Figure 1 'Taking apart a flower to see what it does' *or* 'examining a plant's reproductive structure' – which phrase do you relate to?

COMMUNICATION

HAVE WORDS, WILL UNDERSTAND?

*Shifting the focus from words to concepts – does it work? **Jon James** shares the findings of a project with three primary schools*

Key words:
Children's ideas
Creativity
Science and literacy

Ensure pupils continue to practise the scientific vocabulary of forces.

For the purposes of primary level work, pupils should measure mass in grams and kilograms, and the difference between mass and weight should not be addressed

Recognise these quotes? Well they are from the year 5 (ages 9–10) guidance section of the recently produced draft English National Curriculum for Science (DfE, 2012). One interpretation of them might be that, for 2014 when the new curriculum becomes statutory, concepts will be lagging behind the introduction of scientific terms. Such an analysis, however, is in stark contrast to some work carried out in three primary schools in the Bristol area during 2012.

Background to the project

Many children, not just those with literacy difficulties, find mastering the language of science difficult and do not make the progress that they could. Encountering complex terminology can also mean that children do not relate to the science language used in the school classroom and become disengaged. There is evidence that those from socially disadvantaged backgrounds cope less well in making the switch to using the formal language of science (Lemke, 1990). However, tensions are evident among science educators, with some advocating that teachers use an exploratory approach in children's own language, while others argue that such an approach encourages low expectations

Plant part	Description	Job
Petal	Brightly coloured; they have a scent	Help 'export' pollen; attract pollen carriers
Sepals	Green – like little leaves around the outside of the flower; smaller than the petals	Protect the flower when it is in the 'bud' stage
Stamen	Male part of the plant; made up of the anther and filament	To make pollen
Anther	Yellow knob	Where pollen is made and stored
Filament	A thin stem/stalk – bendy; varies in length	Supports the anther; allows movement; long if pollination is by wind; short if pollination is by insect
Carpel	Female part; tall column/stalk in the middle of the plant with a swollen base and short branches at the top; three parts	To receive pollen and transfer it to the seed
Stigma	Top of the female part; like a landing stage	Where pollen lands
Style	Tube running between the top and bottom of the carpel	To enclose the pollen tube as it grows down to the seed (ovary)
Ovary	Swollen base of the carpel; holds tiny balls	Holds eggs – seeds form here and it will become the fruit
Pollen	Yellow grains/specks/dust	'Male seed'

Box 1 Plant parts: key vocabulary to be avoided until the concept had been understood

Green: Word can be used

Red: Word not to be used

Orange: Teacher to judge as the topic proceeds whether the word should be used

of children's ability to engage with scientific terminology and is likely to introduce inaccurate understanding.

This project drew on the work of researchers such as Brown and Ryoo (2008), who advocate a 'content first' approach to teaching science, where concepts are explored in everyday language before scientific words are introduced.

Who was involved?

The three schools invited to participate all serve disadvantaged communities as evidenced by their free school meal percentages being significantly above the national average of 17%. The head teachers were intrigued by the project and nominated teachers from years 3 to 5 (ages 7–10) who they thought would engage well with the work and benefit from the experience. The teachers likewise were interested in the basic premise, although this was tinged with a degree of scepticism about the likely effectiveness and in some cases concern that pupils could actually be disadvantaged by the approach.

Planning – the important bit

Planning meetings involved taking a forthcoming science topic and deconstructing it, in terms of its language and concepts. Topics were selected that either involved a lot of subject vocabulary, such as plant reproduction (Box 1), or

