**6.4 A critique of language usage in Science Education**

The following is an extract from a document which was written by one of us as part of an MSc thesis in Science Communication some years ago (the thesis itself was entitled *A Critique of Junior Cert Science*)*.*

The depersonalised language of science is one reason why so many students are turned off of it. This is often blamed on the early scientists or ‘natural philosophers’ as they were then known, in an attempt to make their new discipline seem in some was superior. This is a little unfair however. After all, Galileo wrote much of his work in his native Italian, rather than the conventional Latin, so than that it could be read by more people. Newton did likewise with ‘Optiks’ (although he wrote the ‘Principia’ in Latin). Indeed Charles Darwin’s “On The Origin Of Species”, written 150 years ago, is still quite readable today.

Some early members of the Royal Society did explicitly warn against using ‘flowery language’ in their discourse, and this has generally been heeded ever since, but they still wrote of their experiments in the first person. They were not interested on closing off their work to the public. Indeed as a new society seeking support, the opposite was the case.

The idea of making one’s language appeal only to fellow professionals was to appear in the late 19th century (Montgomery, 1996). It was partly an attempt to show that Nature was speaking for itself through the scientist - that the scientist’s beliefs and practices were not themselves influencing the ‘truth’ or the scientific ‘facts’. It is as though the scientist is offering a disclaimer: 'It is not I who is saying this, but my equipment’.

It was also a consequence of ‘positivism’ – an idea (popular at the beginning of this century) which suggested that the only worthwhile questions were ‘scientific’ ones, and that ‘scientific language was its own special realm, with an elite relationship to truth, one that could not be effective if diluted by “literature” or “philosophy.”’[[1]](#endnote-1)7

 (Montgomery, p. 110)

Science therefore becomes information to be received, rather than information to be discussed – something which goes a long way to explain the current format for writing up school lab reports. Ideas which in the past took decades to sort out are now expected to be ‘rediscovered’ and confirmed by students in a double-period laboratory class.

The result is that science is now presented as being:

* Depersonalised, whereas in practice it cannot but be personal – carried out by real people, with all the personal baggage and biases that come with that term.
* Absolute; black and white, whereas in reality it is tentative, speculative – at times sounding even apologetic.

 This problem is exasperated when the students, while trying to ‘rediscover’ these laws, are told that all they have to do is write down what they see. It would perhaps be more beneficial if they were reminded of the warning that ‘there is more to seeing than meets the eye’, (or perhaps the up-dated version from Lou Reed: ‘Believe none of what you hear and half of what you see).

Students might find it easier to accept the ‘hard words’ if they realised that this language caused great problems for the scientists also. Scientists found it difficult to describe new phenomena precisely because the necessary language didn’t exist and either had to be ‘invented’ or adapted from existing use. So for example we have the example of Harvey describing blood having ‘*motion, as [if] it were in a circle’*, or Boyle describing the properties of air: “*One may also fancy a portion of air to be like a lock or parcel of curled hairs of wool …”.*

The problem is summed up by Michael Faraday, writing in 1845:

*You can hardly imagine how I am struggling to exert my poetical ideas just now for the discovery of analogies and remote figures respecting the earth ,sun and all sorts of things – for I think that is the true way (corrected by judgement) to work out a discovery*. (Taken from Sutton, 1995)

This tendency to accept words as labels for definite things, and science text as ‘gospel’ leads to some interesting consequences:

We teach that visible light is composed of seven discrete colours , as was ‘discovered’ by Newton. Usually within a few pages of the same textbook we then teach that electromagnetic radiation – of which visible light is a component – is a spectrum, and therefore not discrete.(see Appendix)

This contradiction is rarely questioned by students, illustrating that they can learn the information ‘off by heart’, but not in a critical manner. This sanitised version of events also suits the teachers, who (if they recognise the anomaly themselves) choose to ignore it because it will only confuse the students. More significantly perhaps, they realise it will not appear on an examination paper.

This is not mere intellectual nit-picking. This sanitised view can – and has - caused problems for society at large. For instance in science textbooks we teach that there are definite distinctions between living and non-living things. This becomes a problem however when we debate whether a newly fertilised egg is ‘a life’ or not. The problem is that scientifically there is no clear distinction and by realising this, the debate can become more focussed on the more moral issues.

This problematic relationship between language and ‘reality’ was realised by Werner Heisenberg, who had more experience than most in trying to explain new phenomena in physics. (He, along with Neils Bohr, was instrumental in developing the ‘Copenhagen Interpretation’ of quantum physics – which is now accepted as orthodox). He wrote that:

“*It is of course a well-known fact that the words are not so clearly defined as they seem to be at first sight and that they have only a limited range of applicability. For instance we can speak about a piece of iron or a piece of wood but we cannot speak about a piece of water. … Or, to mention another example: In discussions about the limitations of concepts, Bohr likes to tell the following story: A little boy went into a grocer’s shop with a penny in his hand and asks: ‘Could I have a penny’s worth of mixed sweets?’ The grocer takes two sweets and hands them to the boy saying: ‘Here you have two sweets. You can do the mixing yourself.*’”

(Heisenberg, 1989, p. 157)

But the student is never told about this problem with language. It is no wonder therefore that he or she ends up “confusing the theoretical language of the scientist with the ‘thing-language’ of everyday life” - a useful phrasing of the problem first proposed by Arthur Pap.

Students wonder whether atoms are red, green or blue; whether they are hot or cold; whether their *theory* of who the best footballer is is as valid as Darwin’s *theory* of Evolution.

So what should be done?

I think at least one class period per book-chapter should be devoted to looking at a vignette such as the one included in the appendix. This illustrates many of the foibles which scientists unconsciously fall in to.

Resources should be made available for teachers to trace the history of scientific terms if they so wish. This would also show how the related concept was developed, and this could be passed on to the student, making the word seem more ‘natural’.

Students should be encouraged to use their own interpretative voice when writing reports, rather than the current ‘third person passive’ which is by its nature is impersonal.

Teachers should encourage students to understand that scientific language is persuasive in its nature and not just a medium for receiving ‘the truth about the real world’.

This would have to be written into the science syllabus and made examinable.

1. [↑](#endnote-ref-1)