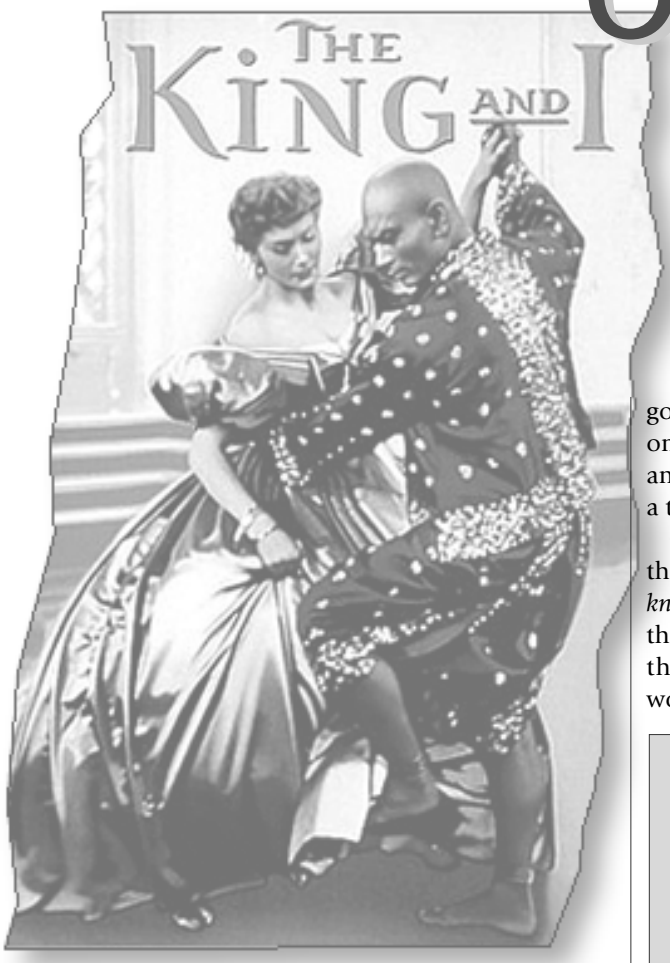
Conversations in primary science: advice for 'older learners'

Neville Evans

REVEALS HIS 'SONG OF SCIENCE' AS THE BASIS FOR SUPPORTING YOUNG INVESTIGATORS



Questions and dialogue

My favourite film musical is *The King and I*. Yul Brynner plays the King of Siam (now Thailand) and Deborah Kerr is a governess from England whom the king engages to give his large family of children (mostly in key stages 1 and 2 in our terms) a 'proper' upbringing. The film explores in a poignant and humorous way the development of relationships between, on the one hand, the governess and the children and, on the other hand, the governess and the king. The film is based on a true story.

Of the several catchy songs in the film my favourite is '*Getting to know you*', which is sung firstly by the governess to the children and then the children to her. The words are shown in the panel.

> Getting to know you,
> Getting to know all about you.
> Getting to like you
> Getting to hope you like me.
> Haven't you noticed? Suddenly it's bright and breezy,
> Because of all the beautiful and new things
> I'm learning about you,
> Day by day.

I hereby declare this to be 'The Song of Science', with '*you*' being the 'system' being studied (e.g. plant, elastic band, bouncing ball, magnet, dough, rock and so on) and '*I*' being the young science investigator. It is really all about '*getting to know you*' (the knowledge bit of the science National Curriculum or other course), not just superficially (a few unconnected facts about this and that) but '*getting to know **all** about you*' (the understanding bit of the National Curriculum or other course), with the **all** changing according to the age, ability and aptitude of the investigator within the changing opportunities afforded by better resources. The mutual '*like*' hints at the investigator's concern for the 'system', its rights and its conservation. Who is to say that the 'system', too, does not have a propensity for 'liking', if treated properly. The other lines of the song reveal the happiness and joy of discovery, something new everyday – a process or journey that is not without its challenges, even disappointments, but which is ultimately deeply rewarding.

