beyond the classroom

ELIZABETH BRITEN USES A SCHOOL GARDEN AS A 'RESEARCH STATION' TO HELP CHILDREN CARRY OUT THOUGHT EXPERIMENTS ON PLANTS

SOWING the seeds of creativity

The exciting world of plants may be something of a mystery to many children, and the often-dry content of a curriculum taught indoors inhibits real understanding of many complex biological processes. Moving outdoors opens up an unexplored world and presents rich opportunities for imaginative learning. The *Life processes and living things* part of the National Curriculum for England can be taught in a creative way through cultivation of a small plot of land within the school grounds, to engender a love of the living world outdoors.

The value of outdoor learning

The Qualifications and Curriculum Authority analysis of the 2004 key stage 2 National Curriculum tests (taken at age 11 in England) concluded that to help improve future performance pupils need opportunities to: '*learn the functions of the reproductive parts of the flower and the role of these in the life cycle of the plant*' (QCA, 2004).

Similar conclusions regarding reproduction and plant life cycles were also drawn following the 2003 analysis and as far back as 1998. Through getting involved in the real process of growing plants from seed to fruit and onwards, the cyclical nature of life is revealed to children and explored *in situ*: the thrill of getting dirty and the excitement of 'hands-on' learning inspires a keenness to learn. Investigative work outdoors provides a meaningful context for the development of a wide range of enquiry skills; children can observe, record, plan and carry out enquiries where the purpose is clearly evident. Important biological concepts are developed, with renewed understanding being brought to previously abstract ideas.

Clear links can and should be drawn to citizenship with its emphasis on responsibility. Appreciating the fundamental role of plants within our delicate ecosystem is vital for children of today, born into a world environment suffering from human abuse. They need to understand the issues and ultimately make informed choices. This process can start on a small scale within the school grounds. Letting the children have ownership of the garden and responsibility for its welfare provides a vehicle for the promotion of many personal and social skills.

The creative garden

There is a justified drive within education to approach the curriculum in a creative manner, spurred on by recent government initiatives and teachers dulled by the rigid implementation of successive 'strategies'. Yet creative teaching is not necessarily instinctive. Creativity is not a natural process of the brain. The latter has a preference for 'in the box' thinking, with new experiences fitting into previously recognised compartments. Creative thinking, however, is concerned with new ideas and new ways of looking at things:

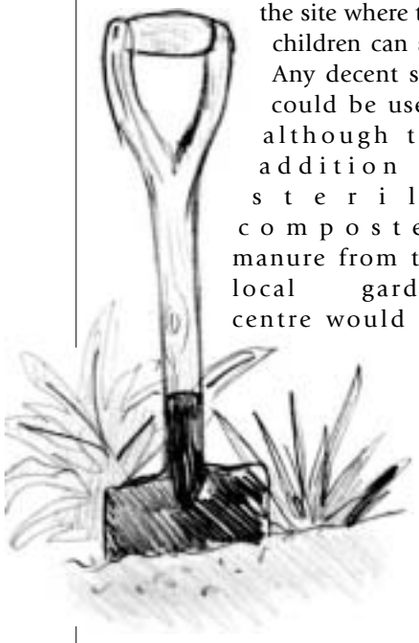
Creativity involves 'thought experiments'. You cannot tell in advance how the experiment is going to turn out. But you want to be able to carry out the experiment. (de Bono, 2000)

Although the creative solving of dilemmas within a school garden may be on a small ecological scale, the fight for survival and continuity of the species may be just

as real for the plants themselves and for the small scientists caring for them.