Figure 2 Modelling the reproductive process of plants

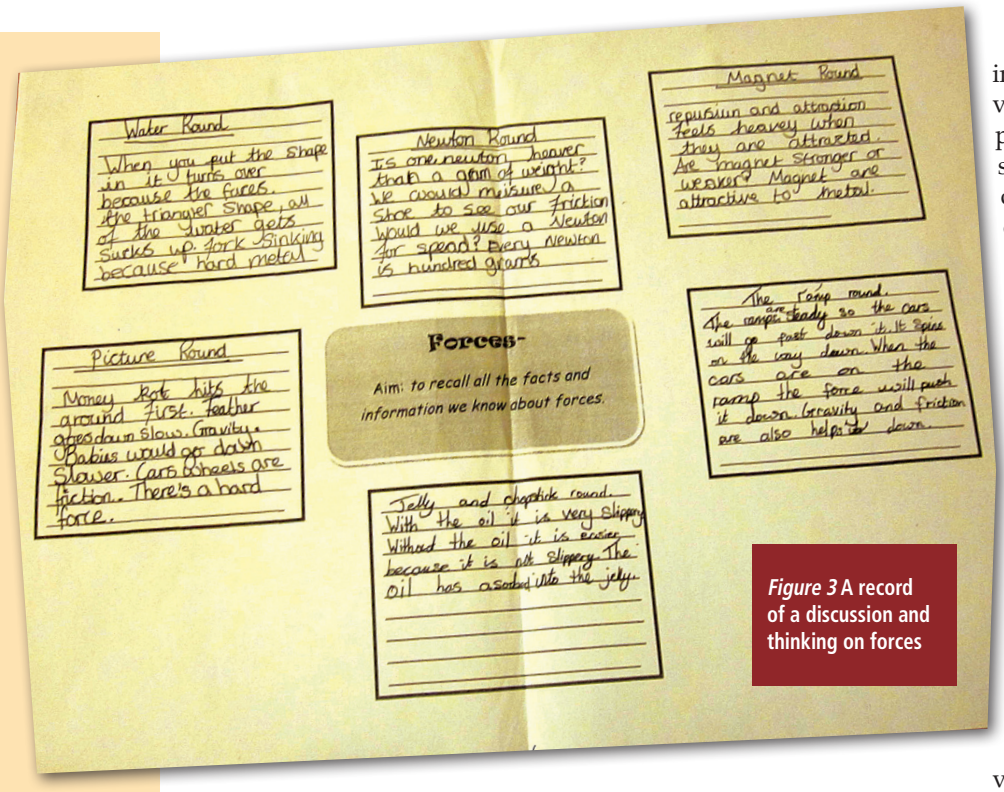

Figure 3 A record of a discussion and thinking on forces

where scientific terminology was used as a means of introducing children to abstract concepts, such as forces, which cannot be seen and often cannot be felt. These words usually served almost as a script for the teachers when in the classroom to aid the conceptual context.

The teachers themselves decided which words would be 'taboo' (and indeed there were some similarities to the game of this name!) based on their experience and knowledge of the children. Elimination of key subject vocabulary challenged the teachers to think about their own conceptual understanding as it could not merely be draped around the technical terms, but rather had to be articulated in precise, everyday language, so going back to basics and a deep understanding that actually makes it easier to teach and easier to learn.

The teachers wanted to adopt a range of approaches to introducing the scientific vocabulary, having focused on the concepts. One was adamant that they would not do so at all, contending that it was much better if children took the concepts forward with them rather than meaningless terms. Another planned a quite formal final teaching session where key words would be matched to the names of plant parts and processes that children had displayed on large posters.

In the classroom

There was inevitably some concern about how it would go, but fears were quickly allayed. One teacher removed the already prepared labels that adorned the giant diagram of a flower on her classroom wall so that children would not encounter vocabulary by other means, but commented:

Initially I was quite worried as it felt quite different. I wanted to use the key words, but then soon got used to it. I've found that we've been going at a quicker pace (compared to a parallel group) as we've been less concerned about vocabulary.

There was a definite sense that the 'concept first' intervention had made teachers more positive about teaching the particular science topic and, in addition to this, there was an increased focus on discussion in the classroom; teachers and pupils were more confident in explaining concepts using everyday language:

I think it's changed my teaching approach as I've focused more on explanations and discussion. There's been better engagement, particularly of those with weak literacy or with English as an additional language. (teacher of 9 and 10 year-olds)

In one class, children worked in mixed-ability groups on a variety of stations that presented phenomena involving forces, such as picking up jelly using different chopsticks as a means of exploring friction. They were encouraged to discuss their thinking as a group and then record a brief summary of their ideas (Figure 3). The teacher played an active role here in stimulating their discussion.

All the teachers reported that the work had motivated less able learners, particularly boys with weak literacy skills. There was a perception that these groups of pupils had made progress beyond what they normally achieved and that they could use the key ideas of a topic without being restricted by having to remember key vocabulary. It appeared that teachers experienced a sense of freedom in using the approach, although they were unsure about how to apply it to other science topics. This revealed the importance of having secure subject knowledge to be able to discuss the concepts fully. But the approach also showed the teachers how to think and engage with the subject concepts and not just 'skate' over the top. Their own understanding had been enhanced. Hence it was clear that the 'content-first' approach could be used, in a collaborative and supportive environment, to enhance teachers' understanding of scientific concepts.

Several teachers who were positive about the outcomes expressed concern about not being able to make the topic 'neat' at the finish. They empathised with more able girls who appeared to want to know the key words and worried about whether children could engage with a topic when it was revisited in the future.

The children's learning

Real progress was seen in constructing and using concepts where the teachers focused on observational experience and carefully guided children towards the more abstract ideas, such as how forces affect motion. With no assumption of knowledge of

technical terms or introduction of new words, children were able to develop understanding in their own everyday language. While ideas expressed were not always a complete scientific description, for example '*The style helps to put the man seed down to the ovary*', there was a sense in the case of the plant work that they had grasped the key processes of pollen transfer and seed dispersal.

Is this something worth trying?

The benefits seen here would seem to raise questions about the emphasis placed on 'practising vocabulary' in the proposed new National Curriculum for Science. This project has shown that, using a 'concept first' approach, children in these schools were able to engage with scientific ideas more readily and articulate their thinking in their own social language. Both staff and children were positive about an approach that made them feel more at home with science. There were interesting consequences as well: some pupils expressed a desire to know the 'scientific words' that went with processes and concepts, indicating that they perhaps grasped the importance of a scientific way of looking at things. It is worth stressing that the approach does not seek to eliminate scientific vocabulary, but to give careful thought to when and how it is introduced.

For many of the teachers the project revitalised their approach to teaching certain topics and gave them a chance to explore the concepts with the children while not having to emphasise verbal correctness. There were others clearly who felt a degree of insecurity in not using the familiar key words. If you can relate to this, but are keen to give this planning approach a go, consider working on it as a team in your school. The talk about the words was the key to this project. Collaborative planning that looks at adapting the 'content first' approach for teaching science to the children in your school could enhance your understanding and enjoyment of the subject. You can also have a good argue over which words really are taboo!

References

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