A learning partnership

So, your first task as a supporter of young investigators is to teach them The Song of Science. It then becomes a matter of partnership between the younger learner (the pupil) and the older learner (the

teacher), mostly based on the question: By what means shall '*getting to know you*' etc. be planned and implemented? The whole enterprise is one of initiating and promoting good conversation between the younger and older learner. It is *not* an enterprise of the older learner questioning/probing/interrogating/testing the younger learner. Rather is it that the two of them together put the 'system' under scrutiny by questioning, probing, interrogating and testing. All of any worth in school science is lost if a pupil gets the impression that he or she is the 'system' under the scrutiny of the teacher. In these circumstances neither is interested in the proper 'system' (plant, etc.) and the whole endeavour becomes joyless and a negation of the letter and spirit of The Song of Science.

Most conversations in everyday life are inconsequential and wayward and, as such, often lead to intemperate language, attitudes and behaviour. Conversations in science have to be different; otherwise they will lead to frustration and lack of fulfilment. They must, therefore, be specific to some feature of the 'system' and use language that is clearly expressed. It is worth noting that the language of science is more than technical terminology, which itself can be an impediment if foisted unthinkingly upon the younger learner. Needless use of technical terminology is sometimes the characteristic of an insecure, older learner who wishes to retain domination of the younger.

Getting to know you

So, what forms the bulk of ploys in early stages of conversational science? There's nothing mysterious (far less, mystical) about this, once it is realised that investigators who become skilled at '*getting to know*' readily acknowledge that the means of '*getting to know*' are simply the five human senses. What do they sense? The signals which 'systems' emit, nothing more, nothing less. In other words, at the first stages of an investigation, the learners simply talk about what signals (of information) are emitted; this is all free of charge and effort. Here are a few examples. What colour is it (light is the signal, the eye is the sensor)? What noise does it make (sound is the signal, the ear is the sensor)? What does it smell like (scents are the signals, the nose is the sensor)? What does it feel like (texture or heat are the signals, the skin/fingers are the sensors)? What does it taste like (chemical actions are the signals, the tongue is the sensor)?

The other lines of the song reveal the happiness and joy of discovery, something new every day – a process or journey that is not without its challenges, even disappointments, but which is ultimately deeply rewarding.

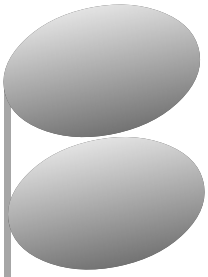
The whole enterprise is one of initiating and promoting good conversation between the younger and older learners

It is a crucial role of caring that the older learner must acquaint the younger learner with the potential hazards associated with each of these. Essentially, however, the conversation is about which signals are most appropriate for sensing in a particular investigation and how are they best described (words/pictures and so on) for future reference, often with an eye on grouping 'systems' with their characteristic signals.

The approach is one of non-interference by the investigator; he or she just receives from the 'system'. The quality or detail of the sensing can be enhanced by the use of instruments, such as, bioviewers, binoculars, thermometers, telescopes, light meters and so on. It is just as well to note (if only to remind all investigators of the need for humility – the '*like*' bit of The Song of Science) that instrumentation is needed because of human limitations not because of inadequacies of the 'system'. The non-interference method of science study is sometimes the only option, for example, for astronomers and for those who study large animals in the wild – run a video showing David Attenborough among gorillas.

Getting to like you

An alternative, and more prevalent, method of investigation is the interference method, where the investigator does something to the 'system', such as heating, cooling, stretching, bending, placing in a liquid. This is where lines 3 and 4 (the '*liking*' bit) of The Song of Science are wholly relevant. With respect to good conversation, this approach is represented by questions such as, '*What will happen if I do this to it?*' or, better (as indicative of a gentler, more respectful attitude), '*I wonder what might happen if I were to do this?*' There are two branches of this approach in real-life science, destructive testing and non-destructive testing. It is incumbent upon the older learner to engage the younger in good conversation about the pros and cons (responsibilities and attitudes) of these two types of testing. Aldous Huxley (a distinguished man of letters and brother of Julian Huxley, a distinguished man of science) wrote, '*Man's worst difficulties begin when he* ***is*** *able to do whatever he likes*'. In the context of primary



science this might not be an issue if an elastic band is tested to destruction, but what about subjecting living things (especially animals) to the same regime? I am still agitated by the memory of reading a statement by a year 5 pupil about an investigation with worms: '*Our worm measured 20 cm at a stretch*'. I don't have sleepless nights about this now because I checked with the teacher and she assured me that my worst fears were unfounded.

