



Jane Johnston reminds us how fundamental observation is in learning science and provides a range of examples across all primary age phases to illustrate how observation can be developed in the science classroom



Learning from early years classroom practice

All scientific enquiry begins with the skill of observation. Observation is recognised as an important initial skill in early years and primary science (Harlen, 2000; Johnston, 2005; de Bóo, 2006). However, as a teacher and science specialist, I am still learning about what observation looks like in young children and how it develops. In the early years, science appears (and

should be) very tactile and involves not just the sense of sight, but all senses. Close observation appears to follow from this, although my research and observations of children have sometimes been at odds with the view that children get better at observation as they develop. For example, very young children sometimes make the most pertinent and creative observations, such as observing that they 'can see themselves the

right and wrong way up in a bubble' or that the inside of an ice balloon 'looks like the inside of a peach'. These types of observation can be overlooked by older children, who may be much more focused on one aspect of what they are observing and miss the 'bigger picture', so that they may only be focusing on whether the ice balloon floats or sinks or melts under different circumstances. Older children may also be influenced by



Figure 1
A collection of seeds and plants can be sorted and classified in different ways

teaching and their own personal theories (see Tompkins and Tunnicliffe, 2001) and interests (see Tunnicliffe, and Litson, 2002).

How observation leads to other enquiry skills

Other enquiry skills, such as prediction, measuring, classification and interpretation, develop from observation: the type of activity, resources and interaction can determine how these skills are developed and used.

Classification, for example, can develop from a collection of objects or pictures which can be sorted. A collection of seeds or plants (Figure 1) or pictures of animals can focus on observable similarities and difference between groups of living things. A collection of sweets or different solids (e.g. plasticine, playdough, clay, cornflour and water, finger paint, etc.) or familiar liquids (lemonade, water, bubble bath, vinegar, lemon juice, detergent) can focus on the observable properties of different materials. A collection of moving toys can engage children in sorting the toys according to physical properties, such as how they move and what energy sources they use. All classification activities can be very open-ended and so the same collection of objects can be sorted and classified in different ways and be appropriate for younger or older children. For example, a collection of seeds will be sorted by foundation stage and key stage 1 children (ages 3 to 7) according

to observable properties, such as shape, colour or size, whilst key stage 2 children (ages 7 to 11) are more likely to classify by the type of seeds and can be encouraged to sort them according to seed-dispersal methods.

Prediction skills can develop through

observation of seeds: children can predict what size of plant will grow from different seeds and in what conditions the seed will germinate. Observation of a collection of objects can lead to predictions about which will float or sink and what will happen when different substances are mixed with water or during baking.

Further collections can lead to development of the skill of hypothesising: a suggestion or explanation as to why something happens, will happen or has happened. Children observing some different animal skulls can focus on the teeth and, using their prior knowledge about animals, hypothesise as to what type of food the animal eats. Children can make similar hypotheses about what animals eat and where they live from a range of pictures of animals cut out of magazines. When baking, children can hypothesise as to why margarine melts when added to hot water and why sugar dissolves. When playing with a toy, children can be encouraged to hypothesise about what is making it work. One year 2 child (aged 6) was playing with a toy frog that jumps when you squeeze a rubber ball which forces air down a tube to its legs (see far right of Figure 2). The hypothesis was, it worked 'because there's air in there and when you press it down, the air goes in then it jumps up'.

There are also opportunities for close observation to lead to explanations and interpretations of scientific phenomena. Observation of a sick plant can lead to children

providing interpretations as to what has made the plant sick (too much/little water, not enough/too much light, etc.). Observation of heating water, melting ice (especially when salt is added), or what happens when a nut or pip is added to a glass of lemonade, can lead to interpretation of physical phenomena. A year 6 child (aged 11) provided the following interpretation to explain how a wind-up toy worked whilst playing with the collection of toys in Figure 2:

Well I think maybe it's like some string that like when you turn it backwards it gets tightly wrapped round something and so then when you let go it sort of starts spinning round.

Factors affecting observation

Teaching

Teaching does affect the development of enquiry skills (Harlen, 2000; de Bóo, 2006) and good observational skills can be supported by focused and structured teaching. Some teaching approaches do not place observation as a central part of the activity and in some cases teachers have undertaken the observations themselves, 'attended' by children (Kallery and Psillos, 2002: 55). This is especially tempting when teachers focus observations on meeting narrow objectives and lose sight of the bigger picture. For example, early teaching about plant growth can lead to incorrect ideas that plants need the sun for warmth and soil for food, with no mention of the part played by air; this creates problems when children attempt to understand photosynthesis. Creative activities, such as making large movements to loud sounds and small movements to quiet sounds, can also lead to the incorrect assumption that the bigger the object the louder the sound (Watt, and Russell, 1990).

Time

Time is essential to enable children to make good observations and also to discuss the observations afterwards, especially where the observations create conceptual conflicts that can be debated and discussed by children and

teachers. In my recent research with children, I have found that time for the children to explore and observe together is essential, and that older children, especially, benefit from engaging in their own debates about observed scientific phenomena.

Type of activity

In motivating explorations, children have observed using their senses, by noticing details, sorting, grouping and classifying objects or sequencing events. In more structured investigations the children are often directed, by the structure, as to what to observe and if this contradicts their personal theories, the activity does not necessarily move them on. In one structured investigation with year 3 children (age 7/8), the children had to prove that 'air had mass' by:

- balancing a stick, on a pencil, on top of a tin;
- attaching two balloons to the ends of the stick and checking the point of balance;
- blowing up one balloon and seeing what happened when the stick was put back on the same point of balance (Johnston, 2005).

When the inflated balloon dropped, most children changed the point of balance to make the inflated balloon rise, as their personal theories were that 'air is light' rather than that it has mass!

Observational aids

Observational aids such as magnifiers, stethoscopes and digital microscopes can all aid observations, although sometimes they can detract from the actual observations as the children focus on the use of the aid itself (Johnston, 2005). In many ways this does not matter, as after a period of 'playing' with the observational aid, children can begin to use it effectively to make close observations. Digital microscopes and slide projectors can be good aids to focus on close observations, making very small objects and details clearer to individuals and groups of children. They can also support drawing of the observations, which more traditional microscopes and magnifiers cannot.

Social Interaction

Observation as part of practical play or exploration is more appropriate for younger children (Johnston, 2005; de Bóo, 2006); older children benefit from open-ended explorations and investigations. In all cases, children should be allowed to interact with each other and be supported by the teacher. I have found that some of my own teacher questioning has limited the development of observation leading to other enquiry skills, as I seem to encourage more explanations and interpretations. Social interaction supports children's scientific development (Vygotsky, 1962), especially in explorations that build upon previous experience and understanding. Without opportunities to interact fully with their peers, children are likely to move from general observations (Tunnicliffe and Litson, 2002) to particular observations, without improving their observational skills.

Summary

It seems that in busy primary classrooms the opportunities to observe and to develop observation skills can easily be overlooked, but finding time for children to observe phenomena and to follow their own interests will pay dividends in supporting quality outcomes in all areas of scientific enquiry and understandings. In a discovery approach, the outcomes will be greater in terms of all enquiry skills, as well as understandings and attitudes, where the children:

- are central to the learning;
- explore and discover things about the world around them that arise from their own initial curiosity and observations;
- construct their own understandings through their observation and exploration;
- are supported by teachers and peers through social interaction (Johnston, 2004).

Meanwhile, I will continue to try to develop my understanding of observation as an enquiry skill, and my pedagogical skills to develop and support observation in young children.



Figure 2 Children sorting a collection of toys

References

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