used as a recording device. There are many varieties as we know to choose from. Your school may have a range of stand-alone digital cameras or alternatively, may have a set of tablet computers such as iPads which all come equipped with digital cameras. For some teachers, this may seem as the better option as more of these are handed out to classrooms in schools and the fact that they are easy to transfer images to applications.

Observations and recording is an important part of primary science lessons. By using digital cameras, students can provide quick and accurate records.

A lot of scientific experiments can exploit the power and immediacy of digital still images. As a teacher, you need to consider how images taken are stored and managed once on the computer.

A single image can be used an innumerable number of times, in a great variety of ways. This allows young children even to take responsibility of the process from start to finish. Students can decide what they wish to photograph, capture the image and decide if they wish to use it, but if not then delete it.

Some ideas or units of work which may benefit from the use of digital cameras include:

- Growing plants;
- Plants and animals in the local environment;
- Variation;
- Helping plants grow;
- Characteristics of materials;
- Habitats;
- Interdependence and adaption.

Presentation Programs

Presentation tools such as MS PowerPoint and Prezi combined with Interactive Whiteboards can provide fantastic opportunities for students to consolidate knowledge, assume responsibility for and ownership of their learning. PowerPoint presentations can engage them in higher order thinking skills and be able to support them in communicating their learning to their peers.

The slide and bullet point structure can aid students' identification, development and sequencing of points to be made. This is not only valuable for teachers who find that this creates a coherent lesson, but also for students as it helps them present their ideas. It helps them present to class and also to turn their ideas into a written report and forms an important tool for reflection.

When it comes to ICT skills, concepts and attitudes, such a tool has enormous potential for enhancing students' learning in primary science. By preparing presentations, they could be involved in communicating all aspects of planning and carrying out experiments, rehearsing hypotheses, describing methods and discussing their recording procedures.

This might also lead to data interpretation, inference and drawing conclusions which would mean that they would have to 'tell the story' of their work to their peers.

By effectively encouraging presentations in primary science, you will be able to help promote key attitudes such as cooperation, perseverance, originality, responsibility, independence of thinking, self-criticism and open-mindedness.

Internet

The Internet in primary science can be used either as reference source or as a means of communication. It can provide a wealth of resources for learning and teaching.

Browsing the Internet and searching online means finding science information. However, a single word is likely to generate a large number of suggestions. Therefore, it is important that students are educated in information literacy and being able to evaluate sources of information on the Internet and narrow their search results using more sophisticated criterion.

There are many websites for primary science that provides activities that aid students' concept development in specific content areas and have the potential to arouse curiosity.

Control Technology

A good example of control technology today is when we see an assembly line of cars being assembled and painted by robots. Students may not use this technology, however, any sort automated technology in science lessons will be of good use. Really, any technology is akin to science like a hand in a glove.

Control technology has a strong ICT input and as such has cross-curricula links to Design and Technology where you might start with young children making very simple models that have a mechanical working part such as a pop-up Christmas card.

Control technology requires ‘inputs’ and ‘outputs’ and for these to work you would need a control box.

There are two basic approaches to the teaching of control technology. Firstly, you could either have the students make the model to be controlled, and then to write their own code to control it. Secondly, you can simply just buy kit. These kits can provide easily assembled models, driven by the computer.

Simulators and VR

Virtual reality and simulators is on the rise in science classrooms bringing new learning experiences to students. These are great means of enabling students to explore places without leaving the classroom saving on costs for schools.

As a teacher you would instant feedback to reinforce student learning of the topic being examined.

A key benefit of this ICT tool is that it allows teachers to create a unique learning experience in which students can learn by failing, in a safe learning environment.

Remember that simulations can never replace physical science laboratories.

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