Good conversation

These then are the parameters or boundaries for good conversation in science; it is talk about actual and potential experience. My advice to older learners is: try very hard not to introduce questions that force younger learners to make a response when they do not have some basis of experience. Thus, an inadmissible question would be: '*Which ball will bounce highest?*' My objection to this is that the pupils are really being required to make a baseless guess or prediction. They have nothing in their past on which to draw to offer a response. This advice is not to be interpreted as a prohibition upon allegedly 'hard' questions (i.e. 'hard' in relation to the younger learner). Such questions are essential for development of learning but they must, in my view, be ones for which the older learner can point to the younger learner's past experience for connections.

When an investigation is complete (or, better, at a stage where evaluation and interpretation can be attempted), conversation is mostly about the reasonableness, not the rightness, of comments. What can we reasonably (perhaps equivalent to 'cautiously', 'safely') say about our data? However, timidity is not a feature of good science, so '*boldly go …*'. Ask probing questions, but avoid the pitfall of saying (and especially writing in the later years of key stage 2) something that is evidently at variance with the recorded evidence in the form of measurements and their various forms of presentation (drawings, tables, charts, graphs).

Science is mostly about general rather than specific behaviour: what can we say about the behaviour of several bouncing balls rather than this particular ball? This feature can be the basis of conversation speculating on an extension or variation of the study. I recall speaking with a year 2 pupil about her investigation of how cress seeds grow. She was very well informed about the importance of water. By way of variation, I asked '*What do you think would happen if you had given them lemonade instead of water?*' After a period of reflection, she replied, '*They would still grow, but they'd come up frizzy*'. Think about it. It's truly brilliant. You won't get this quality of response every time, but follow the principle of inviting them to think about (on the basis of past experience) variations on the familiar theme.

Classroom realities

What about the realities of classroom life? Clearly, the older learner cannot hold extended conversations with each one of 30 younger learners in a class. Strategies have to be deployed (ranging from whole-class discussions to carefully constructed worksheets and ICT equivalents) that provide guidance on the sorts of conversation that groups of younger learners should conduct among themselves about how they will interrogate the 'system'. What then is the role of the older learner? She or he has to be acutely conscious of one trap, that of becoming an interfering inquisitor, as distinct from an intervening partner in learning.

From time to time, by agreement with other staff, you, as class teacher or science coordinator, can take three or four pupils to a quiet part of the school, there to tape-record the conversation. Replay the tape to yourself and make notes. Have the entire conversation typed and share it with colleagues. From sobering personal experience I warn you that this may be a very unsettling experience, but ultimately one for your self-improvement as a participant in conversation. What I discovered about myself was that I was not listening carefully to the responses of pupils, but incessantly, without subtlety, asking questions that forced them to give answers that I wanted to hear. I was not really interested in their 'systems' of study. I just wanted to quiz them. Don't be put off by this personal recollection. I got better with practice, so give it a try.

I am writing this piece in the week of 1 March, which is the day of St David, Patron Saint of Wales. Legend has it that he advised his followers '*Do the little things*', implying also '*Do them well*'. I declare St David to be the patron saint of science, because the proper conduct of science requires a disciplined attention to detail (measurements, words) but not an unthinking obsession with detail. Science paints the big picture.

If you are not too keen on St David or the authors of The Song of Science (Rogers and Hammerstein?), I commend to you St Paul of Tarsus. In his *Letter to Phillipians* (New Testament, Chapter 1, Verse 9) he offers this prayer:

that your love may grow ever richer and richer in knowledge and insight of every kind, and may thus bring you the gift of true discrimination.

Love in this context means care for others, response to others, interest in others, with 'others' being living and non-living.

I declare this to be the prayer for all science investigators.

That's it, any questions?

Neville Evans is a retired HMI.