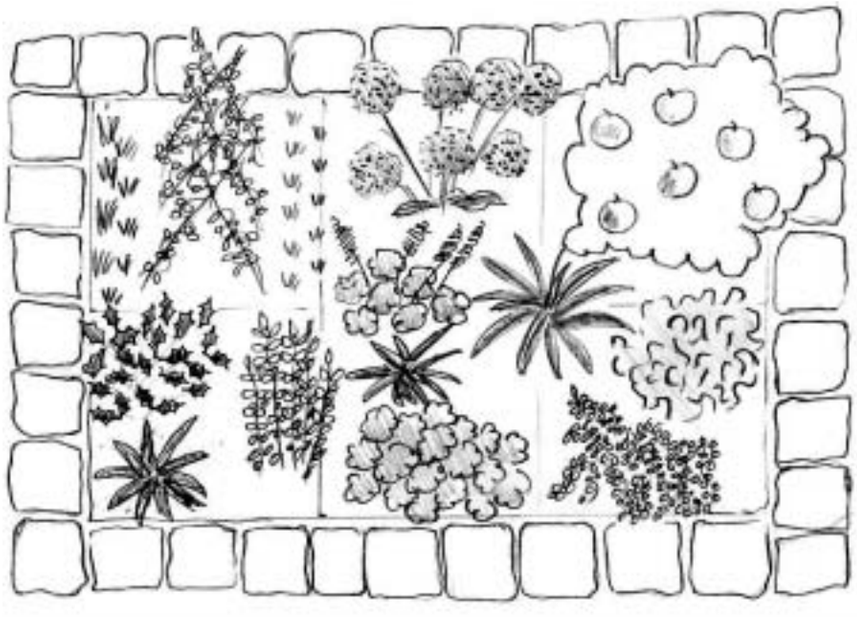
Into the garden

The garden (or 'research station', as it may be called) can be used for a multitude of creative learning experiences that develop essential enquiry skills and build scientific understanding whilst promoting important life skills. The garden need not be large: 3 m by 2 m would be a good starting point, with additions being made later if necessary. Ideally it should receive a good deal of sun, with an area of paving or grass around the site where the children can sit. Any decent soil could be used, although the addition of sterile composted manure from the local garden centre would be highly advantageous!



Choosing the plants

An enormous range of plants is readily available but a few points should be considered before final choices are made. The plants should require the minimum of fuss and yet represent the diversity of species that exists. The *Phormium* for example is a red plant! Examples that have appealing scent and texture are wonderful for partially sighted children. Fast-growing colourful plants are a must for the younger age range. The inclusion of species that illustrate their many uses to humans is valuable. Plants should be chosen that will flower, fruit and set seed at points within the school year. Finally, be aware of avoiding plants that contain sap that may irritate the skin, e.g. *Euphorbia*, or that produce poisonous fruits, e.g. *Laburnum*. (See the ASE publication *Be safe!* (ASE, 2001) for further information on suitable plants and those to avoid.) Box 1 gives some suggestions.



A suggested planting plan for a small school garden

Using the garden

The following collection of ideas suggests some ways in which 'thought experiments' can be employed whilst addressing areas of the science National Curriculum.

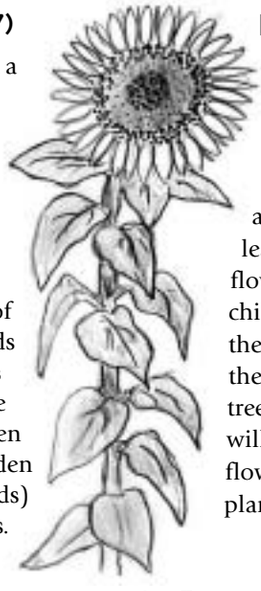
Key stage 1 (ages 5–7)

Seeds. Discuss what a seed is and what happens when it is planted in the ground. Plant a range of different seeds, predicting what will happen. Record what happens with the aid of drawings. Pick the seeds from the garden plants and keep to replant the following year. Cut open the fruits from the garden (berries, beans and pods) to reveal the new seeds.

What is a plant? Discuss what is living/non-living, and what a plant is (many children have odd ideas about these!). Use pictures to aid the classification task.

Sunflower competition. Plant sunflower seeds and record growth. Plant different varieties of sunflower seeds and compare results. '*Russian Giant*' will usually live up to its name, growing up to 3 metres in height!

Using plants. Consider ways in which plants are used by humans. Expand with a visit to a local supermarket to look at produce that originates from plants (not only food; what else are plants used for?).



Sunflowers – an excellent plant for observing and recording growth

Plant shapes and sizes. Look at the variety of plants growing in the garden and compare their different shapes and sizes, including leaf shapes and types of flower. Encourage the children to think about the 'why?': e.g. Why do the flowers on the apple tree smell sweet? What will happen once the flowers on the bean plant die?


Allium


Phormium (flax)


Nigella (Love in the mist)

Key stage 2 (ages 7–11)

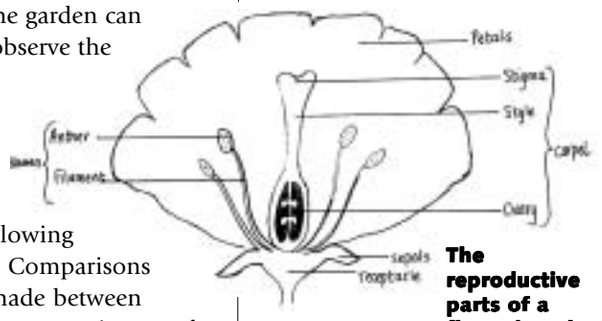
Garden vocabulary. Discuss definitions of words associated with the garden, e.g. seed, plant, weed, fruit, vegetable. We may think we know what they mean, but do we really? Good one to try in the staffroom!

Leaf classification. Produce a branching key (ICT is an invaluable tool here), using observable features of leaves from plants in the garden. Consideration of how to distinguish between leaves will prove challenging! Adjectives such as rounded, lobed, spiky, saw-toothed edges may help in the process.

Plant classification. Extend the leaf classification to consider the range of plants that exists. A simple 4-group system is often helpful, i.e. mosses, ferns, conifers and flowering plants.

Life cycles. Many of the flowers in the garden can be used to observe the male and female reproductive organs and what happens following pollination. Comparisons should be made between different flowers, noting number of stamens, carpels, petals, etc. It would be valuable to record the stages from germination to seed dispersal with the aid of a digital camera.

Adaptation. Consider adaptive features of plants



The reproductive parts of a flowering plant

Box 1 **Some possible plants**

Plant	Features	Notes
Allium	Flower heads die back to reveal newly formed seeds within 2–3 wks of flowering.	Flowers May/June. May grow to 1 m. Buy as bulbs to plant in autumn. Collect and plant seeds the following spring, if not already dispersed by the plant.
Apple tree	If flowers are pollinated, fruit containing seeds (pips) produced in autumn.	Deciduous tree. New smaller varieties may be grown in a container. Flowers produced in spring. Flower scent attracts insects for pollination.
Aquilegia	Following flowering and pollination, many seeds are produced. Can be collected and replanted to flower the following year.	Flowers May/June. Perennial. Small to medium height. Dies back in winter. If seed heads left on plant seed dispersal occurs and new plants grow around the old.
Daffodil	Flowers clearly show reproductive organs. Good for close observation, comparison or even dissection!	Plant bulbs in autumn. Spring flowering.
Holly	Holly is an example of a plant that is 'designed' so that male and female reproductive parts are on separate plants.	Evergreen shrub. Insignificant flowers. To get berries on the female plant also need a male plant. The plants produce berries containing seeds. Holly berries are POISONOUS if ingested, so grow a single male plant only e.g. Ilex 'Silver Queen'.
Nigella	After flowering, interesting seeds pods are produced illustrating dispersal mechanism.	Annual. Height 30–60 cm. Plant seeds straight into ground in autumn or spring to flower in summer. Also known as 'Love in the mist'.
Phormium	Red-coloured leaves to illustrate not all plants are green. Some use pigments other than green chlorophyll to photosynthesise.	Evergreen perennial that flowers in summer. Height up to 1 m. Plant any time of year.
Runner beans	Illustrates full life cycle that can be observed during school time.	Flowers in early summer with beans being produced from summer into autumn. If beans left on, plant will dry and seeds inside pod can be collected and replanted the following year.
Sunflower	Children's favourite. Fast growing with seed being produced once flowers are fertilised. Great for recording growth.	Summer flowering annual. Plant seeds indoors and observe growth before planting outdoors in garden complete with stake.
Tulip	Male and female reproductive parts can be clearly observed, recorded and compared with other plants.	Flowers April/May. Plant bulbs in November.

within the garden, e.g. Why does holly have prickles? Why do some plants produce juicy fruits enclosing the seeds where others have dry seed pods?

■ **Design a plant.** Children design a new plant complete with adaptations to suit its environment. They could consider pollination and seed dispersal mechanisms (with drawings) or write a short item for a seed catalogue giving instructions for care and maintenance of the plant.

■ **Lawn seed trials.** Engage in a series of trials in part of the garden, using lawn seed appropriate for differing situations, e.g. shade, full sun, etc. Small repair packets can be bought to keep the costs low.

■ **Using fertiliser.** Extend the usual growth experiments by using differing quantities of fertiliser. Observe the effects and compare with plants not receiving the benefits. Be aware that misconceptions may occur as some fertilisers are termed 'plant food'.

The garden can be used for a multitude of activities. The list is endless, particularly if one starts to consider the wonderful opportunities for cross-curricular work. Perhaps the children could even think of their own creative learning experiences linked to the garden – hand them the National Curriculum and see what happens!

Above all we must ensure that science is exciting, stimulating and taught in such a way that it challenges and inspires children to search for answers. We must capture children's imagination and interest early in their educational career by using contexts that are meaningful and supportive of the learning process: *Informal, non-classroom-based contexts can make an important contribution to learning for pupils studying science. Whether the outcomes are measurable in terms of their contributions to the planned curriculum, or in terms of the development of the individual, their impact is significant and long lasting.* (Braund and Reiss, 2004)

References

ASE (2001) *Be safe! Health and safety in primary school science and technology*. 3rd edn. Hatfield: Association for Science Education.

Braund, M. and Reiss, M. ed. (2004) *Learning science outside the class room*. London: RoutledgeFalmer.

de Bono, E. (2000) *Six thinking hats*. London: Penguin.

QCA (2004) *Implications for teaching and learning from the 2004 tests*. London: Qualifications and Curriculum Authority.

Websites

Kew Gardens' website: http://www.rbgkew.org.uk

Elizabeth Briten is senior lecturer in science at Kingston University School of Education. Email: e.briten@kingston.ac.uk